

TECHNOPOLIS



RCN Divisional Reviews

Background report No 5 in the evaluation of the Research Council of Norway

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Reports in the evaluation of the Research Council of Norway

Synthesis report

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

Background reports

1. The Research Council of Norway and its different funding mechanisms: The experiences and views of researchers in universities, colleges and institutes.

Background report No 1 in the evaluation of the Research Council of Norway
Magnus Guldbrandsen, NIFU

2. Bibliometric Analysis of Norwegian Research Activities.

Background report No 2 in the evaluation of the Research Council of Norway
Sybille Hinze, ISI

3. RCN in the Dynamics of Research: A Scientist's Perspective.

Background report No 3 in the evaluation of the Research Council of Norway
Frank van der Most and Barend van der Meulen, University of Twente

4. RCN in the Research and Higher Education Sector.

Background report No 4 in the evaluation of the Research Council of Norway
Erik Arnold and Ben Thuriaux, Technopolis

5. RCN Divisional Reviews.

Background report No 5 in the evaluation of the Research Council of Norway
Ben Thuriaux and Erik Arnold, Technopolis

6. RCN and international co-operation .

Background report No 6 in the evaluation of the Research Council of Norway
Paul Simmonds, Sarah Teather and Alina Östling, Technopolis

7. RCN budgets, policy instruments and operations

Background report No 7 in the evaluation of the Research Council of Norway
Egil Kallerud, Liv Langfeldt and Randi Søgne, NIFU

8. Internal functioning of RCN.

Background report No 8 in the evaluation of the Research Council of Norway
Barend van der Meulen, University of Twente, James Stroyan, Technopolis

9. RCN in the Public Understanding of Science.

Background report No 9 in the evaluation of the Research Council of Norway
Paul Simmonds, Sarah Teather and Alina Östling, Technopolis

10. Norges Forskningsråd 1989 – 1995. En dokumentanalyse om etableringen av Norges forskningsråd.

Background report No 10 in the evaluation of the Research Council of Norway
Egil Kallerud, NIFU

11. Faithful Servant? Ministries in the governance of RCN.

Background report No 11 in the evaluation of the Research Council of Norway
Erik Arnold, Technopolis

12. RCN in the Norwegian Research and Innovation System .

Background report No 12 in the evaluation of the Research Council of Norway
Stefan Kuhlman, ISI
Erik Arnold, Technopolis

13. User oriented R&D in the Research Council of Norway.

Background report No 13 in the evaluation of the Research Council of Norway
Heidi Wiig Aslesen, Marianne Broch, Per M. Koch and Nils Henrik Solum, STEP

14. Evaluation at RCN.

Background report No 14 in the evaluation of the Research Council of Norway
Erik Arnold, Technopolis

15. RCN: Needs and Strategy.

Background report No 15 in the evaluation of the Research Council of Norway
Erik Arnold, Technopolis

16. RCN International Context.

Background report No 16 in the evaluation of the Research Council of Norway
Sarah Teather and Erik Arnold, Technopolis

This document presents the synthesis of the six divisional reviews carried out by panels of international scientists and administrators as part of the overall evaluation of the RCN.

The report is presented in 3 main sections.

- **Section A** presents a synthesis of the issues identified as part of the evaluation and briefly discusses the overall review methodology. This serves as an executive summary and the contents presented here have effectively been integrated into the overall evaluation report
- **Section B** presents the six individual review reports either as they were agreed with the relevant RCN divisions, or in two cases with appropriate feedback and comments on the report by the division. There is an executive summary and main recommendation section for each of the 6 reviews.
- **Section C** presents the briefing material provided by the divisions as part of the preparations for the peer review visits.

Given the size of this report, the busy reader will benefit from reading **Section A** and then exploring particular issues in detail by covering the executive summary and recommendations of any division he or she is particularly interested in.

SECTION A

Executive Summary

1 Summary of the RCN Divisional Reviews.

This section presents the overall conclusion of the 6 RCN Divisional Reviews. **Section 1.1** introduces the review method and its strength and limitations in order to allow the reader to contextualise the discussions in this report.

At a aggregate level, **Section 1.2** presents RCN level issues, **Section 1.3** presents a summary of the issues experienced at the level of the division and **Section 1.4** outlines some of the more significant recommendations arising from the review.

At a more detailed level, **Section 1.5** presents individual summaries for each of the six divisions.

1.1 Review process for the Expert visits to the RCN Divisions

In order to get an international view of the way RCN is operating, we asked 14 experts 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 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 then wrote reports individually, using a standard format, which Technopolis synthesised and send 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 most cases, following minor changes, the Division directors were satisfied with the final evaluation report. In two cases the response of the division has been appended to the specific report as the reviewers and the division "agreed to disagree" about certain aspects of the report. This section is based on Technopolis' analysis and summary of the divisional reports.

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 the division and it would clearly have been useful to take it 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– 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 of 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 Technopolis were able to look for areas of convergence between the reviews as an input into the overall evaluation of RCN.

1.2 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, in that 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 coordinate 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.

1.3 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 1, 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.¹ Consequently, it is difficult for the reviewers to judge whether some 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 exhibits 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

¹ 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 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.

- 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 is 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
 - 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 1 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 multidisciplinary	✓	✓			✓	✓
Lack of internal human resources				✓		

1.4 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 the presence of ‘too many fingers in too many pies’ 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.

Exhibit 2 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	✓	✓	✓	✓	✓	✓

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 coordinating mechanism to overcome the parochial focus created by the sectoral principle, so that there are suitable coordination 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

1.5 Individual Divisions

The divisional review was designed as a tool to evaluate the aspects of RCN's overall performance. The limitations of the review process make the analyses made at the level of individual Divisions less interesting than the overall message which can be synthesised from the 6 evaluations. On the other hand, understanding the detail of the experts comments and the similarity of comments across the division reviews is important as the Divisions have different roles to play - the next six sections present the insights from the different reviews.

1.5.1 Culture and Society

The reviewers are unanimous in their assessment that the merger of the three previous research councils to create KS has had a positive outcome overall. KS has developed into an effective organisation since the turbulent early years of the RCN. It appears to have developed successful working relationships with many of the external Ministries that provide the research funding which RCN redistributes.

The Division appears to have competent staff with very good knowledge of what is happening in the research community. The Division is well managed and there has been a systematic approach to overcoming the cultural differences that might have existed between previous councils.

KS suffers from having to deal with many sources of external funding which appear to over-specify KS' use of resources, but provide insufficient managerial resources to cope with the level of complexity this creates. The range of responsibilities given to KS is significantly higher than for other comparable institutions in Europe. The reviewers note the absence of a clear strategic approach to this complexity, and the effects this has on the Division's work. The reviewers conclude that these problems are often caused by governmental policy for research and higher education and are to some extent imposed on the Division.

In addition, the reviewers feel that the range of responsibilities has resulted in a prioritisation of the traditional research council roles which have resulted in few activities in terms of providing a science advisory role.

1.5.2 Environment and Development

Overall the Division has had mixed success in dealing with the early goals following the merger. Some have been pursued very successfully, whilst others have not yet been achieved, and appear unlikely to be achieved in the near future – largely because of the constraints the Division is working under.

MU has been highly successful in fostering good relationships with the research communities with an interest in environment and development. This was achieved despite initial negative expectations from the research community regarding the level of funding that would be provided from the RCN. The reviewers also feel that EDD has been particularly effective in fostering interdisciplinary research, and has taken this further than most European research councils.

MU has developed a balanced approach to the integration of basic and applied research, and the Division has been highly successful in reducing the number of programmes whilst maintaining a broadly appropriate portfolio for the Division. However, programmes are frequently developed for the purpose of satisfying Ministries, and the reviewers comment that the Division suffers from a lack of independent strategic planning in the sense that some of the programmes would have been funded by Ministries regardless of the Division's strategy.²

The Division 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. As a result the Division has not achieved the level of coordination for environmental research that was initially anticipated and it has not achieved its aims of being a coordinating force for environment research within the RCN.

Earmarking introduces some real restrictions on MU 's ability to change its portfolio and to reallocate resources. Yet despite the earmarking constraints, the Division has set up innovative research programmes with considerable impact.

The Division is well managed within the constraints under which it operates. Staff are competent and highly motivated and programme management is of good quality. The Division will need to pay further attention to the development of new staff competencies.

1.5.3 Medicine and Health

MH has made significant progress towards the goals associated with the 1993 merger and the 1996 strategy documents. However, there are still some problems which need to be resolved, for example, the need to increase funding for its core responsive-mode scheme and to move away from acting as an administrator of Ministries' research.

The Division has successfully campaigned to increase its research and development (R&D) funding. This has been accomplished by a professional and dedicated staff in collaboration with the scientific community. Despite initial setbacks, MH has gradually been able to make the strategic changes and interdisciplinary alliances that were expected of the new organisation.

Communication is good and transparent, and they are able to explain issues and solve them. Despite the problems with lack of funding, the staff have a very positive attitude for the future. The internal management processes within the Division are sound, but although the interaction and communication between the Executive and Research Boards have improved over time, there is still some lack of representation, transparency and dialogue.

² This specific conclusion was challenged by the Division and their response to the reviewers report are included in an appendix to the Review of the Environment and Development Division.

The Division strategy has a good focus and addresses important issues and problems relevant to both Norwegian and international research, and the reviewers consider that the strategy and the process by which it has been delivered is of good quality by international standards. However, the strategy appears to have a limited influence on the universities.

The influence of the Ministries not only on where the money is allocated, but also on how it is used, is at odds with European best practice and the level of earmarking effectively prevents the Division Board and the administration from using their competence to the full. As it stands, the system is needlessly complex, as is the network of relationships, and Ministries still add programmes to the portfolio in an *ad hoc* fashion that undermines the current strategy.

The RCN was designed to foster interdisciplinary research but appears to have failed to make significant progress during the period under review in the evaluation. At the administrative level inter-divisional collaboration is more about information exchange than about action and it was generally accepted during the review that this is caused by the limited budget situation and earmarking.

Finally, in terms of the portfolio, the reviewers argue that the current level of programme and project funding appears to be sub-critical. In particular, project funding appears to be unable to support team-based research projects.

1.5.4 Science and Technology

The Science and Technology Division (NT) has made significant progress towards the goals associated with the 1993 merger. However, it still suffers from a lack of funding, and it is not clear that its current support mechanisms can deliver its mission to provide broad support for the sustainable development of fundamental research in Norway, and to support the other research Divisions of the RCN. Indeed, one of the reviewers feels that the value added by merging the research councils has still not been delivered in NT.

Given the RCN's remit, the reviewers are surprised with the lack of focus on multidisciplinary in RCN evaluations, in specific support measures, or in the existence of coordination mechanisms for fields that span Divisions.³

Given the lack of funding, NT has been relatively unsuccessful at improving funding for Science and Technology and the review panel's major concern is the absence of a significant responsive-mode funding stream capable of supporting research teams working on fundamental, curiosity-driven research. However, the Division has successfully promoted improvements in the funding of resource-intensive research equipment and has made significant investments in the support of post-doctoral and PhD students.

³ The **RCN** subsequently challenged the reviewers' conclusion on this point and argued that there was comprehensive collaboration between the Industry and Energy and Science and Technology Divisions. The **review team**, however, feel that they were not presented with evidence that demonstrated close co-operation during the reviews. Uniquely, the NT review included a short presentation by three other Executive directors on their divisions

The Division has had some success in developing the strategic planning of research in Research Institutions through the SIPS and SUPS programmes, but much work is still needed in this area.

The level of research funding is low, and the small Norwegian community has substantial problems in dealing with conflicts of interest but scientific expertise is spread relatively thinly, and this had led to difficulties with good scientific decision-making. This in some part accounts for the dominant role played by the administration, but the reviewers identified that junior Division staff seem to lack significant research experience.

1.5.5 Bioproduction and Processing

The reviewers comment that the Division appears to be well on its way to operating at a level of international best practice.

BF has very competent staff, who are aware of the relevant scientific issues. The Division's strategy and structure appear to be wholly in line with current best practice, but these need to evolve in the future if it is to deliver its aim of truly multidisciplinary programmes. At the level of the RCN, there appears to be some remaining tension between the Division Board and higher administrative levels in the Council which should be resolved.

In terms of integrating different aspects of research, the Division has been largely successful in developing strategic and user-directed programmes, and the reviewers are impressed with the rather unique mix of basic and applied research.

In terms of funding and prioritising areas for intervention, the restrictions attached to current administrative processes by funding Ministries prevents the Division from delivering its full potential for adding value to the research policy process. This partially explains the relatively low amount of funding allocated through response-mode funding – which is the traditional instrument of other research councils. Similarly, the Division has yet to develop (or be given responsibility to develop) an appropriate policy for the Research Institutes. In addition, whilst the portfolio coverage is relatively wide, the reviewers have the impression that, at the moment, some of the funds are spread too thinly and 'equitably' and that the portfolio would benefit from a sharper focus and larger projects.

A general observation is that Norway seems to lack funding mechanisms for large (team-based) projects – this raises questions about the progression and retention of Norwegian Scientists. As a result, the reviewers are concerned about the future career of the PhD students and the post-doctorates who are currently working on BF projects.

1.5.6 Industry and Energy

Overall, the current structure of IE is wholly appropriate but raises questions about whether the Division is appropriately located within the Research Council and suggests that IE may need to be granted the additional independence one would expect to find, given its structure and role.

The resources provided to the Division appear to be insufficient given the efforts that are being made in other Nordic and OECD countries; neither are the resources provided sufficiently flexible for the RCN. This has led to a situation where:

- A significant number of IE employees are contracted in to operate programmes (and therefore paid for out of programme budgets), rather than being permanent Council employees
- The earmarking by Ministries creates problems within IE so that it has little freedom in programme development and has been forced to operate programmes that clearly have nothing to do with its core mission.

The relationship between IE and other Divisions appears to be relatively weak, in particular, there are few jointly operated programmes and the reviewers saw little evidence of mechanisms to encourage staff to move within the Research Council to encourage a sharing of best practice and different approaches.

The size of research projects funded often appears to be below the critical mass required to capitalise on the research investment. The reviewers were told that the duration of a typical Research Institute (RI) project is less than one person year. This suggests that there are inefficiencies at the research 'bench', but that there are too many small projects creating management problems.

The Norwegian national innovation system has remarkable shortcomings and does not get the attention it deserves. An indication of this is that industrial research and development (R&D) expenditures measured as percentage of GDP are well below the average for Nordic countries and the EU, as well as OECD countries. Currently too many Ministries contribute only small amounts for their specific R&D needs, and no one has a clear responsibility for funding a research development and innovation system.

The RCN argued that Norway lack an overall innovation policy.⁴ The reviewers agreed and note that 'It is extremely challenging to coordinate industrial policy, regional policy, trade policy, educational policy, labour market policy and research policy.' (Strategy for industrial research, paragraph 3.1 (p. 20)). In their opinion this is the task of an advisory body and not of a funding agency.

The reviewers did not have an overall view of the RCN but commenting about the organisation as a whole from the perspective of the division, they argue that it appears that the RCN is not functioning in the way in which its role and mission were originally intended. The integration of basic and applied research with their differing funding philosophies and a closer cooperation of the former councils (transformed to Divisions) has not been reached, and probably cannot be reached under the current structure.

⁴ RCN does not have the task (mandate) of giving general advise on innovation policy overall. However, it can give advice on national R&D policy as part of an innovation policy.

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Review of RCN's Culture and Society Division

Summary of the Expert's reports

July 2001

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Chris Caswill
Enid Mumford**

With

**Ben Thuriaux
Erik Arnold**

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1 Executive Summary

This section presents the summary from the expert review of the Culture and Society Division (KS) Research Council of Norway (RCN), which took place on 5 and 6 June 2001. The report on the Evaluation of KS will form part of the background material to the wider evaluation of the RCN currently underway.

Overall, the expert reviewers' assessment is positive. KS has accomplished a number of the goals associated with the 1993 merger, and the review team consider that the situation has improved considerably. The Division has introduced reforms (for example, the introduction of new decision-making bodies for responsive-mode funding), and its future plans appear already to be broadly in line with the recommendations of the reviewers presented in this report.

However, there are some weaknesses, for example, in the development of strategy and in the reduction of the complexity generated by the number of external funding sources (and associated programmes) and the range of funding recipients. The reviewers conclude that these problems are often caused by governmental policy for research and higher education are to some extent imposed on the Division.

1.1 Conclusions

The reviewers are unanimous in their assessment that the merger of the three previous research councils to create KS has had a positive outcome overall, but that it has at the same time also created some problems.

KS has developed into an effective organisation since the turbulent early years of the RCN. It appears to have developed successful working relationships with many of the external Ministries that provide the research funding which RCN redistributes. The reviewers consider that it has sound policies which are generally taking the Division forward in the right directions (e.g. by reducing administrative complexity and creating appropriate structures to assess interdisciplinary research).

The Division appears to have competent staff with very good knowledge of what is happening in the research community. The Division is well managed and there has been a systematic approach to overcoming the cultural differences that might have existed between previous councils. The relation between applied research and basic research raises some issues, but so far a promising basis for a future fruitful co-existence and co-operation between the two types of research has been laid.

There is one issue which needs particular attention. KS suffers from having to deal with many sources of external funding which appear to over-specify KS' use of resources but provide insufficient managerial resources to cope with the level of complexity this creates. The range of responsibilities given to KS are significantly higher than for other comparable institutions in Europe. The reviewers noted the absence of a clear strategic approach to this complexity, and the effects this has on the Division's work.

In addition, the reviewers felt that the range of responsibilities had resulted in a prioritisation of the traditional Research Council Roles which have resulted in few activities in terms of providing a science advisory role.

1.2 Recommendations

The following points summarise the review team's recommendations

- The KS Board and staff have to operate in a difficult organisational and governmental environment. More can be done to **develop a strategic response** to that environment and a strategic sense of purpose for the Division as a whole. This strategy should focus more attention on developing **quality** research rather than dealing with infrastructure and education issues
- KS should also consider a policy of **integration**
 - between the Board and the Division staff for the development of a strategy as both sides have important contributions to make
 - between humanities and social sciences
 - of Institutes and programmes into the development and delivery of KS strategy
- More resources should be devoted to **assess the outcomes and impacts of KS' work**
- The current arrangements require KS to interact with a number of Ministries, Institutes and research performing organisations, creating an over-complex situation. There should be some attempts to
 - **rationalise the number of funding areas** for which KS is responsible and simplify interactions with funders and researchers
 - **reduce the restraints** within which KS operates
 - free up resources by **shifting some of the coordination work outside KS**
- The Division should develop and implement a **formal training plan**, which should make use of external training provision and consider the possibility of **encouraging secondment** as a method of skill transfer and renewal

The reviewers make a number of incremental proposals (presented in the final subsection of each section) as they feel that incremental improvement is the most appropriate method for ensuring the continuing development of KS.

2 Introduction

This report summarises the results of a short expert review of the Culture and Society Division (KS) of the Research Council of Norway (RCN). The report contributes to the much wider evaluation of the RCN commissioned from Technopolis by the Ministry of Education, Research and Church Affairs (KUF).

It is one of six such evaluation reports looking at the research portfolio and organisation of the Divisions in RCN and provides an assessment and recommendation for future development of the Divisions' research strategy and operation. The report will be appended in a separate annex to the overall evaluation report and will provide material both for other components of the evaluation, and to a summary of the expert reviews of the RCN's Divisions.

3 Method

The aim of the divisional review is to evaluate the strategy, organisation and functions of each of the six Divisions and the various programme elements that they cover, and to draw conclusions for the operation of the RCN from these reviews. The divisional evaluations focus on

- The strategy adopted by the Divisions
- The structure and resources of the Division and how these are managed 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 impact of the portfolio.

The three expert members of the review team were identified by Technopolis and subsequently approved by KS. The team members were as follows

- **Professor Rune Åberg** is the Dean of the faculty of social science at the University of Umeå (Sweden). He is a member of the board of the Bank of Sweden Tercentenary Foundation and Chairman for the Priority Committee on Behavioural Sciences and Social Medicine. He has previously been the Chairman of the Research Committee on Sociology, Anthropology, Ethnology and Social Work for the Swedish Council for Research in the Humanities and Social Sciences.
- **Chris Caswill** is the Director of Research at the Economic and Social Research Council (ESRC) (UK). He is responsible for research policy and the management of the Council's research portfolio of over 200 grants, 25 programmes and 20 Research Centres.
- **Professor Enid Mumford** is an Emeritus Professor at the Manchester Business School, Manchester University. She has made major contributions to the development process for Information Systems and is a recognised world leader in the application of socio-technical concepts to Information Systems design and development.

Technopolis explained the issues that the review team would attempt to evaluate and asked KS to provide a background briefing document on its activities. This was delivered to the panel prior to the review visits.

The review visit took place on 5 and 6 June 2001 and the review schedule centred around a number of pre-agreed presentations followed by a question and answer session designed to allow the reviewers to comment on the evaluation questions. The leader of the RCN evaluation (Dr Erik Arnold) and the consultant responsible for the divisional evaluations within the review (Mr Ben Thuriaux) accompanied the review team.

Following the visits, the three peers prepared their individual evaluation reports. These have been synthesised by Technopolis and validated by the reviewers. The current document forms the review report after some minor alterations following discussions with KS division.

The report addresses the issues on which the reviewers were asked to concentrate and outlines a number of possible recommendations that will inform the overall evaluation of the RCN.

4 Strategy

4.1 History – Context – Remit

The strategy of KS must be considered in relation to its history, the context in which it has to operate and to its instructions.

The 1993 merger between several different research councils created KS as one of the RCN's six Divisions. KS was composed of the former research councils for humanities (NAVF-RHF), social sciences (NAVF- RSF) and applied social research (NORAS). The expectations were that the different parent bodies of KS would be able to cooperate to coordinate a single coherent and efficient approach to social science and humanities research in Norway.

4.2 Strategy and operational goals

Clearly KS faced a difficult challenge in integrating the three previous councils. A crucial question for the evaluation, is whether there was and is a clear and sufficiently well developed strategy to guide the integration process and the continuing work of the Division.

The strategic goals of the organisation were described in the background documentation provided for the evaluation. The material contains a large number of references to strategy, policy, goals and challenges including

- The 1993 single Research Council change objectives
 - improved coordination of basic and applied research
 - better coordination of responsive-mode and programme funding
 - active participation in the development of a joint research strategy
 - greater delegation of responsibility for implementation to institutions
 - exploitation of the possibility of greater cooperation between research in the humanities and the social sciences
 - development of good work-sharing practices and cooperative relationships within the Division
- Strategy papers produced by the Board in 1996 and 1997
- Published priorities and 2001 targets for the RCN as a whole.

The expert briefing document provided as part of the review sets out a vision for the next few years and includes a discussion of objectives and strategy for each of the four main modes of funding.

There is no doubt that strategic thinking and planning is taking place, although strategies are not always clearly formulated. Often they are expressed simply as goals associated with the tasks of the Division, and actions undertaken appear to be guided by practical considerations and tradition rather than a strategic vision of the future which drives short and medium term objectives.

Based on the review visit and the material made available to them, the reviewers believe that whilst the goals and objectives listed above have led to important positive changes, they do not constitute a strategy. There appear to be too many items and a lack of coherent links between them to use to create a hierarchy of strategy, objectives, policies and targets within KS and, they suspect, within the RCN as a whole.

Generally, it seems that often KS has accepted the task of its predecessor councils but has not seriously reviewed the coherence of the areas of responsibilities it is asked to administer.

As examples of activities that might be renegotiated, the panel consider that

- There seems to be little value in KS devoting resources to prioritising PhD grants where it might be possible to let academic departments prioritise these themselves or to fund PhD training as part of research projects involving larger research teams
- The clients for a large part of the work of the Institutes are Ministries of State. There seems to be little value added by employing KS to simply disburse core funding on behalf of Ministries. The recent evaluation of these suggested even more tasks for RCN (and KS) in relation to the Institutes and it is not clear to the reviewers why this is considered to be strategic unless KS is given more control over evaluation and funding allocation.

The number of different objectives and multiplicity of tasks creates problems for KS, and with little formal prioritisation to resolve multiple claims on resources, confusion is created over direction and roles. In addition, this increases the risk of developing conflicting objectives.

Examples of objectives that have been promoted but still require further efforts (and resources) included

- Simplification
- Greater cooperation between research in the humanities and the social sciences
- More money for responsive-research
- Effective inter-divisional cooperation

That said, many of the objectives set out in these various ways seem wholly appropriate and the actions undertaken appear to be guided by practical considerations and tradition rather than guided by a strategy. This was reflected in the practices and views of the people the review panel met, and in the policies presented. KS appears to be an organisation with an implicit sense of purpose and a shared view of the need for dynamic change. However, it seems to be operating more as an instrument of multiple external strategies than as part of an independent research council.

Most research councils develop their strategies based on an underlying responsibility to maintain scientific quality. Two of the reviewers commented that there seems to be relatively little reference to quality in KS material and that this offers a useful focusing device to guide the development of future strategy. One of the reviewers

feels that there is too much emphasis on the support of applied research within KS – he suggested this might be avoided by developing programmes for which the primary selection criteria is scientific quality rather than relevance. As an aside, that reviewer suggests that KS should be wary of supporting applied research programme with its core funding from the KUF.

In addition, to satisfied Government customers, there are many, often in the smaller research funding ministries, who feel under-represented in terms of participating in strategy formulation at the level of the RCN as a whole (for example, the Ministry for Children and Family Affairs).

The reviewers also comment on what appears to be a degree of mistrust between: the Boards at the RCN; KS and programmes levels; and the different categories of key actors within the RCN. This appears to undermine the implementation of strategy.

4.3 Analysis – Responsibility without Power

The multiple objectives and the associated lack of clear strategy do not appear to be issues that are entirely within KS' control – the impression of the reviewers is that the Division is doing rather well considering the framework conditions in which it is operating.

Some of the causes seem to lie outside KS, in the RCN at large, in its turbulent history and in its relationship with the Ministries responsible for research. The range of responsibilities that have been inherited or acquired by the RCN and the number and diversity of groups it has to interact with means that KS is working in a complex and highly politicised environment which is hard to manage.

The multiplicity of funding actors creates a situation unlike that present in other countries in that KS has relatively little control over what its core activities should be and does not control a secure budget for these activities. To summarise, KS is in the unenviable position of having responsibility without much power.

4.4 Recommendations – Strategy

One reason for the multiple aims and changing patterns is likely to be the extraordinary number, complexity and permeability of KS' boundaries. This presents KS with a large strategic challenge, and currently reduces its capacity to act effectively. Much of this problem derives from factors external to KS and will be discussed in more detail as part of the overall RCN evaluation.

There are nevertheless a number of steps that KS can adopt to strengthen its strategic processes and capacity, which will help overcome current constraints. These can be built on the existing culture of reflection, discussion and change. They have

- The benefit of a Director with vision and a determination to succeed, but who appears to be too heavily loaded with other tasks to provide a strategic lead on his own
- A Board which should be the natural focus for strategic vision and which has attempted this task in the past.

They can build on high levels of commitment from their professional staff and from the academics and practitioners involved in their programmes. They can also draw on a good foundation of managerial information, which can provide the evidence base for organisational reflection.

The panel has several recommendations that ought to be considered

- Priority should be given to development of a KS strategic approach, which includes the main Divisional purposes and the paths to be taken to achieve them. This should be based on a realistic assessment of opportunities and barriers. The strategy will need to take account of the RCN organisational context. Once agreed, the strategy can be the basis for specific objectives and policies.
- The Board should free itself from some of its micro-level work and delegate in order to devote more time and attention to strategy and management
- Quality should be a cornerstone of any research council strategy. One of its key functions and contributions must be to ensure that the research it funds is of the highest quality. Quality needs then to be delivered by involving the research community and by the setting of quality standards, not only for research but also for decision-making, advice, performance indicators and evaluation of outcomes. In addition it is important that programmes should be sufficiently broad to encourage healthy competition for resources. Much of this is already happening inside KS but it is embedded rather than explicit. The Board and senior staff should consider how commitment to quality can be highlighted as a key contribution to its strategic approach and the implications for KS policies.
- The current strategies do not explain the strategic rationale for being involved in funding PhD students in the responsive mode. The rationale for PhD funding must be developed and funds for PhD funding should be ringfenced so that they do not displace other responsive mode projects. One of the reviewers feels strongly that funding PhDs is an activity that might be transferred to other organisations (e.g. the universities or a specially appointed board)
- The Division funds a large number of programme activity and KS should seek to increase the amount of control it has over different areas to consolidate smaller programme areas
- Strategic visions are most effective when they are shared, especially in complicated multi-level organisations which act as agents for multiple external sources of funding and provide resources for a range of research performing organisations. The Board and the Director should therefore work together to create a culture of shared strategic development, recognising the different contributions of Board members, staff, and other part-time academic and lay actors. In this context, much more use could be made of programme Chairs, practitioner members of programme committees, and Institute leaders (who seem to be under-represented in KS's policy world). KS should consider having one meeting each year, where it sets the main KS targets and reviews performance against agreed indicators. This would also have the added benefit of delivering the RCN objective that KS should become a meeting place
- Serious consideration should also be given to strengthening the staff section of KS, by adding an adviser post with particular responsibilities for policy and strategy support to the Director. Such a post could also have evaluation and review responsibilities in support both of the Director and the Board's strategic

work. The Director should consider whether there is further day-to-day work that can be delegated to colleagues in the senior management team

- Wider access to funds should be created for the Board Chair and the Director to commission external policy studies in support of their strategic interests

5 Structure of Division

A new administrative structure was created when the three old councils were merged into KS. The task was to merge different organisational structures into one well-functioning administrative unit. This seems to have been achieved very satisfactorily and there was a deliberate attempt to encourage staff from different backgrounds to work together. The structure suffers from a number of problems but appears to be more effective than the pre-1993 arrangements.

The Division structure is clear, and the different Departments provide visible and understandable points of contact for both academic and policy customers. There is a manageable span of control for the Director and appropriate management resources.

Given the heterogeneous nature of the social sciences and humanities there cannot be one perfect set of topic groupings and the present mix seems sensible, although it encourages some separation between fields. For example, two departments have almost no humanities component and conversely one has almost no social science. There have, so far, been few obvious incentives for cooperation across internal boundaries, although the new responsive grant arrangements, which will reduce the number of committees from fifteen to three, will improve this.¹

Over 60% of senior staff came from the pre-1993 predecessor councils, which has resulted in a team with a mixture of academic and professional backgrounds. The review team's (limited) interaction with staff during the visit left them with the impression that KS has put its past behind it and that staff are competent and highly committed.

The large number of activities and resources within programmes are a weighty burden. KS staff act as coordinators for 17 of 27 Programmes, and there are a large number of committees and a rather complex structure which could be simplified. This heavy demand on resources is, paradoxically, accompanied by an unhelpful distance between the programme portfolio and KS' central concerns and needs and there is scope for more strategic integration of the Programme portfolio within KS core activity.

There seem to be few external linkages or little overlapping membership between the different Divisions. This is surprising given the number of external sources of funding and tasks that KS has to perform – working with permeable boundaries with universities, colleges, Institutes, Ministries, industry and, of course, other RCN Divisions.

KS personnel have to cope with a wide range of tasks and it is likely that new ones will be required in the future. One concern is that the issue of training (for

¹ However, it is important to stress that maximisation of cooperation across disciplinary borders should not be the only goal. Research within single disciplines is very important in order to develop an in-depth understanding of social and cultural issues, and there needs to be a balance between interdisciplinary research and pure research in order to maintain the depth necessary to explain complex research areas.

individuals) and skill renewal (for the Division as a whole) appears to be dealt with on an *ad hoc* basis, which is inadequate by modern international standards.

5.1 Recommendations – Structure

Studies of organisational structure (Chandler 1962, Woodward 1965, Lawrence and Lorch 1967, Pugh and Hickson, 1976) confirm that there is no single optimal organisational structure. The appropriateness of structural form is contingent on the role of the organisation, its relationship with and dependence on other actors, the stability of its environment and its strategy. Structure should be reviewed from time-to-time and modified as circumstances change. However, restructuring exercises have large transaction costs and so should be considered carefully.

Our impression is that the current structure supports good working relationships and communication. There is an impression of continuity and stability, which is in itself a considerable achievement after the extreme turbulence of the early years of KS and the RCN, with the departure of so many senior RCN staff, and serious public criticism of the council's performance. The review team feels that KS has adopted an appropriate structure for the Division that has overcome disciplinary boundaries and boundaries between applied and basic research.

The reviewers consider that there is no case for major structural change for KS. They do, however, make a number of recommendations for incremental improvement, which the KS management and Board might consider.

- An improved integration of the programme portfolio within KS core activity and more interaction between the different Board levels
- The introduction of more formal 'horizontal' teamwork arrangements, drawing in staff from more than one department to encourage more integration between the social sciences and humanities. This should be accompanied by an attempt to rationalise the programme portfolio
- Whether the Division's large network of contacts could benefit from better management and mechanisms to facilitate external interactions (for example, an annual conference might be well received)
- The introduction of opportunities for a limited number of secondments of advisers in and out of KS to encourage skill transfer and renewal
- The Division should develop and implement a formal training plan, to make use of external and in-house training provision
- Senior and middle-level staff time could be freed-up by rationalising the number of programmes and shifting some of the coordination work outside KS

6 Portfolio

KS' portfolio addresses the goals and interests of the Division and of Norway. The portfolio is increasingly interdisciplinary and parts of it involve collaboration with research groups in other countries.

Overall, KS has overcome a number of previous failings (for example lack of coverage for interdisciplinary research). The experts felt that some further change is needed and that some attempt should be made to reduce the number of responsibilities the Division owns, for example, by reducing KS' responsibilities for the core funding of Institutes or the provision of PhD grants.

The RCN runs two main types of programme – basic research programmes and action-oriented programmes. Basic research programmes cover important projects on ethics and cultural issues. The Ministries' focus on problem-solving means that applied research receives considerably more funding than basic research, but this is typical of what most governments expect and want. The positive aspect of the applied portfolio is that it appears to be fairly flexible and able to respond to new problems. On the other hand, the applied programmes appear to be time-consuming and disproportionately demanding of RCN resources. In addition, applied programmes are major contributors to internal differences between the social sciences and humanities, and to the boundary issues that KS faces. This suggests that KS should be more active in defining the boundaries of applied programmes to ensure that their coverage satisfies both the Ministries and the needs of the research base.

In addition to the above programmes, the Division's portfolio includes responsive-mode funding and the core funding of research Institutes. The expert reviewers feel that KS has done well to maintain basic research and research focused on the humanities. These modes, which offer most opportunities for the humanities and social science research communities, appear to the panel to be underfunded when compared with other research councils.

There appears to be some lock-in to existing modes of funding and the organisation might be reinforcing this by organising around these modes rather than around goals. This may be linked to the requirements of the funding Ministries but we feel that breaking away or varying from well-established modes might be a creative step-forward in promoting KS' goals.

The need here is for effective implementation and a period of stability. Increasing the focus on the research communities needs through basic programmes and or responsive mode funding seem to offer the main opportunity for gradual enhancement of KS' work, profile and reputation, and should be the focus of attention over the next year.

The reviewers conclude that

- The Board needs to take a considered overview of the different components of its portfolio. It will be important that this review is based on data and evaluation and not on personal experience. If KS is to continue to perform the current large

number of roles within the RCN, it should be provided with an adequate funding base for these activities

- KS should conduct a formal review of the current portfolio of funding mechanisms, to assess whether they are appropriate for its purposes, or whether different ones might better contribute to their overall objectives (for example, some research councils put substantial resources into networks or seminar groups).

6.1 Core funding for Institutes

In Norway, independent Institutes receive core grants from KS. Based on international comparisons, our panel concluded that it is unusual for a research council to have formal responsibility for the core funding of Institutes when these often have more direct links with the needs of funding Ministries.

Nevertheless, this is a large issue for KS as the Institute sector carries out 43% of Norwegian social science. Institutes also get 11% of KS responsive awards, and although there is almost no humanities funding for Institutes, they account for 53% of the social science programmes.

For KS, this offers opportunities to influence and improve the academic infrastructure, although only in the social sciences. From the information we were presented with, the allocation of funds is based on an annual review of the Institutes, using a mix of formulaic assessment and visits. There is a KS committee overseeing the process and KS has decided to manage this process centrally, using 1.5 staff.

The reviewers feel that this is technically very efficient and provides a low-cost solution. However, recent evaluations suggest that scientific quality is not impressive and it is not clear that the current mechanisms can do much to improve the situation (particularly given the pressures to prevent a concentration of resources). The reviewers feel that the ability to concentrate research resources might allow KS to improve the situation by creating real incentives.

Of the 19 Institutes for which KS is responsible, a number have close connections with local interests or support the needs of Ministries. This raised the issue of the value-added by employing KS to disburse core funding on behalf of Ministries on the basis of access to scientific resources, rather than promotion of quality research. In other countries, the provision for core funding is not considered by research councils, and some of the reviewers question whether this should be a core part of the work of the RCN.

6.1.1 Recommendations – Institutes

If core Institute funding is to remain a RCN priority, the review team feel that KS should focus on developing their research, not taking over the role of solving all their problems. The Institutes can make a good contribution to RCN's goals but this requires a better alignment of goals between Institutes and the RCN.

Possible changes could include

- Reducing the number of Institutes for which the RCN provides core funding to by asking ministries to take direct responsibility for Institutes that act as the main resources for their policy needs
- Sub-contracting KS work to Institutes that have the appropriate infrastructure (for example programme coordination), and generally developing better partnerships with Institutes
- Increasing the competitive basis for core Institute funding, perhaps by opening up resources for competition every five or ten years

6.2 Responsive-mode Funding

One of the principal objectives of the Division is to encourage basic research in the humanities and the social sciences by supporting researcher-initiated projects.

Responsive-mode funding is a central element of the research councils' relationships with the academic communities who supply the research ideas and skills, and it makes a strong contribution to the reputation of the research council.

Historically, it appears that the major part of this type of funding has gone to PhD students, with comparatively little funding made available for longer term research projects conducted by senior researchers (in the opinion of two of the panel members this appears to be low by international comparison). The rationale for funding PhDs as part of the responsive-mode funding category and allowing this to dominate the allocation of resources was not made clear to the reviewers.

Generally the rationale for providing centrally administered PhD funding are strategic and based on:

- Providing a change agent to overcome the conservatism of university-based peer review
- The need to increase (or maintain) the number of researchers in a research area considered to be of national importance

Given the large number of responsibilities that KS has to deal with, the reviewers question whether the RCN is adding much value by evaluating PhD proposals given that these currently appear to be assessed in competition with other proposals on quality criteria alone. The panel wonders if this could not be delegated to some other board or organisation(s) with a combined education–research remit.

Historically, the application success rates have been low with a funding rate of around 15%, which suggests that

- There is much demand from the research community to get researcher-initiated projects
- A two-stage process should be considered by the committee, particularly as 'hidden criteria' (for example, regional and discipline fairness) have an impact on the process

Until recently, the assessment system prioritised the needs of the academic disciplines, but it appears to have been over-administered given the money available. Earlier attempts to reform the system in 1994 were resisted by the academic community, but changes have now been made which

- Reduce the number of committees to three (Humanities, Social Sciences and a Cross-disciplinary board).
- Prioritise larger 'project' awards
- Aim to reduce the number of awards given for PhD support only
- Encourage work across the humanities–social science boundaries

Although it took over seven years to make the transition, the decision to fund fewer and larger projects will now promote modern humanities and social science research, and should improve the reputation of KS. Changes will need to be monitored, and KS should reflect on the required balance between different response mode–funding categories. For example, a problem with large interdisciplinary projects is the fact that they require skilled leaders to devise and run them. Checks should be made that such leaders can be found in Norway or can be attracted to work there.

6.2.1 Recommendations – Responsive-mode

The recent changes all take KS in the directions it wanted to go. They appear to be beneficial for the promotion of modern humanities and social science research, and for the reputation of KS. The changes seem to have been implemented very effectively, although no doubt this conceals some large debates inside and outside the council. There are a number of incremental recommendations that can now be made

- Further Indicative targets should be set for large awards, PhD awards, and the proportion of cross-disciplinary funding. Performance should then be reviewed against those targets
- The provision of funding for PhD projects should be separated from the general responsive mode budget so that there are well-defined budgets for the provision of PhD training and for the support of research project. Funding for PhDs should be
 - better justified by making national arguments for the total number of PhD required (beyond what gets funded by universities)
 - based on the need to provide alternative sources of funding to overcome the conservatism in university departments
- Consideration should be given to improving participation and cooperation by including a representative of the social sciences on the HU committee, and *vice versa*
- There may still be too many types of funding provided under this heading (for example, conferences and journals are also included). KS should consider concentrating its resources on high-quality project research.

6.3 Basic Programmes

The basic programmes are those that KS has established on the basis of its own judgements and budgetary discretion, through participative consultation with the research community and users' needs. These are the types of programmes that

exemplify the traditional role of research councils, and provide an opportunity for KS to adopt a visible leadership role in identifying priority areas at the interface between the academic and policy agendas.

Overall, the reviewers feel that one of the most significant problems for this part of the portfolio is that the degree of freedom afforded for basic programmes appeared limited, and they suspect that the level of funding available is sub-critical.

The nature of this review did not afford the opportunity to investigate in detail the content of these programmes, but the Panel is impressed that some appear to have reached high international standards (for example, the ARENA programme). However, they feel that the coverage is may not be strategically balanced and that compared to other European research councils, the humanities are underrepresented² (some subjects may also be underrepresented e.g. social statistics).

The selection of basic programme topic areas is arguably the most important opportunity for KS to deliver on its traditional research council responsibilities. KS has grasped the importance of this mode, and set itself the target of finding funds within its ‘free money’ for at least one new basic programme a year. However, the reviewers feel that the process of developing basic programmes is not transparent enough.

6.3.1 Recommendations – Basic Programmes

Given their potential strategic importance for the Division, the KS Board should seek to enhance the funding for the basic programmes. Reference has already been made to the opportunity for a more strategic approach and for use of KS themes for that purpose. High quality, high visibility basic programmes, derived from wide-ranging discussion with stakeholders, can be one of the main instruments for delivering the strategy.

There are some specific steps KS can take to improve the impact of basic programmes

- Discuss and publish information on how KS intends to develop basic programmes in the future, including the decision timetable. It will do no harm to point to the need for more money for this mode of funding
- Consider the opportunities for public engagement in the process, through the Web, for example, or more radical methods such as citizens’ juries which can be used to create support for these programmes
- Agree and publish the selection process for programme development and selection
- Engage key Institutes in basic programmes, as contributors of ideas and knowledge transfer sites, in addition to their role as recipients of funds.

² This is **not** a criticism of KS and we acknowledge the constraints inherent in the fact that the balance between Humanities and Social Science in the Basic Programmes is determined by the budget requirements from the Ministries

6.4 Applied Programmes

These programmes cover areas of interest for external funding agencies but many research topics within these programmes are also central topics in international social science research. Applied programmes are the most innovative and user-oriented part of KS' portfolio, and they can demonstrate the importance of good-quality research with users and provide researchers with good opportunities to influence policy and practice.

On the other hand, the current funding arrangements create huge complications, workloads and boundary problems for KS. In addition, the administrative costs of the applied programmes seemed high, and it was not clear why so many of the programmes needed to be coordinated in-house.

The reviewers feel that there are too many small and narrowly focused programmes and that it should be possible to obtain synergies by incorporating these in larger multi-actor programmes with a broader coverage. This might also address the issue of disciplinary coverage³ and the pressure for short-term research.

6.4.1 Recommendations – Applied Programmes

There is no easy solution here. The main recommendation is that serious attention be given to focusing, managing and obtaining maximum benefit from this mode of funding. KS should consider the benefits and costs (and especially opportunity costs). Additionally, a few specific suggestions can be made

- Generally, KS should seek to negotiate more flexibility in the resources it receives from funding ministries and should resist requests to provide matched funding for applied programmes from the “free” funds it receives from KUF. It should seek support for this approach within the RCN
- KS should continue to monitor the real costs of managing applied programmes - if appropriate, this information should be used to justify an administration ‘fee’. An alternative would be a ‘basic research tax’ on each applied programme, to be used by the Board as it saw fit.
- KS should also consider how it could improve the definition of the programme boundaries for applied programme work to represent better the longer-term research interest of the research base

Finally, KS effectively acts as a programme manager for external funders – if it cannot simplify its relationships with funding Ministries, it should consider extending this sort of relationship with other organisations interested in funding research (for example, industry and foundations).

³ There is apparently little scope for involvement of the humanities in applied programmes and they are major contributors to the large structural differences between social sciences and humanities funding in KS.

7 Effectiveness and Impact

Based on their experience and the information gained during the evaluation, the reviewers feel that KS appears to be a healthy and effective organisation. Applications seem to be at a high level and the programme portfolio seems to cover the areas international research funders believe to be the 'hot topics', and the staff seem well informed, motivated and effective.

It does appear, however, that little attention is paid to assessing impact and influence of KS' actions. This may be because of corporate constraints, or work, or the small society effect of believing that these things are known. This is a potential weakness at a time when all societies and governments are increasingly interested in value for money and the effective delivery of publicly funded services.

Generally, the impact of the research the Division is doing could be improved by devoting more attention to addressing marketing and presentation issues. For example, although most researchers want to publish in learned journals, these journals are not read by the general public. Applied research should also be published in popular journals, in the press and on the Internet or even video programmes. This, in turn, helps the researcher to learn to communicate in a more popular writing style, which is a useful skill.

The reviewers were initially sceptical about the effectiveness of KS, as it appeared to be consuming considerable resources to manage 400 MNOK worth of research funding. However, the visit and presentation have revealed the complexity of KS' situation and the reviewers now understand why KS needs more resources than other international councils. Overall, given the difficulty of the tasks they have faced, the review team feel that KS' performance has been fair

- Many of the Division's goals for change have already been achieved
- There has already been a comprehensive restructuring of programme activities together with guidelines for programme management
- Research priorities have been agreed and methods of evaluation developed
- The applied programmes are likely to deliver useful results for the sponsoring departments and hence public policy

However, the complexity of the system within which KS operates prompted some members of the team to suggest that there would be scope for significantly improving effectiveness by reducing complexity – releasing KS from some tasks and simplifying others.

In a number of cases, it appeared that Board members and staff of KS clearly felt inhibited about their own roles and opportunities, as a Division of the RCN. This is dysfunctional in a modern organisation and the RCN management should be advised of the value of encouraging more divisional activity and responsibility and of supporting rather than impeding divisional initiatives which contribute to overall Council goals and effectiveness.

Finally the reviewers do have a concern about the continued separation of the humanities and social sciences in that there are noticeable structural differences which seem not to be addressed. This suggests that the objective of integration of the Humanities and Social Sciences within KS are not being well met.

7.1 Recommendations – Effectiveness

A number of the earlier recommendations will have an impact on the organisational effectiveness and the review therefore only has two suggestions for improving the effectiveness of the organisation.

- KS should review the impact and influence of KS' actions so that this can be monitored and communicated
- The role of the Humanities in programmes has been somewhat limited to a number of small subject-based capacity building initiatives. There is scope for wider participation in the areas where the humanities and social sciences naturally meet. This issue needs to be addressed because of the limiting effect it has on KS work.

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Review of RCN's Environment and Development Division

Summary of the Expert's Reports

August 2001
(revised November 2001)

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With

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1 Executive Summary

This section presents the summary from the expert review of the Environment and Development Division (MU) Research Council of Norway (RCN), which took place on 14 and 15 June 2001. The report of the Evaluation of MU will form part of the background material to the wider evaluation of the RCN currently underway.

The expert reviewer's assessment is mixed. MU has made significant progress towards the goals associated with the 1993 merger, however, there are some weaknesses, for example, in the development of a strategy both for the RCN and for the Division. The reviewers conclude that these problems are often caused by government policy for research and higher education, and are to some extent imposed on the Division.

1.1 Conclusions

In many respects the current RCN bears a striking resemblance to the situation prior to the 1993 merger. Ministries still use Divisions within RCN as conduits for funding, and seek to exercise influence on the substance of programmes. Sectoral responsibility and tight control of spending goals by Ministries prevents RCN from delivering on its remits and from delivering a pro-active strategy. On the other hand, the relationship has maintained strong ownership of the some of the Division's programmes and facilitated the uptake of research by policy makers.

The RCN plays a double role in the governmental science policy. On the one hand, it is the implementing agency for the research requirements of the government. On the other hand it is supposed to act as the principal advisor to government on science policy issues. This combination of roles means that there is a risk that the advice given is short-term rather than strategic.

The reviewers assessed the change goals of the Division as these were envisaged following the 1993 merger. Overall the Division has had mixed success in dealing with these goals. Some have been pursued very successfully, whilst others have not yet been achieved, and appear unlikely to be achieved in the near future – largely because of the constraints the Division is working under.

MU has been highly successful in fostering good relationships with the research communities with an interest in environment and development. This was achieved despite initial negative expectations from the research community regarding the level of funding that would be provided from the RCN. The reviewers also feel that MU has been particularly effective in fostering interdisciplinary research, and has taken this further than most European research councils.

The reviewers argue that MU has been fairly successful in developing a balanced approach to the integration of basic and applied research, and in developing actions plans that have led to an appropriate portfolio for the Division. However, there is a feeling that the programmes are frequently developed exclusively for the purpose of satisfying Ministries. The division has been highly successful in reducing the number of programmes. This has led to a more efficient use of staff resources and must be

seen as a positive step towards greater cooperation between Ministries. It is also an improvement from the perspective of potential applicants.

The Division has had less success in integrating research on environment and development within the programme and the projects it manages, and the value of covering environment and development in one Division has not been conclusively demonstrated. This is partly due to the fact that these activities are funded by different Ministries, who do not to attach much priority to integration.

The Division 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. Despite the development of the well-reasoned 1996 strategy for the environment, the Division has not achieved the level of coordination for environmental research that was initially anticipated. As a result, MU cannot be said to have achieved its aims of being a coordinating force for environment research within the RCN and other Divisions appear to regard environment research as MU's remit rather than being a concern for the RCN as a whole.

The reviewers feel that, in common with the rest of the RCN, the Division has not been able to make changes to the practice of Ministerial earmarking – although there has been progress in terms of obtaining funding for multiple Ministries for a number of their programmes. In addition, it appears that some of the earmarking for the division is agreed at a programme or division level between MU and the funding ministries so that some of the earmarking generates funding for the areas that MU is interested pursuing. However, this is not always the case and the earmarking introduces some real restriction on MU's ability to change its portfolio and to reallocate resources. Despite the earmarking constraints, the Division has set up innovative research programmes with considerable impact.

The Division is well managed within the constraints under which it operates. The staff is competent and highly motivated. Project and programme management are of good quality, although the small number of staff in relation to the demands from the programmes should be critically evaluated. Further reduction of the number of programmes could improve the situation.¹ Attention to further development of new staff competencies (e.g. to address increased attention for integration of results and transfer to user communities) will also be valuable.

The coverage of the portfolio is broadly appropriate, but appears to be uneven, and driven more by the wishes of the funders than by what the reviewers would consider to be a research council strategy. In the present structure of the RCN, more attention should be given to important emerging areas that require cross-Division programmes (e.g. genomics and engineering-based environmental research). Similarly, the funding mechanisms (projects and programmes) appear to be suitable. The funding and support for responsive-mode research appears to be too low however, compared with other research councils in Europe.

¹ This would also address the load on researchers having to write proposals for several different programmes

1.2 Recommendations

The following points summarise the review teams' recommendations

- **The RCN should re-examine the value of hosting environment and development research in a single Division**
 - At present, there appears to be little synergy between the two main remits of the Division and there may be a good for separating these two roles
 - Alternatively, environment and development might be given a more strategic role within RCN, ensuring that all research supported by RCN makes a contribution to 'sustainable development', which must then become a guiding principle for the RCN's other Divisions
- **The MU Board should be given more freedom and responsibility to develop a strategy for its domain.** The MU Board should meet regularly with the programme committees in order to strengthen the link between programmes and MU strategy and progress in the programmes
- To remedy the fragmentation of the research effort arising from the separation of the 'harder' engineering components of environmental research, **the Division's remit needs to be clearly defined, and a conscious effort made to link environmental projects with research in other Divisions.** A major part of research funding should be allocated across Divisions, and relationships with research in other Divisions should be given priority in evolving research programmes
- **The MU Board should continue its Vision 2030 process** and should (as planned) include its recommendation as an input for the next divisional strategy and to deliver on its remit of providing advice to government.
- The management should consider an **active job rotation system** within the RCN, to create a greater sense of corporate identity and to facilitate knowledge exchange within the RCN. MU should also consider the possibility of **secondment to and from the research base**, as a mechanism for ensuring that staff have access to up-to-date scientific expertise
- **The budget for the responsive-mode funding for research should be reviewed and increased** so that it is comparable with the percentage of funding allocated by other European research councils
- **The RCN should play a stronger role in the discussion about the institute landscape in Norway.** The rationale for providing core funding should be clarified, as at present, the RCN funding does not appear to be linked to developing quality research, and is more concerned with providing access to research resources for Ministries
- A RCN-wide policy should be formulated to examine the specific issues associated with the multidisciplinary **aspects of its research programmes and the issues these can create for peer review panels.**

2 Introduction

This report summarises the results of a short expert review of the Environment and Development Division (MU) of the Research Council of Norway (RCN). The report contributes to the much wider evaluation of the RCN commissioned from Technopolis by the Ministry of Education, Research and Church affairs (KUF).

It is one of six such evaluation reports looking at the research portfolio and organisation of the Divisions in RCN and provides an assessment and recommendation for future development of the Divisions' research strategy and operation. The report will be appended in a separate Appendix to the overall evaluation report and will provide material both for other components of the evaluation and for a summary of the expert reviews of the RCN's Divisions.

3 Method

The aim of the Divisional review was to evaluate the strategy, organisation and functions of each of the six Divisions and the various programme elements that they cover, and to draw conclusions for the operation of the RCN from these reviews. The Divisional evaluations focus on

- The strategy adopted by the Divisions
- The structure and resources of the Division and how these are managed to support the delivery of its missions
- The choice and relevance of the research portfolio supported by the Division and the way in which these are designed and used
- The effectiveness and impact of the portfolio

The two expert members of the review team were identified by Technopolis and subsequently approved by MU. The team members were as follows

- **Dr John Marks** is the Director of Earth and Life Sciences at the Netherlands Organisation for Scientific Research (NWO) and has considerable experience within NWO in the areas of environment, life sciences and R&D strategy. He worked on similar issues in the ministry of Education and Science as head of the division of Environment, Life Sciences and R&D Strategy. He was previously the Acting Executive Director of the International Geosphere-Biosphere Programme
- **Professor Michael Redclift** works in the Department of Geography at King's College, London works in the department of Human Geography and the Environment at King's College London and was previously Professor of International Environmental Policy at Keele University. He has written a number books which broadened the debate about sustainable development, and was responsible for the Food and Agriculture Organisation's response to the work of the Brundtland Commission. He was the first Director of the Global Environmental Change Programme for the UK Economic and Social Research Council

Technopolis explained the issues that the review team would attempt to evaluate and asked MU to provide a briefing document on its activities. This was delivered to the panel prior to the review visits.

The review visit took place on 14 and 15 June 2001 and the schedule centred around a number of pre-agreed presentations, followed by a question and answer session designed to allow the reviewers to comment on the evaluation questions. The leader of the RCN evaluation (Dr Erik Arnold) and the consultant responsible for the Divisional evaluations within the review (Mr Ben Thuriaux) accompanied the review team.

Following the visits, the two peers prepared their individual evaluation reports. These have been synthesised by Technopolis and validated by the reviewers. A draft report was submitted to MU and subsequently amended to respond to MU's response to the original draft.

The present version incorporates some changes to the original draft to address the comments raised by MU - it should be noted, however, that not all of MU's comments were integrated in this final version. To ensure that the reader has access to both sides of the arguments presented, MU's comments are reproduced in Appendix B (general comments) and Appendix C (specific comments).

The report addresses the issues that the reviewers were asked to concentrate on and outlines a number of possible recommendations that will inform the overall evaluation of the RCN.

4 Strategy

MU started out to develop a strategy for its domain, but appear to have been unable to really implement it. This is primarily caused by the restrictions placed on the manner in which it is required to distribute funding on behalf of Ministries and on the apparently weak position of MU within the RCN.

The Division has undertaken the difficult task of creating an environmental strategy for the whole of the research council. On the whole the process by which it went about this was sound, and the recommendations were clear. The impact of this strategy was weak however, and this appears to be due to the lack of incentives for the other parts of the RCN (other Divisions and the Executive Board (EB)) to implement it.

It is not clear whether or not the EB is willing to devolve the process of strategy development down to MU.

The Division is active in most of the important areas that fall under its remit, and there is a very positive consultation process in the development of new research areas.

4.1 History – Context – Remit

The strategy of MU must be evaluated in relation to its history, the context in which it has to operate and to its instructions. The reviewers feel that MU is quite unique and know of no other council with the same mandate.²

In 1993, Norway's five research councils merged to form a central organisation with responsibility for managing both basic and applied research on behalf of government Ministries. Much of what used to be directly managed research now flows through the research council, but it is important to note that Ministries still retain their own research budgets and research units. The current system enables Ministries to distance themselves from the research community and research institutes, and so facilitates advice to the Ministries from the RCN.

MU has a special position within the RCN for two reasons

- The Division did not have a council as its predecessor in the previous system
- MU was given a coordinating role across the RCN for environment research.

In view of the coordinating role, MU took the initiative to develop (through wide consultation) a strategic plan for research on environment and development for the RCN. The RCN EB adopted a plan that was expected to become the leading document in this area for the whole council.

² The remit of the Norwegian Research Council as a whole has similarities with other national research councils in Europe, although RCN probably has most in common with the Canadian Research Council.

However, the plan was not considered by the other Divisions to be a core component of their planning. The reviewers' interviews with representatives of different Ministries suggests that Ministries did not feel ownership of the plan and consequently paid little attention to it in drafting their research plans. In the end, only MU developed an implementation plan, which was published in 1999.

The process to arrive at the 1996 strategy was based on best practice, and the document is well reasoned and has clear objectives. However, despite attempts to involve the Ministries in the process, in the end, neither they nor the other RCN Divisions felt they needed to implement it because it was not seen to be relevant and was viewed as the strategy for MU alone.

The review team was provided with a series of 'priority actions and achievements', which expressed a resolve to further existing good practice, or to initiate new practices. Most of these lack measurable criteria and it is difficult to assess whether or not they are any more than just an expression of intent. The reviewers feel that plans play only a limited role in the development of the programme portfolio, and the structure of the portfolio is dominated by the desire to continue programmes (programme inertia) and the requirements of the funding Ministries. The issue here is whether the programmes which were started were the result of the strategy, or whether these programmes fitted the strategy, but would have come about in any case because of ministerial demands. This is not to say that responding to the demand side is not an important part of a strategy but it must be balanced with a supply side strategy.

This issue is largely the result of the 'strings' attached to the funding of programmes by the Ministries, which leave little room of manoeuvre for the RCN. In the present system, MU (and possibly the other Divisions) is pretty much 'hand tied', and acts as an implementing agency for the requirements of Ministries. There also appears to be little cross-division coordination and real collaboration on joint programmes.

Discussions with the Division's board revealed that in their opinion the RCN EB has not allowed sufficient freedom for the MU Board to develop a new strategy process for their domain and raises questions about the quality of the EB strategy development and the function of the MU board.

It appears that the Division's activities are heavily influenced by the work of the EB and other top-management, but the reverse process is not apparent. Despite their cross-cutting responsibilities for environment, there seem to be few ways in which the Division influences general RCN strategy or policy.

Despite these shortcomings, the review team was told that the wishes of the Ministries are nearly always formulated via an interactive process involving RCN and researchers.

The reviewers feel that MU seems to be addressing the important areas that fall under its remit and are impressed with the Division's success in reducing its programmes from 30 to 12 over the last few years.³

4.2 Developing a Strategy

The distribution of the budget of the RCN over the different Divisions appears largely to be determined by historic and external considerations. Until recently there appears to have been no mechanism at the EB level to redistribute funds on the basis of the strategy plans, and this limits the usefulness and effectiveness of having a single research council.

In considering the development of a strategy, the reviewers felt that the driving forces in the fields relevant to MU should come from several areas

- The process of **globalisation** has served to relocate activities – including research and environmental policy – at different geographical levels. These include the enlarged EU, multilateral agreements like the World Trade Organisation (WTO) and the Kyoto Protocol (Conferences of the Parties to the UN Framework Convention on Climate Change (FCCC))
- Norway's possession of important hydrocarbons and hydropower resources might lead it to play an important role, at the international level, in some of these developments⁴
- Shifts in substantive areas of science, notably the life sciences, and especially genetics and human/animal genetics already carry implications for law, social and environmental policy and require strong collaborative linkages – absent at present - to other divisions of RCN with partial responsibilities for these emerging fields.
- New systems of technological co-operation have been stimulated by global information systems (such as the Web) and carry implications not only for science and technology policy, but for areas like and the environment. There are specifically Norwegian dimensions to some of these problem areas, especially given the proximity of Russia and the strategic importance of the Arctic
- The expansion of new (increasingly) 'market' based economies, especially that of China, has forced a reconsideration of the meaning of 'development', and 'underdevelopment'

These are all issues that the RCN should be handling in the twenty-first century and there are signs that progress has been made to address these (for example, in the research program on 'globalisation and marginalisation'). However, in most cases the reviewers did not feel that there was a strategy within the Division to address the bigger picture in a coherent way.

Drawing on their experience of comparable arrangements in different countries, the reviewers suggest that receiving funding from Ministries may introduce a bias

³ From the portfolio it is apparent that, although a substantial reduction of the number of programmes has been achieved already, there are still programmes in the portfolio with an annual budget of less than 3–4 MNOK

⁴ There have been some interesting policy moves, such as Joint Implementation, carbon offsets, and tradable emissions policies, which have involved Norwegian institutions

towards short-term research results and may prevent an even coverage of research areas. If Norway were not a relatively small research community, there would be enormous confusion and more fragmentation than currently exists. However, scientists and science appear to be very familiar with what is happening in other congruent organisations.

4.3 Recommendations – Strategy

- The RCN plays a dual role in governmental science policy. On the one hand, it is the implementing agency for the research requirements of government. On the other hand, it is supposed to be the principal advisor to the government on science policy issues. However, this latter role is underdeveloped, largely because of the pressures under which the RCN is operating. Representatives from the Ministries argue that there is a risk that RCN advice is too short-range and specific, rather than strategic
- Allowing MU to develop a successful strategy would require it to be given rather more freedom to allocate resources. Then, in place of this current rather fragmented and incoherent division of territory, the Division will gain from the current Vision 2030 exercise, which will identify areas for prioritisation
- In the area of development research there would be an improvement in the effectiveness and synergy if RCN/ED and NORAD were to develop a better and more intensive working relationship for joint funding of projects. We heard several remarks about the difficulty of finding funding for developing country participation in development research projects

5 Structure

It is difficult to compare the portfolio to that of other councils because of the unique character of MU. However, the strength of having environment and development in a single Division is not sufficiently apparent, and raises doubts about the value of the current structure.

At the moment MU is both constrained by Ministerial involvement and, at the same time, party to continued barriers between Divisions, which force it to adopt a brokerage role. Its relative ineffectiveness in integrating the whole range of environmental research is a direct result of this structure.

5.1 Rationale for Current RCN Structure

The RCN is a unique organisation, combining the tasks of a classical research council with the role of the implementing agency of government science policy on behalf of all Ministries. This is conceptually an attractive structure, as it increases the potential for creating synergy between different partially overlapping scientific objectives and reduces the bureaucratic load for researchers by creating a single 'counter' with more or less uniform procedures. It also makes best use of the expertise in developing and managing programmes.

A number of conditions must be fulfilled in such a structure, which does not seem to be the case in a sufficient number of cases in the RCN (and certainly not in MU). The most important conditions being that

1. The ministry of Education provides a sufficient budget for the council to perform its research council task. This budget should be given to the RCN on the basis of a strategic plan, without attaching additional conditions to the spending. A sufficient proportion should be set aside for responsive-mode funding of the best and most innovative projects and of the best researchers in various stages of their career. Funds should also be available for equipment and infrastructure investments. A balanced portion should be used to strengthen the fundamental/strategic character of the thematic programmes developed in partnership with other Ministries
2. The other funding Ministries allow the RCN and its Divisions to draw up plans for the most effective spending of the goal-oriented budgets. This is best done within a system where the Ministries define the policies that require scientific support at a more strategic level. This would then be followed by a process in which the RCN translates these requirements into a portfolio of programmes, bringing together the needs of different Ministries in larger scientifically coherent programmes, as much as possible.. This ensures the most effective use of the research capacity in universities and institutes. In order to be relevant to the needs of the Ministries, it is essential that transfer of results and transformation of results into policy-relevant information are an important and integral part of the programmes. There must also be feedback mechanisms to take account of the goal oriented character of the programme.
3. This requires that RCN effectively operates as a single entity from the viewpoint of the 'user clients'. For reasons of span of control, it is necessary

to have a certain amount of Divisional substructure. In this model, this is best achieved by creating a few broad (multi)disciplinary Divisions. ie, transferring the biological and earth sciences from the Science and Technology Division to the life, health and environmental sciences.⁵ These Divisions are then in fact the competence centres with the expertise on the available resources in the scientific community. For each goal-oriented programme, the relevant Divisions collaborate in its creation and management. At the same time these Divisions should play a role in the implementation of the research council function. In this model the Ministries ‘see’ a single implementing agency able to mobilise the full range of (multi)disciplinary expertise to address their questions, whilst the scientists ‘see’ a Division with expertise and experience in their own domain.

4. Given the long-term character of the research and the effort and lead times involved in the process of translating policy requirements into programmes, it would be advisable to put in place a strategic dialogue to develop a portfolio every 4–5 years. Of course, in addition there should be some flexibility in the system to respond to urgent policy requirements.

5.2 MU's Structure and Resources

Generally, the reviewers feel that the Division seems to lack resources to deal with MU's wide range of responsibilities (advisor, research broker and funder of research). Currently, the resource constraints mean that MU is not able to deliver all of these roles. As a result, it has focused on administrative rather than policy tasks which has reduced the value of having a unitary council capable of adding value to research through policy formulation.

The reviewers feel that the logic of having environment and development in a single Division has not been demonstrated, and the current set-up appears to have led to relatively few activities that obviously benefit from this situation.

The emerging area of the life sciences falls under the responsibility of at least four Divisions. Unless very effective mechanisms for joint programmes and real intensive collaboration are developed, the reviewers feel that the further development of the life sciences in Norway will be seriously hampered.

The reviewers are not convinced that the two strands of activities for the Division (environment and development) have sufficient synergies to justify focusing these activities in a single Division. This is compounded by the fact that MU seems to have been left with the ‘softer’ environmental areas, such as conservation, ecological systems and consumption behaviour. However, the reviewers do feel that the attempt to perform interdisciplinary work between the natural and social sciences – which is particularly difficult – is positive.

The funding balance is skewed towards environment, and there appears to be some uncertainty about the definition of the ‘development’ remit. However, it is positive that ‘development’ is not perceived in terms of developing countries alone and new programmes have been developed to deal with this.

⁵ This is a slightly modified version of the Grøholt recommendations.

The structure of the Division and the source of its funding, means that programme responses are essentially tactical, and instrumental – acting as a conduit. In the opinion of the reviewers (and, importantly, also of some of the programme chairs) budgets allocated to the different programmes in the portfolio are not always commensurate with the ambitions of the programme or with the level of interest in the scientific community.

Although considerable work has been devoted to reducing the number of programmes the Division deals with, there appears to be little synergy between programmes and still less with other Divisions, where boundaries seem to have been maintained (with a few notable exceptions) as if the pre-1993 structure still existed.

The reviewers feel that the budget for fundamental undirected research and personal support for researchers (at present less than 10 % of the MU's budget) is low by international standards, and programmes are mostly strongly policy-driven. There are also some areas that did not appear to be represented in the Division's portfolio.

The reviewers argue that the structural problems which beset the Division ('strategy' passed down from above; Ministerial 'earmarking' of research; few incentives to disseminate effectively to policy communities etc) account for most of the operational problems discussed above.

5.3 Recommendations – Structure

The appropriateness of structural form is contingent on the role of the organisation, its relationship with and dependence on other actors, the stability of its environment and its strategy. As a result, structure should be reviewed from time-to-time and modified as circumstances change.

At the level of MU, the reviewers recommend that

- **More attention should be given to coordinating the funding of important emerging areas** which require cross-division programmes and effective mechanisms for this must be developed within the RCN as a whole (rather than at the level of individual divisions)
- The RCN should continue to put pressure on the funding Ministries to **develop larger programmes that cross the borders of the Divisions**. This would reduce the proportion of overhead cost, and make it easier for applicants to understand the sources of funding within the RCN

At the level of the RCN the reviewers recommend that

- The lack of effective mechanisms for intensive collaboration and planning across the four Divisions with responsibilities for the life sciences, should be addressed through new structures; they also recommend that **the proposals of the Grøholt commission be revisited**
- The structure to deal with the hard and soft part of environmental problems (i.e. the idea of **sustainable development**) should be developed to form a central component of the RCN's work. There would then be either a Division capable of dealing with both the social and engineering aspects of sustainable development, or sufficient incentives and funding for appropriate Divisions to collaborate.

6 Management and Governance

A distinction needs to be made between the management of the Division, and the management of research.

The problem with management and governance of the work undertaken by MU is that there are simply too many bodies making decisions over a disparate range of issues. To make matters worse, it was suggested to the reviewers that the top management of RCN did not encourage inter-division cooperation.

There appears to be quite a strong sense of identity within the Division, but this is partly because it suffers from something of a ‘siege mentality’ – it feels disempowered and has its hands tied over funding by the Ministries. Gender issues are taken very seriously however, and with considerable success.

The programme Boards and administration appear to be performing well – especially given the complexity of their responsibilities. However, there is a suggestion that the Division may lack staff resources to support the current programmes.

Finally, despite RCN's role as the main source of science policy advice, there is a consensus from the programme level that messages on science policy are slow to work their way up the system.

6.1 The Ministries

The distinction between ‘environment’ and ‘development’ funding also carry problems for management and governance in the Division. The Ministry of Foreign Affairs understandably would like to see more ‘mainstreaming’ of development research within the RCN. However, this undermines the principle that *sustainable* development should be a central concern of all the RCN's work, by taking ‘development’ out of the equation.

The Division does not, in practice, have a coordinating role for environment, and still less for sustainability, within the RCN. The environment is accepted as important by other Divisions but they do not co-ordinate their environmental efforts and deal with it in the way they think is most appropriate in terms of their substantive concerns – industry, technology or culture. The ‘heavier’ science/technology sectors (funded by other Ministries) work through other Divisions in seeking to address technological environmental issues. Environment and development is left, effectively, with the ‘soft’ areas of the ‘natural’ environment – ecology, conservation and cultural attitudes to the environment.

6.2 The RCN

Division staff and representatives of the previous division board indicate that funding decisions, and overall strategy are closely constrained by the Director General and close staff. There is consultation with Division Heads, but they are not involved in the final resource decisions regarding funding for each division. Management is top-down, with apparently insufficient representation of, or delegation to, the Division and its Board.

One consequence of the fragmented approach to environmental work is that the Division (like others, one assumes) tries to ‘capture’ new areas for research. One example is the work being contemplated on marine development, as a ‘new’ area that they can steer with their ‘own’ funds. This is not a desirable state of affairs for a number of reasons

- It risks overlap with the work of other Divisions, and cases of this are already clear, such as globalisation, which is also being undertaken in another Division (although there it has a focus on the impact of globalisation on the Norwegian economy).
- It acts to *discourage*, rather than encourage collaboration across Divisions. In an effort to avoid being marginalised from other work on the environment, MU risks duplication and poor management of research.⁶

6.3 The Divisional Board

The MU Board appears to be made up of highly competent individuals capable of providing scientific advice and strategy for the Division. Gender equality policies have achieved a good balance of gender representation.

The Divisional Board answers to the RCN EB, and seems to possess few powers of its own. The RCN gives advice to Government Ministries, which influences the selection of research priorities.

The distribution of tasks between the MU Board and the staff of MU is clear and appears to pose no problems. There is a discussion about the role of the MU Board, both in relation to the RCN EB and the programme committees.

The representatives of the Board voiced a degree of uneasiness about the lack of freedom to develop strategy and policies. There is a feeling that the EB (or rather the central administration) forces the MU Board to operate under too many constraints. As an example it was mentioned that the Board is not allowed to develop new strategy for MU.

It is not clear to the reviewers how programme aims are linked to those of the Division. Objectives such as the development of research capacity in either the natural or social sciences, and the balance between them, appear to be established (if they are established at all) at the programme level. Similarly it is not clear to the reviewers whether the Divisional Board has any real effect in setting priorities for Norwegian research in the field of environment and development.

6.4 The Division

The Division has a dedicated professional staff with high qualifications. Management of the Division is of high quality as well. There is every indication that the staff can be considered to be an excellent executor of Board decisions. Appropriate attention has been given to equal opportunities for women.

⁶ This situation is complicated by the fact that researchers frequently work for programmes in several Divisions, similarly that Ministries fund research in several Divisions, and that researchers are wearing innumerable ‘hats’ at one time!

Staff of the Division, like other RCN staff seem to have good relationships with Ministries, and influence them in the way that funds are distributed, thereby effectively acting as brokers between programme activities and Ministerial decisions. A number of Division staff have experience of working in the relevant Ministries and we were impressed by the openness displayed between staff and Ministry representatives in the sessions we attended. On the other hand, the senior staff of the Division have little flexibility in allocating funds, setting priorities or developing a strategy.

Coordination with the rest of the RCN is much more of a concern. This is in part due to the non-interventionist culture within the RCN, and in part due to the strong role of the funding Ministries, which seriously hampers intra-RCN coordination and synergy. The reviewers felt that the difficulties experienced had much to do with the structure of the RCN, and the interest that Ministries had in preserving some aspects of this structure.

The recent decision to set up a high-level coordinating group between the Divisions, chaired by the Director of MU is supposed to address this problem, but the reviewers are rather sceptical about the likely success of this mechanism.

The changing roles of the Division staff appear to require a change in the skill set available and the reviewers feel that staff training and development should be increased. There appears to be little staff mobility either between the RCN and the scientific community or within the RCN itself.

6.5 Programmes and Funding Boards

Management of the programmes is strong and there seems to be more sense of direction at this level than at the Divisional level.

There is no indication that membership of the Programme Committees (PCs) poses a problem. There is an appropriate mix of scientists and users (the former being in the majority) and the users appear generally to have a satisfactory scientific background.

We heard concerns about the limited capacity in MU to give the support required to the PCs. Increasingly the support is not just administration of projects and management of review processes, but also organising integration of results, developing international cooperation, transfer of results etc. This requires new high-level skills and is a time-consuming task.

The people involved in managing programmes spoke clearly and effectively for their PC. There seems to be a loose working relationship between programme management and the researchers themselves, but the reviewers noted that PCs are constrained in their allocation of research funds to area of high demand from the research base because of Ministerial 'earmarking'.

The increasing complexity of programmes and the requirement to communicate results and other activities, goes beyond classical programme management and puts a heavy burden on the staff, both in terms of capabilities and in capacity. It is not clear whether or not there are sufficient resources for these tasks. A number of the

programme Chairs expressed concern that there might not be enough resources to manage their programmes, and that it was likely that the programme Board would take on additional management responsibility.

The management of research programmes in Norway is complicated by the fact that the people who represent the PC represent a large proportion of the research base. In a relatively small research community this presents problems – and staff acknowledged that it was often very difficult to fill vacancies on programme committees. In at least one programme that was reviewed the decisions had been taken to prevent members of the PC to apply for funding from the programme - this creates additional problems as Scientists are increasingly reluctant to rule themselves out of funding in their own specialist area.⁷

Another issue which should be considered is the process of review of proposals and decisions on the funding of projects. The current selection mechanisms do not place enough emphasis on the separation between the prioritisation process and the decision on funding of projects. Such a separation increases the transparency of the process and reduces the risk of conflict of interest. This is particularly important in a country with a small scientific community.⁸

6.6 Recommendations – Management and Governance

The reviewers have the following recommendations

- The RCN Executive Board does not appear to have the right resources to set a framework for developing divisional strategy or to make decisions on the allocations to different divisions.⁹ The reviewers feel **that the strategic leadership of the Board should be strengthened** and that it should be given authority and resources to formulate and implement its strategy and that the coordination of environment and development in other RCN Divisions should be given more authority. This should include some representation of the MU Board at the RCN EB to ensure that there is better alignment between the two bodies.
- PCs obtain their mandate and decisions on project funding from the MU Board but there appears to be little interaction between the Board and the PC once the programme has started. **The relationship between the MU Board and the PCs should be reviewed to increase the amount and quality of the interaction** between the Board and representatives of the PCs.

⁷ Even in larger research communities, this issue presents difficulties. It is addressed to some extent by ensuring that the Director of each programme receives incentives for his/her participation – in the UK their work attracts 46% indirect costs, and their management is treated as a research grant. It is more difficult to attract committee members, but more senior researchers regard it as the price they pay for attracting funding to their own research area.

⁸ In the Netherlands proposals are usually sent to foreign referees. At least two reports must be obtained; these are sent to the applicants for their comments. Referee reports and comments are used by the PC to determine an order of priority of the proposals, and the aggregated result of the prioritisation is discussed by the committee. The prioritised list is then sent to the Board for a decision on funding. Funding decisions are made at a distance of the programme (thus reducing conflicts of interest). This also allows the Board to exert an overall quality control on funding decisions, and to monitor the integrity of the processes.

⁹ The alternative would be to transform the RCN into something similar to the US NSF, but this would have far reaching consequences for RCN and its staffing.

- Increasingly, programme support goes beyond project administration and management of review processes to include integration of results, developing international cooperation, transfer of results etc. This requires new high-level skills and is a time consuming task. **The Division should review training needs** associated with these new demands and ensure that it has sufficient highly skilled staff
- A systematic **policy of job rotation should be introduced**
 - Internal rotation of RCN staff between the Divisions would significantly increase the internal coherence of the RCN
 - External rotations would allow the RCN to refresh the scientific competence of its staff and would increase the scientific competence of RCN via access to competent scientists and engineers

7 Portfolio

From the presentations, the impression arises that in general the origin of programmes is not based on a strategy to represent the supply side (i.e., researchers) but to respond to Ministries, with the result that some elements of the portfolio are mentioned in the strategy, whereas others are not.

The reviewers have provided short comments on the 13 components of the portfolio which were presented (**Appendix A**). The principal conclusions from the presentations are that

- Most of the programmes appear to be performing well
- A great deal of effort has successfully been devoted to promoting interdisciplinarity. However, this has created process and management problems which require additional resources. It is not clear whether or not the resources at MU's disposal have evolved to deal with the additional demand arising from interdisciplinarity
- A number of programmes appear to be over-ambitious given their available budget
- A few programmes seem to have a weak research impact – this is attributed to the role of the Ministries in the development and management of the programme
- A number of programmes seem to overlap, and it appears that programme separation is often the result of financial/logistical constraints brought about by Ministerial ‘earmarking’

Although the merger of research councils was intended to promote interdisciplinary research, the sectoral distinctions provided by Ministries are still replicated in the farming of research programmes by the RCN. This has led to the proliferation of small but separate initiatives in many areas so that whilst there is more integration in the post-1993 structure, there is still a level of overlap such that programmes in different Divisions and from different Ministries run along roughly parallel lines.

The reviewers argue that this is evidence to support their view that the Division lacks a clear strategy for the portfolio to follow. However, they feel that there is evidence from the structure of the portfolio that a positive attempt has been made to respond to policy ‘problems’, and the reviewers feel that some of the larger research programmes often have considerable strategic coherence.

The reviewers also saw little evidence within the portfolio of programmes that successfully covered both environment and development and this strengthens the comments regarding the value of dealing with these issues in a single Division.

The funding mechanisms (projects, programmes) appear to be adequate. The funding for responsive-mode research and person-oriented support for excellent researchers appears to be too low in comparison with other countries. The Division lacks a mechanism through which outstanding science can attract additional funding.

Based on international comparisons, the budget for responsive mode funding appears to be rather modest, and focuses exclusively on quality rather than considering the innovation potential of some of the research proposals. In addition, one of the reviewers feels that the research base would benefit from a strengthening of the person-oriented support to give the best established scientists the possibilities to develop their own ideas in relative freedom.

The reviewers note that they had not had the opportunity to discuss infrastructure requirements. The review panel was told that for institutes, the investment in (large) equipment is funded from the income earned from commercial work. The reviewers' experience in other countries is that that institutes typically require special funding arrangements.

To the extent that funders allow it, there appears to be a reasonable balance between fundamental and applied research in the programmes. Uniquely, compared with similar organisations in Europe, MU has a role with regard to the 'landscape' of institutes in the field of environment and development in Norway. The reviewers feel that this is an area where it could play the role more forcefully and more strategically.¹⁰

The Division staff are active in promoting internationalisation and play an active role in international bodies; many of the research projects are linked to international programmes.

Collaboration between the natural and social sciences is not easy to achieve, and MU appears to have a real impact here. There is little evidence of interdisciplinary research in the description and structure of the portfolio but it became clear in the presentations of the different programmes that the promotion of interdisciplinary collaboration across the natural and social sciences is taken very seriously by MU.

However, the decision to exclude the technological aspects of sustainable development from MU's remit, undermines its ability to deal with sustainability. Because of the distribution of responsibilities, MU only deals with the 'soft' environmental sciences and the reviewers feel that MU's impact could be much greater if it were responsible for the whole range of environmental research, including technology, energy saving and alternatives, as well as environmentally-sound production.

One reviewer felt that MU ought to have more influences in research areas in the earth sciences, which are covered by the S&T Division and could be considered to be global (for example, oceanographic research, continental margins). According to the reviewers, there are also some other gaps in coverage in important emerging areas.¹¹

¹⁰ This is especially important as there is a discussion (ongoing or starting) about the institute structure in Norway

¹¹ For example genomics which poses important and exiting scientific and environmental challenges.

Similarly, it was unclear why population, public health and quality of life, and values for sustainable development were left out.¹²

The Division staff argue persuasively for more ‘blue-skies’ research. However there are still some important issues that should be to be addressed, for example

- What is the ‘trade-off’ between curiosity driven research and more targeted policy-relevant research?
- How important is peer-review as against policy relevance?

The reviewers feel that in too many cases MU staff tend to associate free funding with good science, and programmes with ‘initiatives’. The reviewers feel that the responsive-mode of research can also provide insights into new research questions, and new policy choices. Indeed, the responsive-mode (through free funding) might well prove more important for innovation than the use of programmes.

7.1 Recommendations – Portfolio

The reviewers recommend that

- The rationale for hosting environment and development research in the same Division must be reconsidered
- The issue of the coordination of soft and hard funding for environment research should be resolved. MU must either be given additional responsibility (and resources) for funding environmental research in the life and physical sciences or responsibility for environmental research should be adequately coordinated by a budget holding coordination mechanism (this is after all one of the advantages of a unitary research council)
- MU should continue to negotiate with Ministerial funding sources to ensure that programme boundaries are clearer and more accessible for the research base. If the Ministry were to provide the RCN with a core discretionary budget of sufficient size, to be spent on fundamental research, either responsive mode, or in the framework of programmes, this would strengthen the fundamental research and would give the RCN some room to negotiate with other Ministries
- Some programmes would benefit from a better alignment of their scope with available budgets, as they risk being assessed as having failed to achieve all of their goals
- The rationale for funding institutes needs to be adequately resolved, and responsibility for core funding should be justified on either a quality or a relevance basis. The use of evaluations (and their recommendations) should be strengthened
- The resource requirement for dealing with the complexity brought about by the strong focus on interdisciplinarity should be reviewed to ensure that MU has sufficient resources to deal with programmes properly. This may require investment in additional human resources or the further development of existing staff

¹² We were subsequently told that these areas are important parts of MU's portfolio but (possibly because of the selection of material presented) this was not apparent to the reviewer making the comments.

- MU should review the areas where research councils with environment and development remits are active. MU should be given more power to negotiate research coverage, taking into account the interests of the research base

8 Effectiveness and Impact

Based on their experience and the information gained during the evaluation, the reviewers feel that MU appears to be an effective organisation whose weaknesses derive from the constraints of the system it operates in.

It is difficult to gauge accurately the effect of its programmes on policy in Norway because

- the fragmentation currently occurring leads to a very blurred set of impacts
- few programmes seem to have been evaluated seriously

Generally, MU lacks an adequate mechanism to measure the effectiveness of targeted research and the staff seem to regard the funding of ‘good science’ as the main component of the much-desired free funding.

The direct funding of specific programmes by Ministries, and their participation in PCs creates direct links into the policy making process. The representatives of the Ministries with whom the reviewers spoke were satisfied with the advice they received on the basis of the research results, and several of the programme Chairs gave concrete examples of the impact on policy-making. But at a more strategic level, the impact of MU on the RCN and on government policy appears to be limited.

The reviewers did not have sufficient time to discuss the adequacy of dissemination mechanisms. In general, the international impact will be highest if the programme is well connected internationally and if it attracts Norwegian researchers of world level. From the presentations it appears that a number of the programmes have the potential to have (or have had) a real impact on policy.

8.1 Recommendations – Effectiveness

In general the RCN should think about suitable performance indicators, and not only for the amount of interdisciplinary research. There is an increasing demand for such information by the providers of funds.

Appendix A Portfolio Comments

A.1 Core funding for Institutes

This part of the portfolio deals with institutional capacity, and so has been evaluated from a different perspective. Historical evolution, rather than conscious policy – as in many countries – determines the portfolio of Research Institutes (RIs).¹³ In view of the fact that there appears to be a discussion about the institute structure in Norway, it seems wise to strengthen the role of the RCN in this process. On average, RCN block funding provides 15% of total funding for RIs and the proportion of funding thus allocated is planned to decline. On the basis of international experience, this level of core funding is on the low side, even for institutes earning its external income.

Much of the RCN funding of RIs seems to help support research staff in the preparation of scientific articles etc. A recent White Paper recommends more competition between RIs and a reduction in their number. The RIs themselves say that the Ministry of the Environment could force them to merge, and MU could use funding to produce this effect.¹³

MU has only limited abilities to steer the mission of institutes. At the moment two-thirds of the budget is directly given to the institutes for competence building and this is directed through external *ex post* evaluation; there appears to be a rather weak coupling of the outcome of such evaluations to funding decisions.

The funding for the Strategic Institute Programmes is given on the basis of competition and peer review of proposals. About one-third of the core funding is distributed in this way. Feasibility or acceptability rather than any real strategy appear to determine competence building and the division of the core budget between strategic programmes. .

RIs claim that that MU adds value by coming between the Ministries and the RIs. However, they also receive money directly from Ministries, so it is a complicated picture, and the reviewers are not clear as to the value of having multiple core funding sources which appear to pull the institutes in two different directions at once. Within the current arrangements, a more rigorous allocation procedure, based on quality, would be advisable, if the role of the RCN as the guardian of the quality of these is to be taken seriously.¹⁴

More coherence needs to be brought to the way in which research institutes are supported, especially in view of the changes in European funding and the role of universities. Norway needs to be clearer about what it requires from the institute sector and what role they are to play in implementing the Norwegian Research, Innovation and Technology policy.

¹³ MU has provided incentives for a number of the environmental institutes to collaborate.

¹⁴ This is no comment on the quality of the institutes, but on the process of allocation of funding (as we were not presented with information on the quality of the work of these institutes).

A.2 Globalisation and Marginalisation

The programme in Globalisation and Marginalisation represents a continuation and enlargement of previous work, particularly in political science. The MU Strategy has been used to push for a broader and larger programme, as this is a politically important subject.

The programme is wide enough to cover various kinds of existing or new research. There have been three rounds of applications so far. There were more than 200 draft proposals, narrowed down to 38, of which 50% (19) were finally funded.

The reviewers feel that

- the area is of significant interest to the international research and policy communities
- comparing the research with that of DfID in the UK, it appears to be less constrained by political and immediate policy implications. However it is difficult to assess the quality of individual projects comparatively
- the impact on other user-sectors depends critically on the measures that are taken to target outcomes and deliverables

The principal problems associated with the programme have been those of a very inter-disciplinary program with numerous cross-cutting issues, in which it is not always easy to connect natural and social science approaches.

The reviewers feel that that the programme is too broad in relation to the available budget (illustrated by the very high number of sketch proposals). They question the value-added to the individual themes, and question whether a special programme is the best way to fund this research. It might be better to create a larger and responsive mode 'open MU programme' with, if desired, certain thematic priorities, as part of the core business of the council.

Interdisciplinarity is often less well served by breadth. The scale of the programme, the high costs of administration, and the level of preparation in its development, raise the question of whether such initiatives obviate the need for other kinds of funding.

According to the programme Chair, gains can be achieved if the programme can lower the barriers between the disciplines and attract good joint proposals from the natural and social sciences. One of the reviewers feels that achieving this could be a reason for maintaining it as a separate programme.

The reviewers note that it was not evident from the short project descriptions in the action plan that the programme attracts a large amount of interest in developing countries.

A.3 Fisheries in Developing Countries

Fisheries research (with forestry) has been a key area in the pioneering work on sustainability in the 1980s. In many respects it is a good way of capturing social and natural science interfaces, since it tends to be problem focused, and clearly sectoral. The programme appears to have achieved a high impact in the form of publications.

This is an area in which Norway has specific scientific and practical expertise – comparative advantage. The reviewers feel that the natural and social scientists have been brought together quite successfully and that the programme acknowledges that fisheries management is increasingly international.

As this is a small programme, the reviewers wonder what minimum size and complexity of a programme would justify the development of a single programme.

The reviewers were told that many of the programme participants know one another already. One of the reviewers feels that this is a potential flaw in a fairly specialised area that needs to galvanise those outside the field, as well as fisheries specialists. He hopes that future global fisheries proposals do more to overcome this.

Although the programme aims to address fisheries in developing countries, it has been difficult to attract the necessary funding for partners in the South. The reviewers wonder whether it might have been worthwhile to draw NORAD into the programme for that purpose.

One of the reviewers feels that the theoretical advances are not clearly presented and that more could be done to disseminate these if they are significant. A follow-up programme is planned, with an expanded scope. It would be worthwhile to explore the potential for international collaboration in such a programme with countries having a strong research community in this area.

A.4 The Multilateral System in the Field of Development

The Norwegian Foreign Affairs Ministry would like to know more about the World Bank approach to conflict and security, especially since 50% of Norwegian aid is put through the multilateral system. Ministry officials are very interested in fostering critical research in this area.

The reviewers feel that this is an interesting programme, operating at a system level. With an explicit focus on scientific quality, and attention given to publication in peer reviewed literature, there has been a positive shift towards looking at conflict and security within the programme. The Budget (so far 30 MNOK) in relation to success rate of applications (one-third) appears to be adequate.

The Ministry has two members on the programme management Board but there appears to be room to strengthen international connections –this is important if the results of research are not to be confined to ‘in house’ work for government. For example, this could be a subject for joint efforts with Germany, UK and the Netherlands, in view of the close existing relationships between the respective Ministers for development cooperation and their common interest in the multilateral system of aid.

A.5 Cooperation with Central and Eastern Europe

The reviewers were told that the programme is concerned with the transfer of knowledge from Norway, and institution-building in Central and Eastern Europe. The origin of the programme lies clearly in the political interest of Norway in setting-up collaboration with these countries.

The reviewers question whether such a ‘capacity building’ role is truly research based. The program accommodates political/policy needs, rather than clear research objectives, and focuses on the foreign policy objectives of Norway, particularly in the light of its border with Russia.. The trade-off between academic quality and institution building is recognised, but the usefulness of scientific outputs is unclear, although it is positive that project proposals are peer reviewed independently in Norway and in the countries concerned.

The programme has been externally evaluated and the recommendations provide an opportunity to focus the programme, depending on its ambitions

- If high quality is the ambition, this programme should concentrate on environmental sciences
- If capacity building is the main ambition, then health and social sciences are recommended.

The two reviewers feel that Ministerial involvement is very high, but that this has resulted in ill-defined research objectives. The reviewers are unconvinced that the RCN can really achieve very much with such a politically driven remit – especially since the area includes the war-torn Balkans.¹⁵

There appears to be an as yet unexplored potential for collaboration and co-funding with other Divisions. Similarly, because of its development remit there appears to be scope for attracting NORAD support for future activities.

A.6 Arctic Light and Heat

Arctic research represents an area in which Norwegian scientists have traditionally excelled. Norway has been very active in international fora and in international science programmes in this area. However, one of the reviewers feels that more could be done to encourage international cooperation within this programme.

The main problem with this programme has been achieving cooperation between geophysicists and biologists. This is an area where the scientific expertise is very specialised, and the impression is that project leaders under this programme, who have good international connections, are able to define (for both the programme, and the RCN) what is scientifically interesting.

One of the reviewers feels that it is not clear how this programme contributes to either the ‘development’ or the ‘environment’ remit). The coverage of the programme prompted one of the reviewers to suggest that given the available funding the programme appears to be quite ambitious – he feels that the programme should attempt better to define its scope or seek additional funding if it is to achieve its objectives.

A.7 Changing Landscapes

¹⁵ The comparisons with the UK are instructive. The Research Council (ESRC) has had a large programme in this area, but the objective is to increase UK capacity, rather than that of Eastern Europe or the Balkans.

This is a broad multidisciplinary programme, building on a number of smaller predecessors, which grew partly out of the Bio-diversity Convention of 1992. The challenge is to integrate findings from a number of Ministerial sides, especially the Ministry of Agriculture, and the Farmers' Unions. The principal interest in the programme seems to lie with conservation management bodies, and much of the research in these fields currently being undertaken in Norway seems to be done by RIs.

Although the programme hints at wider questions – beyond those of ecosystems themselves – it has proved difficult to marry the different sides of the programme, specifically, (1) conservation/bio-diversity; (2) resource management and (3) heritage and cultural interests. The combination of the highly biological and aesthetic/amenity concerns of landscape and recreation makes this programme unique compared with other research programmes in Europe. There is also an explicit commitment to develop models of integrated evaluation of conservation values, although it is not clear how the present projects could help provide such models.

The programme Chair argues that the effort required to bring about real multidisciplinary collaboration is underestimated. In general her opinion is that the resources necessary to appropriately run such a complicated programme, giving sufficient attention to internationalisation and networking, have not been available. The reviewers support this argument and warn of the tendency for programmes to become more complex, increasingly more international and thereby increase the complexity of project development without having access to additional resources and new staff capabilities.

The strong cross-disciplinary nature of this programme also raises some serious questions for refereeing, since peer review in any of the fields might be quite narrow.

A.8 Committee for Independent Projects

The RCN has been in dialogue with the universities about 'free research' for some time. Research that is curiosity-driven is attractive to both university researchers and the RCN. However, there is usually a trade-off (not usually acknowledged) between targeted research, relevant to policy and the Ministries, and research of a high scientific standard.

This is the area in which responsive-mode funding is commissioned, and which is seen by the RCN as one in which additional funding needs to be available. The difficulty in achieving high quality research is that there is little flexibility in the funding mechanism. At the moment, research grading for quality makes little difference to the volume of research funded, and there are many more research applications of high quality that cannot be funded. More effort might be made to 'highlight' research which has proved innovative or influential (in either policy or more academic terms) to enable the Division to leverage more funding from the system. At the moment, MU seems to regard responsive-mode research as 'basic' and therefore less innovative, when this may not necessarily be the case.

There is a weakness in the current appraisal system for interdisciplinary research, and it is acknowledged that MU gets significantly different peer review evaluations for interdisciplinary proposals. The range of disciplines involved makes it difficult to put

together a committee covering the full spectrum of research, and one of the reviewers suggests that a Jury system¹⁶ should be adopted to overcome this.

The importance of an open competition on the basis of quality, and personal support for excellent and less established scientists should not be underestimated. Less than 10% of the ED budget is spent on responsive-mode funding – this is a small amount compared with the European average for research councils, some of which operate almost exclusively in response mode.

In the light of a success rate of about 25% in this programme, one might reasonably draw the conclusion that the budget is appropriate. However, this underestimates the distortion created by the system and the calculating behaviour of the scientific community.

The Chair reported that the committee uses progress reports to steer, and even discontinue, projects if necessary. No information is available on the impact of the research (scientific impact in the literature), nor has a comparison been made between quality and impact of this project funding and programme funding. There is a growing demand for such indicators, and serious attention should be given to this.

One of the reviewers commented on the apparent focus on supporting doctoral students within the responsive mode projects arguing that a balance needs to be struck between the responsive and ‘dedicated fund’ models. There is a rationale for favouring central, government-funded research programmes, over university funded PhDs¹⁷

- It avoids duplication of effort and specialism.
- Research council funding for PhDs can more truly reflect the candidates’ abilities; it is easier to be competitive than within separate institutions, with their own biases and favourites.
- It enables government to make strategic decisions over resources and capacity: putting capacity where it is most needed, or within institutions with comparative advantage.

A.9 Sustainable production and consumption

This is a programme with a very small year budget (with funding from four Ministries). It grew out of the work in industrial ecology and similar areas, being undertaken by other cognate Divisions, and the emphasis on ‘culture’ came from the Culture and Society Division.

¹⁶ In such a system, a jury of a statistically relevant size (12–15 persons) is put together, who are essentially laymen in many of the disciplines, who then individually, on the basis of a sufficient number of expert referee reports (4–5 per proposal), put together their priority list. The individual lists are aggregated into a single list, and the standard deviation is determined. Projects with a large deviation are discussed separately

¹⁷ In some countries research students themselves submit proposals, which the council evaluators rank more highly if they are clearly linked to recognisable strengths in Departments and universities. That is, the best proposals from PhD students have also to be located in the most appropriate places. So the initial idea is ‘responsive’ (although it might have been suggested by a staff member initially) but the success of these studentships depends, critically, on there being capacity in the institution to which they are applying.

This is a rather pioneering but amorphous area, in which it appears that weaker projects have needed to be supported. We were informed that the programme focuses mainly on consumption, but it appears that the first phase was largely dominated by sustainable production proposals. Sustainable production is already part of the portfolio of the Industry Division, but funded by a different Ministry.

On the content side, there appears to be a potential for collaboration with both the Industry and Energy Division and the Bioproduction and Processing Division. At the present there appears to be no inter-Division collaboration. This seems to be a missed opportunity to demonstrate the added value of having a single council capable of bringing together multiple research interests and acting as the intermediary for different funding sources.

However, the integration of different sources of funding has had a positive impact, and one of the results of the programme is that four Divisions are now contemplating work around industrial ecology. In addition, the reviewers felt that the programme would benefit from increased involvement of the private sector.

There do not appear to be any particular lessons for theory from the work so far commissioned. One of the reviewers feels that this is a weakness, since this is an area of very substantial theoretical development elsewhere in Europe (around both ‘sustainability’ and ‘consumption’).

The reviewers feel that the RCN should be aware that there is substantial research being undertaken in this area in other European countries, especially in the 5th framework programme of the European Commission.

A.10 SAMSTEMT

This is felt to be a good example of a programme of substantial size, which has had some success in attracting funding from the Industry and Energy Division (IED). Attempts are also made to attract funding from the energy sector. There appears to be a great deal of interest in the programme, given the total of 120 MNOK worth of applications. Given Norway’s energy resources, this looks like a priority area. The only note of concern expressed for this programme is whether Norway has a comparative **research** advantage in these areas.

The forerunner of this program – the SAMRAM programme supported by the Ministry of Energy – had a high impact and its results were used as part of the Norwegian input into climate negotiations.

In the case of SAMSTEMT, cooperation was sought with the IED to put up funds for joint funding. It appears to be another case of the naming of programmes, and their ‘refocusing’ being a means to continue funding, where an assured source has been identified.

The reviewers feel that a key problem for the programme will be to create an appropriate balance between the three programme themes, and they feel that this issue should be carefully monitored.

A.11 Biological Diversity

The reviewers feel that this is a very positive programme, with a strong international component and well-anchored objectives.

Although interdisciplinary projects are (correctly) seen as a tool, rather than a goal, of the programme, it has been difficult to get very good proposals in this area. However it is argued that multidisciplinary projects have been rather successful, as the programme can boast of a number of high-impact publications.

The reviewers agree with the programme representative that there is a need to overcome the problems faced by collaborative projects between the social and natural sciences and to find adequate mechanisms to review these. Generally, the programme has experienced a high level of applications and there steps are being taken to reduce this number. The reviewers express the opinion that this might be an opportunity for MU to seek additional funding from the relevant Ministry, or to obtain additional ‘free’ funding from KUF to meet the interests of the research base.

The reviewers feel that the programme shares some of the coverage of other MU programmes (for example, the landscape programme) and it appears that the separation between this and other programmes was agreed for financial/logistical reasons, rather than scientific ones. It appears that subsequent consultation have taken place with the landscape programme.

A.12 Climate and Climate Change

This is the continuation of a very long term and highly successful programme, and the Norwegian research in this area is well embedded in the international effort.

There is a slight difference of interpretation given by the two reviewers.

- One reviewer commented that the programme was put forward by a well-organised community with strong leadership. He argues that the programme relies necessarily heavily on a monitoring infrastructure which is ‘assumed to be funded from other sources’. Given the essential character of this infrastructure, he feels that the RCN should play an active role in ensuring that such infrastructure is indeed available and funded
- The other reviewer highlighted that the programme has produced very conventional, albeit scientifically competent, research, because it has restricted its focus to extending a well-established research base. He feels that its weakness is that it lacks a policy perspective and input from other disciplines. He feels that the work is concerned almost exclusively with climate science rather than climate policy, and that it lacks a focus on ways of mitigating the effects of climate change, forcing factors etc. Climate science does not precede policy; they advance together

Both reviewers comment on the fact that there appear to be potential conflicts of interest in the way the programme is administered.

A.13 Pollutants

Overall the reviewers are broadly positive about this programme. This programme is modest in financial size, with very broad objectives. (Scientifically, the different

themes could well be in different programmes). It appears to be sensible to incorporate a range of different research areas within the programme to support policy.

The reviewers feel that the contrast with the modest the programme budget and the range of research it might cover might have been addressed by seeking substantial funding from the Ministry representing the largest polluters, and that this would increase the potential impact of the programme.

FEEDBACK ON ORIGINAL DRAFT.

Appendix B and C present the feedback from the Division on the Original Draft of the Report. Where appropriate, the reviewers' response to the feedback has been integrated in the text (in *italics*) to identify changes to allow readers to establish what has been changed and where the reviewers and the division have agreed to disagree.

Review of RCN's Environment and Development Division

**Comments on the draft summary of the Experts' Reports of August 2001
by the Executive Director of the Environment and Development Division**

We have with great interest read the draft summary of the experts' review of the Environment and Development Division. We are impressed by the scope of the report and find many of the recommendations both inspiring and challenging. That is how it should be. However, some of the analyses might be based on imprecise information. We hope these comments will help you prepare your final report.

Appendix B General comments

B.1 The relation between strategy and portfolio

Several places the draft summary suggests that there has been no consistent strategy process leading to the portfolio.¹⁸ This is not the case. We think the evaluation should take into account the following points, which was mentioned in the written material presented at the interview (but which unfortunately did not get enough attention in the discussions due to time constraints):

- After the merge in 1993 the Environment and Development Division invited leading academics and representatives from the users of our research findings to a process leading up to the “Perspective analysis”, which was adopted by the Divisional Boards in 1996. In this document “foresights” of 10-15 years were made, the main priorities within environment and development research were discussed and recommendations were given.
- The general strategy for the whole of the RCN were adopted by the Executive Board in 1996 (Research for the future).
- Based on these two documents the division developed the Strategy for environment and development research in the RCN. This was adopted by the Executive Board in 1996, and applies to all activities in the RCN.
- Based on this, the Division developed the Implementation Plan (Time for action). This was adopted by the Executive Board in 1999, and applies only to the activities within the Division.
- In the Implementation plan four thematic priorities are given:
 - Natural process and man-made changes
 - Management of natural resources and the cultural environment
 - Framework conditions for sustainable development
 - Development and global issues.
- Of a total budget in 2000 of 296 MNOK, we allocated 254 MNOK to programmes and infra structure within these priority areas. The distribution between these areas was however not as originally planned.

¹⁸ “This combination of roles means that there is a risk that the advice given is short-term rather than strategic, and historically MU seems to have lacked a form of ‘foresight process’, which would have produced longer-term advice” (2. subsection under 1.1.Conclusions).

* “However, there is a feeling that the programmes do not always contribute to MU strategy and are developed exclusively for the purpose of satisfying Ministries.” (5. subsection under 1.1.Conclusions)

* “The coverage of the portfolio is broadly appropriate, but appears to be uneven, and driven more by the wishes of the funders than by strategy.” (10. subsection under 1.1. Conclusions.)

* “Despite the lack of strategy...” (4. subsection under 4. Strategy)

* “The reviewers feel that plans play only a limited role in development of program portfolio, and the structure of the portfolio is dominated by the desire to continue programmes (programme inertia) and the requirements of the Ministries.” (7. Subsection under 4.1. History – Context – Remit)

We fully agree with the draft that the Ministries are too detailed in their communication with the RCN. But our reason for that is not that this makes it difficult to pursue our strategies. In fact most of the detailed “instructions” from the Ministries are results of advises from us. The problem with many strings attached to the money, is that it hinders flexibility across the RCN and it makes it a long term project to start new research efforts.

The peers felt that whilst a fair amount of work had been carried out on strategy much of the material that was presented as "priority actions and achievements" were expressed as "a resolve to further existing good practice, or to initiate new practices. Most of these lack measurable criteria and it is difficult to assess whether or not they are any more than just an expression of intent.

Reviewers comments

The reviewers assessments were made on the basis of the presentations and material provided to them for the review. It should be noted that some of the material was not available in English and that the presentations may have oversimplified the division's future strategy.

Nevertheless the peers felt that, whilst a fair amount of work had been carried out on strategy, much of the material that was presented as "priority actions and achievements" were expressed as "a resolve to further existing good practice, or to initiate new practices". Most of these lack measurable criteria and it is difficult to assess whether or not they are any more than just an expression of intent.

One of the reviewers clarified his assessment by stating "In fact the issue is whether the programmes which were started were the result of the strategy, or whether these programmes fitted the strategy, but would have come about in any case. To be fair: a good strategy reflects the thinking about programmes to come. It usually does not come out of the blue. Hence I would be inclined to not to sharp on this issue."

The comments on strategy have been toned down in a number of places but the reviewers did not wish substantially to change their initial assessment.

B.2 Synergy between Environment and Development Research

Several places the draft observes “it appears to be little synergy between the two main remits of the Division”, and thereafter concludes “and there is a case for separation”, alternatively “to make sustainable development the guiding principle for the RCN’s other divisions”.

We think this is a little confusing:

- The name of the Division is Environment and Development. Our mandate was from the beginning and still is to work with Environment research¹⁹ and

¹⁹ defined as: “Research designed to improve the knowledge base required for effective environmental protection work, and for long-term, overall use and management of natural resources and the cultural environment.”

Development research²⁰. It is obvious that in many cases, these are two different tasks. However, being located in the same division has led to:

- more environmental considerations in development research than in any other research area in the RCN,
- more development considerations in environment research than in any other research area in the RCN.
- The draft recommends that “Sustainable development” should be a guiding principle for the whole of RCN, at least in principle. In fact that is already the case. Our Division is working hard to implement this both in our Division and in the other Divisions. “Sustainable development” is also a central aspect of, but not the same as, Development in “Development research”.

Reviewers comments

The reviewers understand MU's mandate and did see some evidence of integration of Environmental and Development issues but as one reviewer mentioned "We saw very little of this, and were not presented with examples of deliberate strategy in this area."

The general thrust of the argument is that there is not much evidence that there is a lot of added value in co-locating the two different remits of Environment and Development.

B.3 The Divisions’ right to make their own Strategy

Several places the draft suggests that the Executive board will not allow the Environment and Development Division Board to decide on its own strategy:

- The normal procedure is that a Divisional Board proposes a strategy for its Division, which is adopted by the Executive Board, in other words: no Divisional Board adopts the strategy for its domain without the approval of the Executive Board.
- It was The Divisional Board for Environment and Development itself who wanted the Strategy for Environment and Development Research to be a strategy for the whole of RCN. This was approved by the Executive board.
- The Divisional Boards has in many aspects of thematic prioritising the right to make their own decisions.
- When it comes to the annual budget processes, it is right to say that the Divisional Boards decisions, in principle are proposals to the Executive Board, but in practice only proposals to the Director General who make his recommendation the Executive Board.
- One could say that this has been an process above and thereby potentially across the Divisions
- One could of course make a procedure where the Executive Board gave the Divisional Boards more or less freedom to pursue their own strategies within their annual budgets, using incentives to bring the Divisions together.

If that is what is meant in the draft’s recommendations, its a new and interesting combination of the Divisional Boards’ right to decide within their own domains, and at the same time promote co-operation across the divisions.

²⁰ defined as: “Research on processes of social change, designed to improve the knowledge base for development cooperation, poverty reduction and promotion of interpersonal understanding.”

Reviewers Comments

The evidence given to the reviewers suggested that the MU divisional board was not given sufficient authority to develop its own strategy. The wording has been changed slightly but as this was part of the evidence presented the reviewers did not wish to change their assessment. The reviewers feel that the Divisional board should be given relative freedom to develop its own strategy

Appendix C Specific comments

C.1 1. Executive Summary

- 4th recommendation: It is the boards intention that the Vision 2030, which is a scenario-exercise, shall be a central input together with the general strategy for the RCN in the process leading up to the next strategy for the Division. **Reviewers comments:** *Wording has been changed to reflect this and to acknowledge the value of Vision 2030.*
- 7th recommendation: The rationale for funding research institutes is not either quality or providing access for Ministries to research resources. Based on the fact that the Ministries is paying about 100 MNOK each year to have access to research resources, the RCN's task is to improve the quality of these resources. **Reviewers comments:** *MU does not have much of a lever to increase the quality of the research of the institutes in the current funding arrangements and appears to be distributing funds for the Ministries - the reviewers do not feels this administrative allocation creates much added value.*
- 8th recommendation: It is not correct to say that RCN has increasing problems with “membership of review panels and conflicts of interests”. On the contrary, RCN has had an extensive policy on avoiding conflicts of interests. This has led to challenges in putting together review panels, programme committees etc. **Reviewers comments:** *Wording has been changed to reflect this and to simply make the point that interdisciplinary research raises difficult issues for peer review processes.*

C.2 4.1. History – Context - Remit

- 2nd bullet-point: MU was given the coordinating role for all environmental research across the RCN, but has just recently got an institutional forum for such coordination. MU was not given a similar coordinating role for development research. **Reviewers comments:** *Wording has been changed to reflect this comment.*
- 5th subsection: The implementation plan / Action plan was published in 1999. **Reviewers comments:** *Wording has been changed to reflect this comment.*
- 7th subsection: It is correct that the “Priorities and achievements” which were presented for the reviewers expresses “good practice”. They are referring to other aspects of good research than the thematic prioritising within our portfolio. As we have explained above, the decision on 4 thematic priorities was intended to serve as guidelines on the thematic aspects of the portfolio, and has done so. **Reviewers comments:** *Wording has been added to clarify this point but the reviewers did not change their minds about the question of strategy development and implementation.*
- 8th subsection: The analysis and conclusions are correct, but the argument is not. “There also appears little cross-division coordination and cooperation (i.e. little joint funding of programmes).” The mechanism should not be that each Division gets its money from its sector Ministry, and then co-finance programmes. In many cases it might be more efficient to channel the sector Ministry's money directly to an other Division than the usual one. In some cases are joint programmes across

Divisions to prefer, but not always. **Reviewers comments:** *Wording has been changed but the reviewers maintain that there is currently insufficient collaboration across division - funding for x-divisional programmes should really be allocated from different division's budgets.*

C.3 5.2. MU's Structure and Resources

- 6th subsection: There will always be Programme Chairs who mean that their programmes get too little money. Compared with the Programme Document the resources are often scarce. That is why the first task for a Programme Committee is to develop an Implementation plan. When this plan is approved by the Divisional Board, there should be consistency between scope of the programme and money available. **Reviewers comments:** *The wording has been slightly altered but the reviewers stuck to their initial assessment (backed up by the programme chairs in some cases) that the funding was often insufficient for the scope of the programme.*
- 1st bullet-point: MU has used and is using a lot of energy on initiating and co-ordinating research in emerging areas. The problem has been up to recently, that there has been little response to this in other parts of the RCN. **Reviewers comments:** *The reviewers agree. Wording has been changed to "developing effective mechanisms".*

C.4 6. Management and Governance

- 2nd subsection: There are not six levels of decision making within RCN. There are three: Executive Board, Divisional Board, Programme Committee/Funding Boards. To count to six you must include: Ministry, Institution and Project Management? **Reviewers comments:** *Wording has been changed to reflect this comment.*

C.5 6.1. The Ministries

- 2nd subsection: The draft has misconceived the borderline between “soft” and “heavier” areas in the RCN. In addition to research on the natural environment and on impacts of human activity on natural and cultural environment, the ED Division is also responsible for the social science research on policy options and instruments for a sustainable development. Thus, the Division is in charge of research both on industrial ecology and on environmental taxation. What we lack is technological research. It can very well be argued that this should be integrated with research on natural/cultural environment impacts and policy options, to make a complete “sustainable development research agenda”. **Reviewers comments:** *Wording has been changed and the text now uses technological research.*

C.6 6.2. The RCN

- 1st bullet-point: It is correct to say that there would have been synergies to merge the globalisation programme under Culture and Society, which deals with the impacts of globalisation on the Norwegian society, and the globalisation programme under Environment and Development, which deals with the impacts on developing countries. But as long as Culture and Society never intended to study the impacts on developing countries, and as long as Culture and Society had not started their programme before Environment and Development started its, it is not an example of capturing each other turfs. **Reviewers comments:** *Wording has*

been changed to reflect the fact that the globalisation programmes have different foci.

C.7 6.5. Programmes and Funding Boards

- 1st subsection: It is difficult to understand the significance of this subsection.
- 4th subsection: With very few exceptions the only ministerial earmarking within the program is in the Programme Document process (1-2 of 6-12 persons in the programme preparing group are from Ministries) and in the Programme Committee (where 1-2 of 7-10 persons are from Ministries). It is the Divisional Board, which decides on Programme Document and the composition of the Programme Committee. **Reviewers comments:** *there were numerous comments about the problem of Earmarking so wording has not substantially been changed.*
- 6th subsection: It is not correct that members of the programme committees cannot receive funds from the programme. We know however that one of our programme committees has chosen to practice such a restriction. **Reviewers comments:** *Wording has been changed to reflect this.*
- 7th subsection: It is not correct to say that the current selection mechanism do not separate between prioritising and funding of particular projects. On the contrary, there are guidelines to do such a distinction for many reasons, but also to reduce the element of conflict of interests. **Reviewer's comment:** *Point here is that in general it is advisable to have the prioritisation of proposals and the decision on the funding of projects take place in different committees. This is particularly important in the case of committees with members who have submitted proposals. In NWO it is not allowed to mix these two tasks in one committee. The wording has been slightly modified.*

C.8 7. Portfolio

- 1st subsection and several other places: This is maybe an impression, but nevertheless not correct. (We refer you to general comments).
- 12th subsection after the bullet-points: This is not correct. Population, public health and quality of life and values for sustainable development are important parts in our portfolio. **Reviewer's comment:** *this does not appear to have been made clear to the reviewers during the presentation - hence the comments. A footnote has been inserted to mention that we were subsequently told about this*

C.9 7.1. Recommendation – Portfolio

- 1st bullet-point: We refer you to our 2nd general comment.
- 4th bullet-point: The same comment as on the 6th subsection under 5.2. MU's Structure and Resources
- 5th bullet-point: The same comment as on the 7th recommendation in the Executive Summary.

Review of RCN's Medicine and Health Division

Summary of the Expert's Reports

**October 2001
(revised November 2001)**

**Eduard Klasen
Olle Stendahl**

With

**Ben Thuriaux
Erik Arnold**

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1 Executive summary

This section presents the summary from the expert review of the Medicine and Health Division (MH) of the Research Council of Norway (RCN), which took place on 30 and 31 August 2001. The report of the Evaluation of MH will form part of the background material to the wider evaluation of the RCN currently underway.

The reviewers' assessment is broadly positive. MH has made significant progress towards the goals associated with the 1993 merger and the 1996 strategy documents. However, there are still some problems which need to be resolved, for example, the need to increase funding for its core responsive-mode scheme and to take responsibilities which go beyond administrating ministries' research.

1.1 Conclusions

At its inception, it was anticipated that MH would benefit from an increase in its research budget to bring this in line with the activities in other European and Scandinavian countries. This increase in funding never materialised, and effectively marginalised MH within the Research Council, resulting in sub-critical programmes.

Within this light the achievements appear good. MH has successfully campaigned to increase its research and development (R&D) funding. This has been accomplished by a professional and dedicated staff in collaboration with the scientific community. Despite initial setbacks, MH has gradually been able to make the strategic changes and interdisciplinary alliances that were expected of the new organisation.

A lot of very good work has been done with a very limited research budget. Within the Division, both the staff and the Board are very professional, knowledgeable and dedicated. Communication is good and transparent, and they are able to explain issues and solve them. Despite the problems with lack of funding, staff appear to have a very positive attitude for the future. To maintain this situation, it is likely that the funding for MH will need to continue to increase over the forthcoming years.

The drive to increase funding from different sources appears to have affected the efforts to develop the quality of research in Norway. The reviewers were told that leadership and recruitment is still weak, funding of basic research is insufficient and the overall impact and quality has not improved significantly – although there are several outstanding groups. This was also highlighted in the 1999–2000 international evaluation of biological research.

The Division strategy has a good focus and addresses important issues and problems relevant to both Norwegian and international research, and the reviewers considered that the strategy and the process by which it had been delivered was of good quality by international standards. However, the strategy appears to have a limited influence on the universities and is disconnected from RCN's overall strategy in that it has historically been difficult to recognise MH's component in the overall RCN strategic plan.

Internally, MH has reorganised its programmes in a positive fashion but it continues to suffer from *ad hoc* requests from ministries to set up programmes which can create problems in terms of integrating these with pre-established strategy.

The structure and management of the Division is well placed to handle most of the likely challenges and reflects international good practice, but so far only a limited number of goals have been reached, largely because a lack of funding and appropriate infrastructure. The portfolio and funding mechanisms must be adjusted to meet the needs of not only the political stakeholders, but also the scientific community. It is vital to improve recruitment, leadership, and impact and to deal with the current conservative bias in the project selection process.

One reason to form the new Research Council was to make the management process more transparent, homogenous and effective. The reviewers feel that the internal management processes within the Division are sound, but identify that the current relationship between the Executive and the Division Board is almost entirely channeled through the administration. After some initial tensions, the interaction and communication between the Executive and Division Boards have improved over time, there is still some lack of transparency and dialogue. Since the Division Board has specific scientific knowledge and expertise, it is vital that there is a good link between these two bodies.

The budget process and the allocation of money are the main driving forces within the Council to convert strategic decisions into an action plan. Although it is positive that both Ministry of Education, Research and Church Affairs (KUF) and the Ministry of Health and Social Affairs (HSA) allocate research funds to medical and health research, the reviewers feel that the level of ear-marking effectively prevents the Division Board and the administration from using their competence. The influence of the Ministries not only on where the money is allocated, but also on how it is used is at odds with European best practice. As it stands, the system is needlessly complex, as is the network of relationships. The reviewers feel that the Division (and its programme boards) should run programmes without interference from the Ministries.

One of the main reasons to merge the previous research councils into one was to foster interdisciplinary research and interaction between different research areas. Judging the RCN as a whole, the ambition has not been reached and it was generally accepted during our review that the lack of interdisciplinarity is largely caused by the limited budget situation and the lack of strategic allocations of money from the ministries without detailed earmarkings. In the current system, it appears that inter-divisional collaboration is more about information exchange at the administrative level than about action. Only a few programmes and initiatives appear truly interdisciplinary. New programmes should consider this aspect. The new genome research programme FUGE will be a real test of whether this is possible in practice.

Finally, in terms of the portfolio, the reviewers argued that the current level of programme and project funding appears to be sub-critical. In particular project funding appear to be unable to support team based research projects. At the same time strengthening the review process to include rebuttal will help the selection panels to better understand the risk profile of the projects they select and thus to counter the bias for "safe" projects.

1.2 Recommendations

The reviewers recommend for the RCN as a whole

- Creating a body capable of formulating a national research strategy. There are two options for this
 - Increasing the amount of scientific expertise and experience on the Executive Board
 - Adopting the model that exists in other European countries to create an independent committee (outside the RCN and KUF) for the sole purpose of developing a national research strategy. This would also resolve the conflicts of interests associated with both providing advice and receiving funding to implement research policy money
- The question of whom this new body should advise should be examined, as at the moment there appears to be too many actors involved in implementing their own strategies
- Strengthening the internal ‘over the border of Divisions’ strategy and to accelerate the current trend towards multidisciplinary and cross-divisional programmes. This will require some real cross-divisional integration to take place. This was the driving force for the creation of the Research Council and must be addressed if the council is to live up to its initial goals

The reviewers recommend for MH as a whole

- Substantial increases to the budget to provide the resources to improve medical research in Norway over the forthcoming years. This will partially resolve the conservative bias in the project selection system and should overcome the problems associated with current projects and programmes, which are too small
- A better balance between politically driven programmes and response-mode projects – additional resources should be made available for responsive-mode funding and the size of programmes should be increased. Stricter scrutiny of programmes should allow these to be terminated if they overlap significantly with other components of the portfolio
- Creating appropriate channels for the Division Boards to interact with the Executive board. For example, Division Chairs could be permanently affiliated to the Executive Board. There is a need to develop some kind of mechanism to formalise exchange between the Executive Board and Division boards to compensate for the current system which overemphasises the role of the administration in reporting between levels.
- That if RCN is to act as a research council, it must be allowed to use the competence of its Board and administration to develop and manage programmes independently. It is inappropriate for Ministries to use RCN simply as an administrative resource to deliver their strategy. However, it is appropriate for Ministries to participate in programme boards as observers, and for MH to maintain suitable interaction with the Ministries to ensure that both organisations are aware of current developments and progress
- MH should focus on providing larger project-based grants for post-doctoral fellows to allow larger projects to develop and to facilitate a transition towards larger and less fragmented research groups in Norway
- It will be important to continue to increase the size of the grants by allocating additional funding. Since the success rate is between 10–20%, it is not realistic to decrease the number of grants significantly. Grants should be allocated to the

principal investigator who should be left to make decisions regarding resourcing for the project in terms of PhD or Postdoctoral researcher

- Similarly, it will be important to strengthen the review process to include rebuttal, at least for the larger projects or the top tier of rejected projects. This would also provide a way to reduce the risk averse tendency which occurs when budgets are so low.

2 Introduction

This report summarises the results of a short expert review of the Medicine and Health Division (MH) of the Research Council of Norway (RCN). The report contributes to the much wider evaluation of the RCN commissioned from Technopolis by the Ministry of Education, Research and Church affairs (KUF).

It is one of six such evaluation reports looking at the research portfolio and organisation of the Divisions in RCN and provides an assessment and recommendation for future development of the Divisions' research strategy and operation. The report will be appended in a separate Appendix to the overall evaluation report and will provide material both for other components of the evaluation and for a summary of the expert reviews of the RCN's Divisions.

3 Method

The aim of the Divisional review was to evaluate the strategy, organisation and functions of each of the six Divisions and the various programme elements that they cover, and to draw conclusions for the operation of the RCN from these reviews. The Divisional evaluations focus on

- The strategy adopted by the Divisions
- The structure and resources of the Division and how these are managed to support the delivery of its missions
- The choice and relevance of the research portfolio supported by the Division and the way in which these are designed and used
- The effectiveness and impact of the portfolio.

The two expert members of the review team were identified by Technopolis and subsequently approved by MH. The team members were as follows

- **Professor Eduard Klasen** is the Director General of the Netherlands Organization for Scientific Research (NWO) and a Professor in Health Research management at the Leiden University Medical Centre. He was previously Director of the Council for Medical and Health Research NWO from 1990 to 2000.
- **Professor Olle Stendahl** was the Secretary General of the Swedish Medical Research Council until March 2001 and is an active researcher in the area of medical microbiology. He is presently involved in graduate and postgraduate teaching on microbiology and immunology at the Faculty of Health Sciences, at the University of Linköpings.

Technopolis explained the issues that the review team would attempt to evaluate and asked MH to provide a briefing document on its activities. This was delivered to the panel prior to the review visits.

The review visit took place on 30 and 31 August 2001 and the schedule centred on a number of pre-agreed presentations, followed by a question and answer session designed to allow the reviewers to comment on the evaluation questions. The leader of the RCN evaluation (Dr Erik Arnold) and the consultant responsible for the Divisional evaluations within the review (Mr Ben Thuriaux), accompanied the review team.

Following the visits, the two peers prepared their individual evaluation reports. These have been synthesised by Technopolis and validated by the reviewers. An initial draft was sent to MH for comments and the current document forms the report of the evaluation as it was subsequently agreed with MH.

The report addresses the issues that the reviewers were asked to concentrate on and outlines a number of possible recommendations that will inform the overall evaluation of the RCN.

4 Strategy

4.1 History – Context – Remit

The current MH is effectively an extension of the Research Council for Medical Research (CMR) which was one of four sub-councils in the former Council for Basic and University Research (NAVF). In 1992, its budget supported both discipline-oriented research (50 mNOK) and 17 research programmes (93 mNOK).

CMR was administratively under the auspices of the Director General of NAVF, but all matters relating to scientific strategies, research funding, etc., were the purview of the Council which was a typical bottom-up organisation dominated and influenced by the Board, its Board members and the scientific community. The work, both planning, decision-making and execution, was done in an interactive and relatively informal manner.

The main focus and priorities of CMR were to

- Maintain high research quality
- Build up research competence
- Increase the funding for medical research in Norway.

The strengths of CMR were its close contact with the research community and strong acceptance for initiatives and funding strategies from the most scientists. However, CMR lacked a clear long-term strategy and had become fragmented with many committees and programmes, insufficient funding and low visibility in the scientific community and with the public.

There were several good reasons to make some strategic changes to research policy-making and research funding in Norway. By merging and reorganising the previous five research councils into one Research Council of Norway, a stronger and more visible platform for research would be formed, that would strengthen the strategic power, interdisciplinary research, administration and economic development of the Council.

The goals of the new MH were to become a strategic and important advisory body to the Ministries and the Health Service, to further integrate basic and applied health research, reduce the number of programmes and programme committees and strengthen the financial basis for funding.

However, despite the fact that medical research has a high priority in the eyes of the public, the merging of the different Research Councils led to a relative marginalisation of the Division in the new organisation, with only 5.7% of the total budget. Both the standing and the budget have, however, improved slightly in latter years.

4.2 Developing a Strategy

Based on earlier strategic documents, international evaluations and impact analysis, and a SWOT analysis of medical and health-related research, a plan of action was formulated to raise the standard and impact of medical research in Norway. Several issues were identified

- Funding is insufficient and fragmented. There are too many small and poorly funded groups so that even the best groups lack sufficient funding
- Norway's comparative advantages are not well exploited (for example, health-related registers, biobanks)
- Recruitment is weak, particularly in clinical medicine
- Medical research has low impact (although there are strong areas like neuroscience)
- The 'new' research areas (functional genomics, bioinformatics, complex model systems) are very weak and underdeveloped
- There is a lack of strategic planning and scientific leadership
- Research policy-making and health-care planning has low impact and is of low visibility .

Some of these weaknesses were highlighted in the evaluation report on research in biology and biochemistry presented last year. The conclusions drawn from the panels "were striking for the overall agreement that research in the biological sciences in Norway, with some notable exceptions, is performing below international standards. The level of performance was linked to several factors related to both funding and research traditions in Norway."

These factors include

- A low level of funding for basic biomedical research
- The practice of funding basic research through targeted programmes rather than through responsive mode funding
- Low mobility of Norwegian scientists
- Lack of strategic planning, leading to fragmented research profiles and poor cohesiveness.

This analysis conforms very well with the commonly held view in the scientific community 10 years ago. It also confirms concords with the analysis made by MH in their Plan of Action in 1998, where they concluded that budgetary trends are negative, Norwegian research efforts are lagging behind and show low impact, and recruitment is weak.

Whilst the problems identified in the strategy are not all specific to Norwegian medical research, they are in most instances more severe and pronounced in Norway. The former funding system had not been able to make the proper priorities and raise

sufficient funds for medical research and it is, therefore, very positive that MH has formulated such an ambitious strategy and plan of action. The strategic goals formulated in this plan focus on the most relevant aspects that the Division should take into account such as

- Strengthening the knowledge base and quality of Norwegian research
- Enlarging the budget for both basic research and targeted research, in particular in the fields addressing major health problems
- Improve research conditions
- Ensuring application of research results
- Influence and contribute to Norwegian research policy.

It is not realistic to believe that all the goals will be reached rapidly, but it is important to set these out so to test that the strategic goals and actions taken are the right ones. Over the past five, years an enormous effort has been put into reaching the goals that have been set. Many of the measurements taken were successful. However, there is still a way to go. The issues, which need special attention, are recruitment, scientific leadership, impact in general and the budgetary position. MH is well aware of these issues and appears to have adequate measures in preparation.

However, there is a lack of integration of strategy across the RCN, and indeed, the strategy of MH does not form part of the strategy of the RCN as a whole. There also seems to be little interaction with the other Divisions on strategic planning.¹

The Ministry of Health and Social Affairs (HSA) is the other strategic partner for medical research, but the reviewers were unable to comment on the strategy from the HSA and to check on the fit between the HSA and MH's strategies. This also highlighted the problems that MH and the RCN faces in terms of taking responsibility for being a national science policy adviser because there appears to be an all-too-large number of organisations (e.g. 17 different ministries) responsible for small components of a national science policy.

The reviewers commented that there appeared to be some *ad hoc* additions to MH's portfolio by the HSA, and that this appeared to hinder the implementation of a coherent strategy by MH and to lead to a fragmentation of the overall research portfolio. Several new initiatives have been launched as part of the Plan of Action as a result of budgetary increases. Although the initiatives are well-motivated *per se*, the reviewers felt that it would have been more important to strengthen the core of MH's activities.

The reviewers commented that MH (and RCN) appears to have a difficult task in terms of acting as an advisory body and as an executive agency and that this must lead to some possible tensions in terms of their responsibilities. For example, it may make MH reactive rather than proactive in their strategic efforts to strengthen medical research. MH appears to be providing adequate advice on medical research policy to its funding ministries.

¹ There is a strategic planning division but the review did not meet any representatives from this division and its role was not clear to the reviewers

The reviewers felt that there were some good examples of collaborative programmes but that in the majority of programmes, cross-divisional collaboration was not impressive. The reviewers were concerned, for example, about the way in which the Life Sciences programme is fragmented within the RCN and commented that whilst there appeared to be a fairly good exchange of information within the council there did not appear to be enough real collaboration across divisional boundaries.

4.3 Recommendations

The reviewers have the following recommendations

- A suitably qualified advisory body should be established to provide advice on national research priorities and the number of organisations responsible for implementing a national science policy controlled by that body should be reduced. This should not interfere with the advice that MH provides to the HSA and should resolve some of the potential conflicts of interest arising from the dual role of the RCN Divisions
- Collaboration within the RCN should be strengthened so that MH can take advantage of what is supposed to be a well-integrated unitary research council. The reviewers felt that more could be done to create multidisciplinary programmes that bridge divisional boundaries. The new functional genomics programme will be an excellent test case in this respect
- MH should protect its independence in the execution of the different programmes. It is appropriate for MH to consult the HSA on the development of programmes. However, it is not appropriate for Ministries to retain programme control by participating in programme committees (although in some cases, it would be appropriate to involve them as observers to facilitate access to state of the art research).

5 Structure

5.1 Historical context

Less than 10% of the budget for the all of the previous five research councils was allocated to MH's predecessor. The reviewers considered that the previous level of funding was very low in comparison with many other countries. The equivalent organisation in Norway's immediate neighbour, Sweden, accounts for twice as much of the total national research funding, and in other countries (for example, the USA), the medical and health funding body is by far the largest federal funding agency.

During the reorganisation process, it was anticipated that the new Division for medicine and health would benefit from an increase in budget in both absolute and relative terms. The outcome was different, and resulted in MH being further marginalised, with funding decreasing to 5.7% of the overall budget for RCN.

With such a weak budget it was not easy to make the proper strategic changes and form interdisciplinary alliances as expected from the new organisation. It was largely 'business as usual', although the decision-making was more top-down in the new organisation. After the initial turbulence and tension within RCN and MH, the

impression now is that the Division plays a major role within the Council, and is influential in the research policy process. This was accomplished by joining forces and collaborating with others. However, whilst the overall RCN aims set through the performance management system² are clearly present at the level of MH, the strategy and the plan of action for the Division have been disconnected from RCN in the sense that the research areas MH has prioritised have not always been represented in the RCN's overall strategy.

The situation is improving³ and the position of Medicine and Health research is gaining increased prominence but much more still needs to be done in this respect.

5.2 Budgeting

MH has a wide range of responsibilities and a complex network to take care of. If the budgetary position does not improve drastically, the strategy of the Division will come under pressure. In particular, the reviewers argued that the current budget for basic untargeted research is far too low to deliver the broad research area, the relevance of medical and health research in general, and the many targets that have to be hit according to the strategic plan.

The budget process and the allocation of money are the main driving force within the Council to convert strategic decisions into an action plan. It is therefore important that this is done in a transparent and interactive way involving both the Division Board and the Executive Board.

The present system is not very clear to the reviewers as there are both formal and informal processes. A great deal of negotiations between the Divisions precedes a divisional funding recommendation to the RCN, but parts of these may have been discussed with the ministries. Part of the funding at least is effectively allocated to divisions even if Ministerial funding is formally allocated to the RCN.

Apart from the KUF several other Ministries allocate money to the different Divisions of RCN. The reviewers felt that the application of a sectoral principle was positive, but argued that there is too much earmarking in the relationship with the Ministries which have influence not only on where the money is allocated, but also on how it is used in different programmes and initiatives. The reviewers felt that in this mode of operation there is a danger of creating a bias towards targeted programmes at the expense of responsive-mode funding. In addition, given KUF's role, the reviewers were surprised that this Ministry also earmarked some of its funding.

5.3 Recommendations

The peers have the following recommendations

- The proposal to double the funding for research is an appropriate target given the low level of funding for this activity - the reviewers suggested that future the increase in funding should principally be allocated to responsive mode funding

² These have been integrated into the RCN's Management by Objective system

³ The situation appears to be improving however and effective work by MH has led to the inclusion of Medicine and Health as a priority area in the recent white paper and then to the most recent RCN strategy

and that MH Board should be allowed to make decisions on the allocation of funding to different modes

- The manner in which the divisional budget is determined should be improved, and in particular, MH should be given more freedom to prioritise the funding made available from sectoral Ministries. In effect, this would mean moving to a system where the research funded with sector Ministry finance is accounted for and evaluated, but in which the current earmarking is removed to allow MH and its Board to exercise their competence.

6 Management and Governance

The establishment of the RCN introduced changes in culture and working patterns and, as is frequently the case where several smaller units are merged to form one large organisation, it appears that the influence of the central administration has been strengthened. The informal autonomous way of working within the former Research Councils are now replaced by an external and top -down process, where the programme and thematic boards seem to have lost some influence to the wishes of the funding ministries.

Looking at the different stakeholders, the reviewers feel that the focus has shifted from the research community to the political scene, so that it appears to be more important to form alliances and take the right political initiatives than the right scientific ones. This may have been necessary during the first few years in order to increase the budget, but the reviewers consider that this strategy has led to the emergence of a number of small and fragmented programmes.

The reviewers were complimentary about the use of an annual overall deadline for all RCN activities, as this effectively ensures that difficult and interdisciplinary proposals are properly dealt with, and that there is a clear allocation of responsibility for assessing proposal across all Divisions.

One reason to form the new Research Council was to make the management process more transparent, homogenous and effective, where the separate roles of the Boards and the administration should be clearly identified. This model relies on an appropriate balance and transparency between the Boards and the administrative staff, both with respect to power and expertise.

The reviewers felt that the management and communication structure within the RCN, in particular between the level of the Divisions on the one hand and the Director General and Executive Board on the other are not transparent. Although the interaction and communication between the Director General and divisional staff, and between the Executive and Division Boards have improved over time, there is still some lack of transparency and dialogue. In other countries it is common for the chair of subordinate boards to be full members of the Executive board so that there is both representation and exchange of information. Since the Division Board has the scientific knowledge and expertise, and the Executive Board appears to lack access to the broad overview of medical research available to the division board, it vital that there is a good exchanges between these two bodies. Historically, the communication

between the two boards has been via the administrative staff to the Director General, and the system seems to be administratively driven.

One of the key ambitions in establishing RCN was to improve coordination and integration of applied and fundamental or basic research. This may well be a reasonable ambition overall, it is clear is that the increased funding of research by ministries such as the health ministry did lead to more managed-mode research and thus more political influence. The division should watch the equilibrium between managed and responsive mode research in total. Whilst, most programmes try to cover both basic and applied research the reviewers questioned how much flexibility was available within non-KUF funding to support basic research.

6.1 Recommendation

The reviewers have the following recommendations

- The interaction between the different board levels (Executive, Division, and programmes and review panels) should be made more transparent and the medical and access to scientific competence of the Executive Board should be strengthened.
- The chair of the Division Board should be a member or permanently represented at the Executive Board – this would strengthen both the scientific expertise and the interaction between RCN and its Divisions. The alternative would be to create a formal forum for the Chairs of the Division Boards to meet together with some of the key non-administrative representatives of the Executive Boards (for example, the Chair and Vice Chair).

7 Staff and Board

The reviewers had limited evidence to assess managerial effectiveness but based on their limited experience the reviewers feel that MH has a very professional and motivated staff and board. Overall the Division appear to be well organised and to be able to engage with its numerous stakeholders.

Within the Division both the staff and the Board are very professional, knowledgeable and dedicated. The communication is good and transparent, and they are able to explain issues, solving problems, and after the first few years of frustration and turmoil, they have a very positive attitude for the future.

One of the main reasons for merging the previous Research Councils into one, was to foster interdisciplinary research and interaction between different research areas. The reviewers feel that previous and current inter-divisional collaboration is more about information exchange at the administrative level than about joint action, and that only a few programmes and initiatives are truly interdisciplinary. These include Commercialisation and capital gains from medical research, Food and Health, and Ethics, society and Biotechnology.

The reviewers feel that if there is one weakness, it is the lack of systematic actions for the renewal of staff competence. The Division does not seem to have mechanisms for staff rotation either internally within the Division, with other Divisions within the

RCN or with the research community at large. This suggests that the divisional staff may find it hard to renew their skill sets or to exchange best practice within or across organisations.

7.1 Recommendation

The reviewers have the following recommendations

- New programmes should take additional consideration of the potential for cross-divisional collaboration; the new genome research programme FUGE will be a real test of whether this is possible in practice and it will be very important to monitor and evaluate this flagship programme
- The Division should consider setting up plans to maintain and update staff competencies through internal rotation and by considering the possibility of funding internships exchanges.

8 Portfolio

8.1 Funding

MH funding received from the Ministries in 2001 amounts to 251 mNOK, 40% from the HSA, and 54% from the KUF, and the rest from the Special Research Fund and other sources.

The two main providers have a strong bearing on the research portfolio. While KUF prioritises basic science-driven research, HSA favours applied and health-related programmes. At present 108 mNOK is spent on 9 programmes and about 90 mNOK on individual projects, research positions and travelling grants. In addition, significant support is allocated to strategic funding and infrastructure from KUF HSA and the Special Research Fund (51 mNOK).

Since one of the main strategic goals of MH is to improve the quality of medical research in Norway, the reviewers suggest that there is an imbalance in the portfolio between programmes and projects. If MH is going to be a major driving-force for high quality research in Norway, the reviewers feel that it should strengthen the funding for independent project and research groups.

The overall management of the research portfolio is done by three departments within the Division. The staffing is appropriate for the work, and the senior staff that were interviewed appear to have the expertise to assist the different review panels. The departments have their specific responsibility for basic research, clinical research and public health and health service research, respectively. In addition, they manage other activities like internationalisation, long-term planning, fraud, etc. Management of the portfolio is efficient, and run in a professional and transparent way.

8.2 Balance

MH has successfully merged 18 programmes into 9 large programmes. The merging of the earlier programmes has reduced the management work-load, but has not always lead to a refocusing and concentration of the health-related programmes. Most programmes still have a very broad mandate and some difficulty in making priorities.

Much of this has simply made the existing programmes more complex and detailed in structure, and goals and the reviewers feel that the programme budgets appear to be too low to achieve all of the programme goals.

The reviewers suggest that the shift to larger programmes should be strengthened and strongly coupled to the strategic plan, as the overall portfolio now looks as though it has evolved in a relatively *ad hoc* fashion. It has clearly developed through seizing chances and not through following a set out strategy. For instance, the programmes on Health Services, Health and Environment, Work and Health, Health and Society have overlapping issues that could be dealt with more efficiently.

Although programmes are reviewed, it is not clear when, and under what conditions, programmes can be terminated. For instance, the programme on Molecular Medicine could have been terminated some time ago and integrated within review panel one.

8.3 Application Process and Peer review

Whilst it appeared to be fairly solid, the peer review system used is not very transparent and may lead to conservatism. The reviewers felt that the low funding rate probably prevented weak proposals from being funded but suggested that the perceived fairness and transparency of the process could be improved by

- Introducing more international reviewers
- Having access to a wider range of specialist expertise for advice outside panels
- Allowing applicants to comment on reviewer's comments (rebuttal). Rebuttal can significantly increase the quality of assessment and of the selection process.

The peer review process is executed in a thorough and expert way. However, the reviewers felt that if the Division is to contribute to the development of the research base in Norway, it needs to enhance the transparency and robustness of the evaluation process, so that applicants should be allowed to give feedback in the review process before a funding decision is taken.

Although the review process may be well conducted, there appears to be very little room for risky and innovative projects. There is evidence from other research councils that low success rates such as those found in some parts of the portfolio (10%) contribute to overly conservative proposal selection.

The reviewers were surprised that the Division expected a great deal of detail in the application forms on the potential project participants. Whilst it is important that proposals are adequately costed, the reviewers feel that the principal investigators should be given more freedom to use the funding as he or she sees fit, and not be forced to include PhD students in their proposals.

8.4 Development of the Research Base

Although it is important to support individual projects, there are far too many projects being supported by the 80–90 mNOK allocated to independent projects. The effort to shift to larger grants has resulted in a substantial increase in project grants of more than 500,000 NOK. This is very positive in itself, but on the other hand, the overall number of grants has not been reduced. This has led to a portfolio with too many grants sharing a very limited amount of money.

The balance between doctoral students, post-doctoral fellows and project grants is not ideal. To foster the best science, the funding should be concentrated on project grants and post-doctoral fellows. Whilst the RCN has some responsibility for the health of the research base and for rewarding outstanding PhD candidates, the running and funding of doctoral programmes should be the primary responsibility of universities.

8.5 Internationalisation

Many of the goals set in MH's ambitious 1996 plan for internationalisation appear to have been reached

- The number of guest researchers has increased
- The number of Norwegian researchers going abroad has increased
- The number of post-doctoral fellows working with a foreign research group during the term of their fellowship has increased
- The number of internationally leading Norwegian research groups has increased.

However, the situation in relation to young researchers worried the reviewers, as it appears that many young researchers show no ambition to go abroad. Although the real reason is not clear, the assumption is that this may well be related to a decreasing interest in a research job in general.

8.6 Portfolio Recommendations

The reviewers had the following comments to make about the portfolio as a whole, and these are presented along with their recommendations

- It will be important to continue to increase the size of the grants by allocating additional funding. Since the success rate is between 10–20%, it is not realistic to decrease the number of grants significantly
- The final evaluation should be transmitted to all applicants. Ideally, one should allow rebuttal from the applicants before the final decision (this is the case at NIH in the US and at NWO in Holland).
- The success rate must therefore increase if new projects and young talented scientists are to come into the system. It should not be necessary to produce an activity report every year – only after the whole grant period when the grant is up for renewal. The committee will then be able to focus more on the new applications
- A formal review process should be integrated within the strategic planning to allow programmes and projects to be terminated so that resources can be reallocated
- Grants should be allocated to the principal investigator (PI) without too much earmarking. The PI should be able to decide how to use the money in the most effective way for doctoral students, post-doctoral fellows, equipment, running costs, etc
- The Division should continue its effort to increase mobility and international exchange both at the doctoral, but more important at the post-doctoral level. Two possible actions should be considered
 - The financing of young researchers on an individual basis, and thorough follow-up
 - Organisation of bilateral exchange of young researchers. This is less anonymous and thus in the end more rewarding

- To overcome the serious recruitment problems in Norwegian medical research, MH should consider developing agreements with universities to clarify the division of labour regarding PhD students and post-doctoral fellows. A shift in the system to provide project funding (effectively to post-doctoral or experienced researchers) appears to be required, and it might be beneficial to make such an effort part of the RCN strategy as a whole.

The Division should seek to strengthen the recruitment of clinically trained scientists into research (and *vice versa*) as this is one of the most effective ways of improving technology transfer from basic to clinical science.

Appendix A

This appendix presents specific comments made by the reviewers on parts of the portfolio presented during the review.

A.1 Mental Health

The programme is very ambitious and broad, ranging from basic biology–psychobiology to addiction and forensic psychology. There is a clear emphasis on supporting and stimulating high quality research by identifying and supporting the best research groups, recruitment (33 doctoral and 12 post-doctoral positions), and promoting networking and cooperation between basic and applied research groups. The reviewers felt that the programme was one of the most relevant in the portfolio but that more could be done to improve the quality of the research (with the exception of the work on epidemiology, which appeared to be excellent). This would best be achieved by linking it to the strong areas in Basic Neurobiology.⁴

Although the budget (21 mNOK) is the largest within the Division, the scope of the programme is too broad, and the number of projects too many to develop high quality research in all the different areas of mental health. Focusing on fewer target areas, or expanding the amount of resources available to make the programme internationally competitive, would strengthen the impact of the programme.

A.2 IT in Medicine and Health

Overall this was felt to be a well-balanced programme which performed well across all the evaluation criteria the reviewers used. The programme has a good focus and a number of realistic goals that are designed to have an important impact on the Norwegian Health Care System. From an international perspective, the programme topics appear sensible, and there are good international connections which can assist and refine relevant activities.

One of the main challenges of this field is to establish a good basis for research, where both the universities and the health care systems are involved. In contrast to most of the other programmes, the reviewers felt that this was an area where equal emphasis would be justified for doctoral and post-doctoral research, particularly if they succeed in recruiting medically trained researchers.

A.3 Molecular Medicine and Gene Technology

The two goals of the molecular medicine and gene technology programme are to support responsive mode research and connect basic and clinical projects in the field of molecular biology. Molecular biology and the different aspects of functional genomics have to be integrated into many areas of modern medical research. Many countries have realised this and are now investing heavily into this field, either via

⁴ On a related point one of the reviewers pointed out that there is an almost complete lack of access to adequate neuroimaging facilities in Norway. However, the other reviewer argued that there are other tools that could be used to link the programme with Neurobiology.

specific programmes or general support. In other countries these efforts have been substantial. In Norway, central fields like bioinformatics, structural biology, stem cell research, gene therapy, and molecular genetics are weak. The reviewers feel that the current budget (11 mNOK) will not allow the programme to deliver its ambitious goals. Considering the international situation, where many countries invest heavily in this research area, this programme, as it stands, is far too small and unfocused to be of value for Norwegian research.

To strengthen the support for high quality peer-reviewed research in Norway, the reviewers recommended that in order not to dilute the support for molecular biology research, the programme should be merged with Review Panel 1. This would make it possible to put some emphasis on the need for post-doctoral international training in molecular biology and genetics. If the programme is not integrated within review panel one an alternative would be to link it (either as part or as a partner) as a component of the cross divisional FUGE programme which is under development.

A.4 Point of Care Clinical Research and Alternative Medicine

The overall goal of this programme is to strengthen patient-orientated clinical research and its translation to clinical care, and to strengthen alternative medicine research. These are very relevant and important goals, given the very difficult situation for clinical research in Norway and internationally. The programme has, however, very limited funding, particularly considering that two of the targets are to support randomised clinical trials and clinical research centres. The reviewers believe that the programme budget is probably too small to finance enough relevant clinical trials, and the programme budget should be reconsidered in line with the goals of the programme.

One of the reviewers feels that MH should reconsider this programme as in his opinion the budget could more effectively be used for the improvement of clinical research in general and for the training of young clinical researchers. Successful examples of such programmes in other countries can be (in part) copied. He also questions the value of dedicating so much of the programme resources to the clinical investigation of alternative medicine and argues that if MH considers continuing the financing of clinical trials the focus should be on orphan diseases as these are typically not financed by industry.

A.5 Health and Society

This programme has a very wide mandate as a result of merging three previous programmes. Within the public health area, alcohol and drug abuse research, health promotion and disease prevention, and health and illness in the cultural perspective. These previous programmes also reflect the three target areas.

The programme focuses on important issues and supports research that may not be supported elsewhere. The strong focus on multidisciplinary approaches within the different areas of research is expected to contribute to interesting research, but raises issues about the quality of dealing with such multidisciplinary research. Although the programme is directly connected to health research policy, the problem of combining

the very big issues of public health and the limited budget will, however, have an impact on the outcome of this programme.

The presentation of the programme did not clearly cover the implementation of research results and the reviewers felt that the activities in this area would need to be strengthened.

The reviewers commented on the apparently weak connection between this programme and others in the field of health services and public health research. They feel that more could be done to bring some of these programmes (and their projects) together, for example by joint funding of some large projects. This is particularly valid for Health and Society, Health Services and Health Economics, Work and Health and Environment and Health.

A.6 Health Service and Health Economics

This programme focuses on an important (and in many ways underdeveloped) field of research particularly as existing expertise in this area in Norway is not widespread.

The programme focuses on three main topics: Health economics, Mental health work, and Organisation and administration of health services. The main thrust of the programme appears to be on developing research groups and networking with stakeholders and academia. The reviewers agreed that focusing the funding on two large competing research groups in Bergen and Oslo was a viable strategy to assist in the development of a top-class research centre.

The reviewers commented on the apparently weak connection between this programme and others in the field of health services and public health research. They felt that more could be done to bring some of these programmes (and their projects) together, for example by joint funding of some larger projects. This is particularly valid for Health and Society, Health Services and Health Economics, Work and Health and Environment and Health.

A.7 Work and Health

The goals and work programme are very ambitious and extensive, and seek to enhance the standard of research and increase the number of research groups in this area. The peers did not expect a significant impact from this programme because of its relatively small size.

Considering the broad implication of these multidisciplinary areas of research, the programme should be able to interact more effectively with other programmes (Environment and Health) and other Divisions (Environment and Development).

A.8 Environment and Health

The programme has a large mandate but has wisely devoted special attention to a limited number of issues: genetics and environment, air pollution, hazardous chemicals, and low-dose exposure of environmental factors. However, the reviewers feel that even with this focus on specific issues the budget might still not be sufficient to deal with these issues properly.

The merging of two previous programmes led to a reduced budget for the programme and this appears to have led to an unacceptably low level of funding and success rate. To strengthen the programme, the reviewers suggested that this programme should consider collaborating with the Division of Environment and Development and with the Work and Health programme.

The reviewers were unclear about how the programme dealt with genetics and the environment and felt that this area could benefit from additional funding.

The reviewers feel that even with the low success rate, the programme committee should focus on maintaining the quality of the projects and research base.

A.9 Commercialising Ideas from Medical Research

One of the tasks of RCN and MH is to improve technology transfer, dissemination of research and industrial development. This programme is a very important link in this development. Focusing on research and development support, patent feasibility, market potential, funding and expertise for commercialisation is expected to be able to support the technology transfer process.

Although this is not a research programme in the strict sense, the reviewers rated this as one of the most important and relevant activities within the Division, and noted the positive collaboration with the Division of Industry and Energy and other programmes within the Division.

A.10 Review Panels

The work of the review panels represents the core business of MH/RCN. All projects financed are excellent but too many excellent and very good projects have to be rejected and there appears to be a risk of losing young scientists in this funding scheme. The reviewers concluded that the small budget for all review panels contributes to low success rates and 'safe' decisions, and that mechanisms should be put in place to combat this bias towards 'normal' rather than 'revolutionary' science.

For that reason they suggested that priority should be given to investigator-initiated projects of high quality and that a separate funding scheme (with a defined budget) should be created for junior scientists.

On a more positive note, the reviewers were impressed with the apparent good interface between the review panels and special programmes. This introduces a certain flexibility in the system, whilst ensuring that every proposal is properly dealt with and that there is no 'buck passing'. From the presentations they heard, the reviewers judged the administration for dealing with proposal appeared to be clear and efficient.

Another problem identified by the panel (and by other evaluations, for example, the recent evaluation of the biological sciences) is the low budget for running costs and for core facilities. It appears that universities do not take this into account, which leads to great problems for very successful groups.

Review Panels I and II

These two panels cover a very wide range of basic biomedical research. With a budget of 40 mNOK, the review process – although scientifically first rate – has difficulty making priorities and providing sufficient funding for high quality projects. Only 10–15% of the applications are funded, and then only partially. The overall priority towards doctoral and post-doctoral funding has led to very little project funding for running costs and equipment, with only 12 mNOK allocated for 80 approved project applications.

The reviewers feel that this allows very limited renewal and risk taking. To fulfill one of the primary goals of RCN and MH, such as developing new and increasing existing high quality research and international collaborations, the funding available to responsive-mode funding should be substantially increased.

There is an overlap between projects covered by Review Panels I and II and the Molecular Medicine and Gene Technology programme. These two activities should merge to establish a stronger focus on basic biomedical research.

Review Panel III

This panel faces similar difficulties with respect to lack of funds in relation to its extensive mandate. The panel focuses primarily on doctoral and post-doctoral support and only a few project grants are awarded.

The reviewers suggest that it will be important for strong links to be maintained between the research funded by this panel and the programme on Point of Care Clinical Research and Alternative Medicine.

Review Panel IV

This panel funds research over the wide range of public health and health services and the panel interacts with the applied programmes Health Services and Health Economics and Health and Society.

Together with all the health-related programmes, public health research appears to have a rather strong position in Norway, particularly in epidemiology and psychology, whereas general practice, dental health and nursing appear very weak. It is, however, difficult to discern a coherent research strategy for all disciplines and topics in public health and health services and the reviewers suggested that more could be done to link the work of the review panel with RCN programmes and with the relevant funding ministries.

A.11 Special Grant Committee

This committee was formed to strengthen internationalisation and recruitment of young scientists. This activity is well focused and addresses some of the main goals and problems of the Division. The student fellowship programme can be instrumental in recruiting medically trained scientists to research.

Overall the reviewers felt that this was an excellent programme which fulfils the needs of the scientific community. There is, however, one potential drawback from what appears to be a very flexible scheme: there is no system of return-grants(with the

exception of career grants which enable repatriation), and this may lead to a brain drain.

A.12 Strategic Funding and Infrastructure

To support high-quality research and outstanding research groups, special initiatives and funding modes have been established. 50 mNOK (20% of the total MH budget) (of which 28 mNOK came from from the Special Research Fund) are allocated to major grants to groups, senior scientists, young career scientists, cancer research, food and health, medical technology and research equipment. This is also a good example of where the different Divisions have been able to work together to allocate funding.

This initiative adheres to similar strategic initiatives undertaken by most funding agencies. The reviewers felt that the support of excellent groups through peer reviewed programmes would be extremely rewarding for Norwegian research, having a very good impact on high-quality medical research in general. Finally the reviewers think that this will also provide much needed injections of funding for the scientific infrastructure.

Review of RCN's Natural Science and Technology Division

Summary of the Expert's Reports

November 2001
(revised December 2001)

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With

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1 Executive Summary

This section presents the summary from the expert review of the Natural Science and Technology Division (NT) of the Research Council of Norway (RCN), which took place on 24 and 25 September 2001. The report of the Evaluation of NT will form part of the background material to the wider evaluation of the RCN currently underway.

The reviewers' assessment is mixed. NT has made significant progress towards the goals associated with the 1993 merger. However, the Division still suffers from a lack of funding, and it is not clear that its current support mechanisms can deliver on its mission to provide broad support for the sustainable development of fundamental research in Norway, and to support the other research divisions of the RCN. Indeed, one of the reviewers feels that the value added by merging the research councils has still not been delivered in NT.

1.1 Conclusions

Since its formation, RCN has operated within the constraints of the Norwegian environment. From the perspective of the evaluation of NT, the reviewers felt that the external influences that continue to constrain RCN's actions and progress include

- The sourcing of funding for RCN from multiple ministries
- The reduction in the science vote which coincided with the formation RCN
- The unusual industrial base
- The size of the Norwegian science base.

Historically, RCN appears to have been relatively unsuccessful at improving funding for Science and Technology and at overcoming the lack of political interest in Science and Technology.¹

However, the Division has successfully promoted improvements in the funding of resource intensive research equipment and has been made significant investments in the support of postdoctoral and PhD students, which could have a significant impact if the scientists supported can be retained.

The Division has had some success in developing the strategic planning of the research through the SIPS and SUPS programmes, but much work is still needed in this area to complete the transition to a research base which is capable of being proactive rather than reactive. The SIPS support and other instruments have created a few sources of

¹ Although much was made of the lack of funding during the review visit, the reviewers were subsequently told that this has improved recently and that the RCN has succeeded in obtaining political approval to increase funding to reach the OECD average within 5 years - it remains to be seen whether RCN can maintain the political will to carry this through.

long-term support for research leaders, but there does not appear to be a credible response-mode funding stream capable of supporting emerging research teams working on fundamental, curiosity-driven research.

A number of systematic evaluations of research institutes and university research groups have been successfully carried out, but the evaluations have not focused on the overall research system, but rather have focused on sectoral/discipline studies. In addition, the evaluations appear to date to have had little impact on research support in Norway.²

The level of research funding is low, and the small Norwegian community has substantial problems in dealing with conflicts of interest. Scientific expertise is spread relatively thinly, and this had led to difficulties with ensuring good scientific decision-making. This may, in some part, account for the dominant role played by the administration but the reviewers note that compared to other countries, Division staff often lack significant research experience.³

The Division delivers its research portfolio through a diverse and complex set of mechanisms, which limits the Division's flexibility and are not always appropriate. The review panel's major concern is the absence of a significant responsive-mode funding stream.

To achieve the aim of becoming a successful single research council, the relationship between the RCN Board and Division Boards needs further strengthening, as do internal communications and inter-divisional working, as there does not appear to be much co-ordination between basic and applied research.⁴ The issue of staff competence and training to bring about the mechanisms to ensure RCN works as a single unit have not been developed.

The concept of multidisciplinary research was one of the driving forces for the introduction of the RCN. The reviewers commented that the focus on multidisciplinary in RCN projects, in the design of RCN led evaluations, in specific support measures, or in the existence of co-ordination mechanisms for fields that span divisions, could have been greater..

² The RCN argued that the evaluations have been followed up by RCN through national science plans. These plans are developed by scientists from the universities and will have impact on priorities within each university. However, the reviewers felt that no evidence of this had been presented during the visits and given the conclusions in these evaluations, the reviewers would have expected these evaluations to have had a fast and significant impact.

³ The issue raised by the reviewers is that although panels and boards formally decide on recommendations put forward by the administration they did not appear to have much time to examine this in detail which suggests that the administration has more influence than in other European Research Councils.

⁴ The **RCN** subsequently challenged the reviewers' conclusion on this point and argued that there was comprehensive collaboration between the Industry and Energy and Science and Technology Divisions. The **review team**, however, feel that they were not presented with evidence that demonstrated close co-operation during the reviews.

1.2 Major Recommendations

The reviewers had the following recommendations

- NT should introduce a properly funded responsive-mode mechanism to support significant projects
 - The selection mechanisms for this funding should be based on scientific quality and should provide sufficient funding for research leaders to develop significant research competence
 - The Independent projects should be explicitly identified as a Fellowship programme
- The number of funding mechanisms should be reviewed and rationalised to prevent a fragmentation of subcritical support measures
- A coordinated effort to increase the level of Norway's investment in research to something approaching the OECD average needs to be made. This should be coordinated across the Institute and University sector to prevent conflicting advice being given to politicians and ministries⁵
- The RCN should do more to introduce specific features that foster multidisciplinary (and cross-divisional) projects and approaches. The RCN should
 - Review any existing mechanisms for coordination between the different Divisions at all levels, both scientific and administrative
 - Strengthen the knowledge of staff and promote greater collaboration across the organisation and beyond by introducing more staff mobility (e.g. through staff exchange with other divisions, or with the science base).
- Increased effort needs to be given to improving the quality assurance methods used to ensure RCN staff select the correct peers, and that staff within the Division are developed
 - The dominance of the administration in guiding funding decisions should be reduced, so that scientific judgements (for example the preparation of ranked lists for approval by board or panel members) are made by scientists, rather than administrators. The procedures followed by the Programme Boards for thematic programmes provide an excellent model.
 - There is much to be gained from a greater engagement of the international community and the use of non-Norwegian peer reviewers should be encouraged both for postal review and panel membership
- Action should be taken to implement recommendations from previous evaluations. Future evaluations should be tied closely to the new, single RCN structures and should cover the University/College sector and the Institute sector in the same review
- The scientific community should be more widely consulted on all issues in relation to RCN

⁵ The RCN have recently been successful in obtaining government support to increase funding for R&D to bring this in line with the OECD average within 5 years. It remains to be seen whether this will be implemented.

2 Introduction

This report summarises the results of a short expert review of the Natural Science and Technology Division (NT) of the Research Council of Norway (RCN). The report contributes to the much wider evaluation of the RCN commissioned from Technopolis by the Ministry of Education, Research and Church affairs (KUF).

It is one of six such evaluation reports looking at the research portfolio and organisation of the Divisions in the RCN and provides an assessment and recommendations for future development of the Divisions' research strategy and operation. The report will be appended in a separate Appendix to the overall evaluation report and will provide material both for other components of the evaluation and for a summary of the expert reviews of the RCN's Divisions.

3 Method

The aim of the Divisional review was to evaluate the strategy, organisation and functions of each of the six Divisions and the various programme elements that they cover, and to draw conclusions for the operation of the RCN from these reviews. The Divisional evaluations focus on

- The strategy adopted by the Divisions
- The structure and resources of the Division and how these are managed to support the delivery of its missions
- The choice and relevance of the research portfolio supported by the Division and the way in which these are designed and used
- The effectiveness and impact of the portfolio

The three expert members of the review team were identified by Technopolis and subsequently approved by NT. The expert members appointed were

- **Dr H-P Hertig**⁶ - the Secretary General of the Swiss National Fund for Research. He has been an active participant in formulating Swiss research policy particularly in terms of prioritising research and in developing mechanisms to deal with interdisciplinary research
- **Dr L Thompson** - a Senior Programme Manager at the UK Engineering and Physical Sciences Research Council (EPSRC). She is responsible of coordinating the interaction between the Engineering and Natural and Life Sciences within the EPSRC and has an excellent overview of the whole range of research funded by EPSRC, MRC and BBSRC, and of the mechanisms used to support interdisciplinary research

⁶ It should be noted that because of budgetary constraints Dr Hertig and the SNF participated in the evaluation exercise without receiving payment for the time taken to work on this project – they are owed a special thanks for the work undertaken and we hope that this will be remembered in future exchanges between the RCN and the SNF.

- **Professor A Warner** - a Fellow of the Royal Society and the Director of the Centre for Mathematics and Physics in the Life Sciences and Experimental Biology (CoMPLEX) at University College London. Her background is in biophysics and developmental biology but she has extensive experience of formulating interdisciplinary research with mathematicians, physicists and computer scientists

Technopolis explained the issues that the review team would attempt to evaluate and asked NT to provide a briefing document on its activities. This was delivered to the panel prior to the review visits.

The review visit took place on 24 and 25 September 2001 and the schedule centred on a number of pre-agreed presentations, followed by a question and answer session designed to allow the reviewers to comment on the evaluation questions. It should be noted throughout that no representatives of the Executive Board or of the Director General were present during the review visits⁷

The consultant responsible for the divisional evaluations within the review (Mr Ben Thuriaux) accompanied the review team throughout the visit and the leader of the RCN evaluation (Dr Erik Arnold) was present for most of the review visit.

Although the reviewers only looked in detail at parts of the RCN, they formed a number of impressions about the way in which the whole structure operates. These are presented in this report but it must be understood that they only form a partial picture - however, it is important to present these as they may represent converging indicators when combined with other parts of the RCN review.

Following the visits, the peers prepared individual evaluation reports. These have been synthesised by Technopolis and validated by the reviewers. The current document forms the report of the evaluation after the reviewers' modified their comments to deal with RCN's comments on the draft.⁸ RCN's general comments are presented in **Appendix B**.

The report addresses the issues that the reviewers were asked to concentrate on and outlines a number of possible recommendations that will inform the overall evaluation of the RCN.

⁷ In that respect the evaluation presents an external view of the Division and its environment based on material presented by the Division. The conclusions regarding aspects of governance and the internal workings of the Council can therefore serve only as partial indicators as they are based on the evidence presented by the Division.

⁸ The reviewers did not significantly alter their conclusions following feedback from RCN

4 Strategy

4.1 RCN History – Context

The history and rationale for the introduction of RCN was clearly documented and explained in the briefing material for the reviewers. The single Research Council of Norway (RCN) was formed in 1993 from the Norwegian Research Council for Science and the Humanities (NAVF), the Royal Norwegian Council for Scientific and Industrial Research (NTNF) together with the research councils in agriculture, fisheries and applied social science.

Before the merger, individual research councils depended on different Ministries for funding. While there was overlap between the different Research Councils (for example, the Agricultural and Medical Councils and the National Committee for Environmental Research), in practice, coordination proved difficult to achieve. This stemmed in part from fragmented national research funding.

4.2 Science and Technology Division

The RCN put responsibility for pure basic research in science and technology exclusively into the hands of NT, and responsibility for user controlled industrial R&D into the hands of the Industry and Energy Division (IE). NT is one of six Divisions in RCN. Its role is to fund basic research across the spectrum of science and technology disciplines and to fund strategic industrially oriented research including core funding for the industrially oriented research institutes. The four other Divisions are responsible for the whole range of research from basic to applied.

These two central Divisions (NT and IE) are supposed to interact with one another and the other four Divisions, to ensure that the RCN follows a coordinated approach to both basic and industry-oriented research. The separation between IE and NT was required because of the different management styles needed to support basic and applied research and to ensure that none of the RCN divisions would dominate the council because of its size. The reviewers agree with this basic strategy but comment that the implementation of the strategy appears to be weak in that little evidence was presented of a coordinated approach between IE and NT which is needed to handle the complex relationship between applied and basic research.

NT developed its remit through a series of strategy documents in 1996 and 1998. These were summarised for the reviewers and showed that some thinking has been put into focusing the efforts of the Division. However, given RCN's overall remit, the reviewers feel that NT scientific priorities are still not properly clarified and that its strategy and instruments suffer from a lack of shared vision amongst the senior staff of the RCN. In the opinion of the reviewers, this lack of clarity at the top of the organisation prevents the RCN from reaping the benefits of its single structure. It also causes NT to focus on its mechanisms and instruments rather than on the scientific priorities, hindering collaboration with other Divisions.

Strategy for the Division is decided at the Board level (the Board is mostly composed of scientists) while implementation is in the hands of the administration. The reviewers were told that initiatives for new programmes normally come from the science community and that the board decides which programmes should be included in the budget proposal, the mandate and budget when the program is started. The reviewers' impression is that compared with other countries, the scientific community appears to have less input into the way in which the research carried out under the auspices of NT is set in hand.

4.3 Recommendations

There is no 'right way' to organise the administration that supports a nations research or there would be less diversity across the world. There is a brave experiment happening in Norway, but, without a vision and forward plan of action from senior management at RCN, which is embraced by all staff, it is unlikely that the full potential of this single council structure will be realised. It will be important that key members of the scientific community also endorse the vision.

NT needs to seize its role as the provider of underpinning knowledge and flow of trained people to support the entire Norwegian research culture and future knowledge economy. However, in order to be effective, this will require a wide endorsement of NT's activities from all other RCN Divisions, and support from the Director General.

5 Structure and Management of NT and RCN

The reviewers argue that, compared with other Research Councils, the Division structures seems unnecessarily complicated in terms of the number of Boards that are required to operate the major support instruments of the Division. In the opinion of the reviewers, the number of structures currently in place do not help the Division to achieve its aims, nor do they ensure that there is adequate interaction with other Divisions, for example to deal with cross-divisional programmes or projects.

5.1 History

After much discussion and dissent, the separate research councils were amalgamated into a single research council which was subdivided into six Divisions, each with its own Divisional Board and Director. These are answerable to a Director General and thence to the Executive Board (EB) of the RCN. NT derived mainly from RNF, which was University and basic research-oriented, and NTNF, which was user-oriented, and promoted technological research to underpin Norwegian industry. In NTNF, industry had played the dominant role in choosing the topics of research, with industrial relevance being more important than scientific quality. The clash of cultures has historically generated problems within the RCN.

5.2 Structure

The Division face a number of problems that stem in part from historical relationships with different funding Ministries, and in part from a responsibility within the RCN for the more fundamental aspects of research research. In other research councils in

Europe the part of the organisation dealing with Fundamental research would have a less demanding responsibility as they would not typically also deal with the problem or goal orientated research which in Norway is supported by other ministries.

Division Board members are drawn from the Universities and Research Institutes and are charged with overseeing the work of the Division. However, the function of the Division appears to be dominated by the administration, and the relationship of Board Members with all but the most senior administrative staff of the Division is weak.

There were two major instruments of structural organisation: the Department of Infrastructure, which deals with basic funding of research institutes which includes strategic institute programs(SIP), strategic university programs(SUP) and the general running of the Division, and the Department of Programmes and Projects which is in charge of free projects, basic research programmes and international activities.

The internal structures of NT appear to have developed in response to the variety of funding mechanisms operated by the Division. An Advisory Committee that reports directly to the Division Board deals with the SIPs and SUPs support. Independent Research projects has its own Advisory Committee that also reports to the Division Board. Each thematic programme has its own programme board, which acts with relative autonomy. Funding for advanced Equipment is dealt with by an Equipment Committee which is responsible for the total RCN support for equipment, and it reports to the NT board,. There are, in addition, a number of large projects, which are funded by special grants from the division board. Some of these have their own board.

The reviewers feel that NT lacks appropriate structures to ensure that the various aspects of NT's portfolio are brought together to form a coherent whole. The structure for interacting with other Divisions is not evident to the reviewers, as there are no obvious mechanisms to ensure that NT is fulfilling its role of supporting basic research which underpins the work of the more applied Divisions.

5.3 Division Management and Staff

The reviewers are unable to comment on the performance of the current Executive Director for the Division as he has only recently been appointed. Overall, the review find senior RCN staff to be competent and capable, but raise a number of issues about the training provided to more junior members of staff.

From brief conversations with less senior member of the administration staff, the reviewers gained the impression that these staff members are often given considerable responsibility for scientific decision-making (e.g. drawing up ranked lists) without having much relevant research experience. In addition more junior members of staff appear to have little awareness of activities in their sister Divisions, and there are no mechanisms to ensure that staff at lower levels gain experience of the work in other Divisions.

5.4 Budget

The overall level of funding for research within Norway is very low, at the very bottom of the European range. While the public investment is at the same level as other countries, private financing is very low. Unlike most European countries, Norway's recent wealth is not the result of industrialisation and the development of national competitive advantage. As a result, the research community has not been successful in persuading the various Ministries and Parliament that research investment is an essential tool in improving national prosperity.

The Research Council receives funding from 14 Ministries each requiring differing deliverables, and the authority/ability of RCN to introduce dynamic change to meet its objectives appears limited. This is compounded further by the reductions in the organisations budget on its formation. There are still signs of the negative impact that this has had on Norwegian research and the senior staff and researchers the reviewers met are still felt very angry over the way in which the transition to a single research council was handled.

NT suffers from the fact that research funding for the various aspects of NT's mission comes from several Ministries. This somewhat reduces the flexibility of the Division to develop new programmes in line with the interests of the scientific community.

NT's budget appears to have had relatively few changes in composition across the different funding mechanisms over the years. The only exception is the equipment-funding stream, which received a government injection of funds after successful lobbying.

Current practice seems to be to set up new funding instruments to entice different Ministries to contribute, without removing any of the existing funding instruments.

5.5 Recommendations

The basic structure of RCN is sound, but there are few obvious mechanisms to ensure that separate Divisions operate as a coordinated whole rather than as individual elements. Until this is achieved, the aim of reducing overlap and engendering greater coherence to Norway's research effort has little chance of real success. The reviewers suggest that some relatively simple mechanisms would speed up the integration process

- A greater interchange of staff between Divisions and with other research councils internationally would benefit the operation of RCN and allow it to develop a common corporate culture
- The RCN should develop (or adapt from other research councils) specific mechanisms to deal with cross-divisional projects and programmes
- Encourage greater interaction between the strategy Division with Division Boards to ensure the active involvement of scientists into the formulation of science policy

The structure of the Division is closely inter-linked with the funding mechanisms so that the required changes in RCN structures are only likely to follow a radical overhaul in the way in which research is funded. The reviewers argue that measures need to be taken to increase the funding for research in Norway and to increase the flexibility afforded to RCN divisional boards to allocate funding.

6 Governance of RCN and NT

6.1 Executive Board and Director General

One strand of the strategy to achieve a single Research Council lies in the part played by the Director General, who effectively controls the interaction between the main Board and the Division Boards in the RCN structure. Although the review did not probe the role of the Director General in detail, the reviewers were surprised to hear that the government had chosen a Director General who did not have a scientific background as in other countries Director Generals of research councils are typically distinguished scientist with considerable research experience.

NT is under the overall control of the Division Director, who reports to the Division Board and to the Director General. The Director is largely responsible for representing the division within the RCN and the chair of the division board is invited to represent the division at the Executive board meetings when budgets are discussed. Both the Executive director and the chair of the Division Board therefore plays a key role in setting the ethos of both scientific and administrative aspects of the Division's work.

The mechanisms for ensuring a proper interplay between the various Division Directors and the main RCN Board do not appear to be adequate. A strong separation between the main Board of RCN and the Division Boards was maintained for a considerable period of time following the merger of the previous research councils. During this period, the chair of the Division Board met with the Executive Board by invitation only and there were informal meetings of the heads of Division Boards. This was in clear contrast to the frequent meetings held between the Director General and the Division Directors.

The reviewers argue that the separation between the administration and the Executive and Divisional Boards within the RCN might have contributed substantially to the failure to achieve the stated aim of a single, coherent Research Council. The separation between the boards has now been partially decreased and the chair of the division boards represent their division at under half the meeting of the executive board.

The part played by the three sections under the direct control of the Director General was not explained. For example, the relationship between the Strategic Planning Division, presumably responsible for overall RCN Strategy, and the strategies of the

individual Divisions is not clear to the reviewers and they are unable to comment on this relationship in detail. However, they note that

- 'Strategic' planning seems to take place at a number of levels within the organisation, which raises the possibility that too many resources might be devoted to planning in a system with so little budgetary flexibility
- It is unusual that the selection process for the Executive Board does not seem to select Board members who would be competent to contribute to a Science and Innovation strategy without support from the RCN Strategy Division.

6.2 Division Board

The composition of the division board is appropriate but the reviewers suggest that the selection process should primarily be based on competence and scientific recognition rather than attempting to create a completely 'representative' Board.

The relationship between the RCN Board and NT Board as presented appears less than optimal, as there are a lack of mechanisms for feeding issues back from NT to the Executive Board.

6.3 Peer Review

Peer review is the corner stone of research council systems internationally. The reviewers argue that there is a strong contrast between the processes used across the Division and that the peer review processes in place for responsive funding are far from best practice.

A greater engagement of the international community in peer review in Norway would overcome the inherent difficulty in the Norwegian peer review system. The science base is small, and without great care, conflicts of interest can dominate proceedings. In the view of the reviewers this may contribute to situations in which the need to resolve conflicts of interest override the need for good scientific decision making

- The need to ensure cross-representation on the various instruments of governance appears to play too strong a part in the selection mechanisms for establishing the review panels
- In some cases it appears to have led to the administration taking on a range of roles that are more usually controlled by the scientific community in other countries.

For the Advisory Committee for responsive-mode projects, project proposals are handled by the administration, which are responsible for identifying referees, receiving and summarising referees' reports and constructing a priority list of projects. It appears that any independent project that maps onto an area of strategic priority is transferred into one of the strategic programmes. The role of the Advisory Committees in making funding decisions appears insufficient as they do not have time to properly review the projects and appear to rely heavily on

- Project summaries and referee summaries generated by members of the administration who have little specialist knowledge

- Pre-prioritised funding lists, again drawn-up by members of the administration.⁹

Overall the review panel conclude that the responsive-mode review procedures are more heavily controlled by the administration than is the case in other research councils with responsibility for basic research. The apparent lack of experience and lack of continuous training of administrative staff raises some doubts about the quality of the review process.

By contrast, the way in which the **thematic programmes** are managed is thought to be exemplary as it ensures that scientists, not administrators, make funding decisions. Each programme has its own Programme Board drawn from the scientific community and a specially appointed secretary. Proposals go directly to the Programme Board, which choose the referees. Referees' comments are seen by the Programme Board, and funding decisions are made by the Programme Board, within the funding limits available and the agreed remit of the programme. The reviewers feel that this part of NT's portfolio represents international best practice.

The **special projects portfolio** brings together a disparate range of projects, which includes advanced scientific equipment, contributions to OECD projects, and the SARS Centre for Marine Technology. Advanced scientific equipment is managed by a separate Programme Board with responsibility for all scientific fields. The management of this aspect of NT's activities seems to be working well and this appears to be one of the areas which demonstrates good coordination between the different Divisions of RCN.

The final observation with respect to peer review was that despite having a single council, there do not seem to be specific measures to deal with multidisciplinary research proposals.

6.4 Evaluation

Although the review spent relatively little time discussing previous evaluation in Norway (because it was not part of the intended review schedule), the reviewers comment here on Norwegian evaluation practice as they feel it is important in the context of the present review. It should be noted that the problems identified here are systemic and cannot be resolved by NT on its own.

Throughout the review, much was made of the role of consultation and evaluation in NT. This commitment to evaluation is exemplary. However, it will be important to move to an 'action-based' approach where evaluation results are reviewed and where approved recommendations are systematically addressed.

⁹ Although these staff members apparently take advice as to appropriate referees from Advisory Committee members, they only do so when they feel that they cannot reach a decision themselves.

Statutory requirements to carry out evaluations are in principle an example of best practice processes within Research Councils. However, the reviewers made a number of comments that suggest that evaluation practice in Norway is not currently adding much value.

The strategy underlying the formation of the RCN was to foster a coordinated approach to Norway's Research activities and the RCN Divisions are clearly related to areas of scientific investment rather than being based on narrow scientific disciplines. However, the majority of evaluations appear to either subject or institute based. For example, the large number of industrially oriented research institutes have been evaluated in a set of completely separate exercises and the different sectors of Norwegian research are effectively being evaluated without considering the overall science and innovation base which the RCN is supposed to represent.

The evaluations do not appear to have much of an impact and the reviewers did not see any management mechanisms to ensure that action was taken as a result of the large number of evaluations that had been carried out. The only consequence of the evaluations appears to be the appointment of national committees with the mandate to draw up strategic plans for individual disciplines.¹⁰ Two strategies have been published, but they do not, as yet, appear to have had much significant impact.¹¹

6.5 Recommendations

The reviewers recommend the following

- Creating better relationships between the RCN and Divisional Boards to ensure that the Executive Board can draw on the competence of the Division Boards. Board members should be appointed on a rotation basis to prevent a situation where the majority of members are removed
- The Chairmen (and possibly Deputy Chairs) of each of the Divisions Boards should meet formally, on a regular basis to discuss issues of common concern. Representatives of the EB should be present for at least some of these meetings to ensure that the debates are transmitted to the RCN Board discussions
- Future evaluation recommendations should be formally scrutinised, so that approved action plans (with resources) are formally associated with these
- Greater involvement of international peers on policy and peer review groups. This will require proposals to be submitted in English but will promote an internationally competitive science base and will support the publication of work in prestigious international journals.
- Increased effort needs to be given to improving the quality assurance methods for the selection of peer reviewers and to develop the expertise of NT staff.

¹⁰ This seemed to add another level of strategy on top of the other layers of strategy that RCN is beset with.

¹¹ Following feedback from RCN the reviewers agreed that it might be too early to see strong impact but felt that two years after the review there should have been some visible progress.

7 Portfolio

The reviewers are struck by the complexity of the research funding mechanisms and the lack of flexibility across these mechanisms given the low level of funding available. NT is the only division that can be effectively charged with the provision of basic support for the health of science disciplines in Norway but the current portfolio does not properly deliver this critical role.

7.1 Portfolio Conclusion¹²

The most striking problem with NT's portfolio is the absence of a funding instrument to support the development of emerging research teams through longer-term research projects.¹³ The closest mechanism (the “free projects”) effectively appears to be a fellowship programme that cannot provide realistic research support costs to team leaders because its main aim appears to be to train postdoctoral fellows and PhD students. There appears to be insufficient investment into fundamental research and the development of research teams in Norway’s Universities, Colleges and Research Institutes and prevents the development of future research leaders.

The reviewers thought that NT's portfolio has suffered from the need to persuade the various ministries that it is in their interests to fund research, and the perception that additional funding could only be achieved by presenting targeted programmes for support.

Evaluation reports made available to the review panel emphasise the need for Norway to increase its investment in curiosity driven research. That is, research that is initiated to solve fundamental problems and from which future strategic research will flow. For such investment to be successful, only the best projects must be funded, without regard to any possible strategic relevance. This is because the pursuit of original research, by its very nature, tends to point to solutions and areas of progress that have not previously been identified. The review team argue that the renewal of the research effort across the spectrum is hindered by a focus on current problems and feel that NT should improve the balance between programme funding and responsive mode funding.

¹² **Appendix A** provides a more detailed analysis of the portfolio composition

¹³ NT later argued that A SUP financed by KUF is a response mode funding stream capable of supporting the development of research teams through long term research projects. The management of university faculties or research institutes decides which of the proposal are within the strategic areas for the institution, but they do not make a priority list. Scientific quality, of project manager and proposed project, based on evaluations from three international referees, is the criteria for selection. **The reviewers**, however, felt that this was an instrument that would only be capable of funding very well established staff and that Norway lacked a funding stream to allow promising scientists to obtain funding in a completely responsive mode.

7.2 Recommendations

The reviewers recommend the following

- Substantial funds of money should be diverted to fund a programme that genuinely invests in fundamental research, which is open to all sectors and which provides realistic research support costs to emerging and established team leaders. This cannot be achieved within the current free programmes as its main aim is to train postdoctoral fellows and PhD students, with only minimal funds to support the research of a group
- NT could simplify its and the science communities life, by reducing the number of mechanisms or allowing a single mechanism to be used flexibility.
- At least 50% of NT's budget should be invested in a responsive mode in order to provide the necessary critical mass for the development of Norwegian Research. This rebalancing of the portfolio will benefit from a significant injection of non-earmarked funding and the government will need to review the flexibility with which NT can reallocate funding from existing activities and programmes to fund this.
- NT should define its contribution to the research and innovation system and clarify its contribution to RCN objectives.

Appendix A

This appendix presents specific comments made by the reviewers on parts of the portfolio presented during the review.

A.1 Strategic Institutes/University Programmes

These two strategic programmes, one to provide funding within the Universities (SUPS), the other to fund the Institutes (SIPS) are managed through an Advisory Committee that reports to the Division Board. The topics for the strategic programmes are developed by the applicants and are designed to allow

- Institutes to address the need to build up longer term funding and hence attempt to grow their future deposit accounts to allow future interaction with industry
- Universities' senior management to strengthen research groups around competent leaders

Whilst the support clearly provides organisations with resources to develop their strategy the fit of these schemes with the divisions strategy was not clear.

The use of international referees is a positive aspect of the scheme but the reviewers did not have enough information on how quality and relevance were balanced (and by whom) to make a final funding decision.

The reviewers commented that the distribution of SIP/SUP's as given in annex 5 of the briefing material look appropriate although it was hard to identify a pattern of prioritisation in specific areas that might be expected in a strategic scheme.

One of reviewer felt that it might be better to replace SIPS/SUPS with a funding competition capable of providing significant funding for longer-term projects teams based entirely on quality criteria.

A.2 Special Projects

This brought together a range of larger of programmes, which ranged from funding for advanced equipment, through support to European enterprises, to the setting up of a new research institute (SARS). Funding flexibility for these projects appears to be rather limited and NT is administrating these projects with little ability to redirect what is apparently earmarked funding. Three areas were presented.

Advanced equipment funding.

The RCN has been successful in attracting new government funding to invest in research equipment and infrastructure, which is included in this category.

The strategy was to take soundings from the community about expensive equipment, such as NMR machines, and then ask for bids for sites where clusters of machines might be located. Where possible, clusters were sited at each University.

The committee set up to oversee decision making worked together with the Universities and Institutes, was effective and, the community appear satisfied with the outcomes. The reviewers felt that this aspect of the Special projects is working well.

This investment is clearly very important although the reviewers argued that NT need to be cautious in investing in state of the art equipment with out making parallel investment to support key technical staff to operate and give appropriate advice to users of state of the art equipment.

Infrastructure programme “Supercomputing II”

The principle for this component was to locate high performance computing equipment at specific institutions. Bids for high performance computing facilities were made against tender specifications, presumably put together by a specialist committee. The programme board made the decision based on advice from an international group of experts.

The reviewers commented that Norwegian investment in this area seemed slightly isolated from events going on in Europe and elsewhere. Grid technology was not mentioned and there appears to have been little participation by external experts, which might have ensured that the investments being made in Norway meshed with transnational investment in this extremely important area.

SARS Centre for Marine Molecular Biology

This centre had been set up because investment was needed in the applications of the techniques of molecular biology to marine biology. This was, in principle, a sensible move because for many years, marine biology failed to benefit from the technical advances now possible because of molecular techniques, particularly in species identification, monitoring of plant and animal movements and responses to environmental change and pollution.

The Centre is located in Bergen and incorporates 37 scientists from 11 different nations divided into 5 groups.. So far the Centre had generated 8 PhD students. SARS is therefore a small-scale investment into a very important area of marine science, which impinges onto a wide range of both basic and strategic research areas.

One of the projects within the centre was devoted to the study of the zebrafish and this had been set up as a result of the advice of an external expert panel. The fact that advice had been given to focus on the zebrafish worried one of the panel members who argued that that:

- The zebrafish is a key model organism for work in developmental biology and has almost no relevance to marine biology. The world wide investment in the study of the zebrafish is huge.
- There are large facilities at a number of places elsewhere in mainland Europe, the UK and in the US. The primary aim of these groups is to understand **developmental biology**, not marine biology. Unless this group is closely linked to one of the larger groups outside Norway, it will be difficult for this small Norwegian group to make an impact on an international scale and this impact will be limited to developmental biology.

Given that investment in the zebrafish generally relates to its utility as a model organism for developmental biology and not marine molecular biology, the investment in zebrafish within SARS is likely to represent very poor value for money in the context of the SARS remit. Based on the limited information presented, SARS appeared to represent too little investment into the wrong things. Since marine biology, in all its aspects, is of great economic importance to Norway, this was rather worrying.

A.3 Independent projects

In other countries the free projects would relate to responsive mode proposals. The objective of this mechanism should be to create, high quality research environments with the ability for self-renewal and must be central to the role of S+T. The documentation confirms that staff in NT understands the critical role of responsive project funding. However the reviewers were rather concerned about this component of the portfolio because:

- The budget for independent projects appears to be far too low (compared to the funding available in other less prosperous European countries)
- The resources allocated to the review procedures do not allow the panel members to properly scrutinise proposals and external assessment and there appears to be a strong reliance on (relatively inexperienced) RCN staff in prioritising proposals. This is particularly important for the assessment of multidisciplinary project proposal.
- The success rates of appears to be too low and are therefore to likely to create a bias towards unadventurous research

From an international perspective the free projects actually appear to be a form of fellowship programme that provides support for small PhD and Postdoctoral research in areas which are not covered by the more strategic programmes. However, the reviewers were told that the support does not provide sufficient funding for equipment or supervision and makes it difficult for younger researchers to develop research groups. This form of support is an important component of any national support for research but, in the Norwegian context, the problem seemed to be that there is effectively no mechanism by which younger researchers, beginning to run their own labs, could develop their own, original research programmes.

The level of funding and the operation of the fellowship programme means that there is a lack of ‘renewal’ in Norwegian research because it is difficult to fund new ideas and only just possible to fund new people at postdoctoral level.

A.4 Thematic programmes

The thematic programmes appeared to be the part of the S+T portfolio that was working most effectively. The rationale for identifying and selecting areas for programmes was robust and rigorous with clear objectives and limited duration. This was by far the best bit of the overall portfolio. Funding within each programme was entirely in the hands of a separate, programme board that operated autonomously. This meant that scientific considerations dominated and that decisions are being made by scientists, not administrators. The peer review of selected projects was a good exemplar which other parts of S+T should consider adopting in delivering their funding decisions. The current distribution of programmes appears appropriate.

The reviewers heard presentations on three programmes.

Computational mathematics

This programme aimed to fund about 10 projects per annum. Criteria for funding included relevance to the programme aims, quality of the proposal, size of the project and the balance of the portfolio within the programme.

This is an important area internationally, with links into most sciences, particularly the life sciences. It therefore was surprising that there was a weak international component on the programme committee. This means that the Norwegian effort may be isolated from the rest of the community.

High priority was being given to projects that promised to develop methods that would relieve bottlenecks in important applications. It was surprising that the use of known methods to solve research problems was given a low priority, since the application of mathematics to solve particular problems invariably leads to the development of new methods. Thus the programme was entirely focused on methods rather than problems. The danger of a method driven approach is that none of the methods developed will have relevance to real problems.

Despite this conflict between research that is method driven and research that is problem driven, this programme was well thought through, the programme board knew what they were about and, in time, this programme is likely to have real impact.

Basic ICT research

The presentation made it clear that the programme received many more good applications than could be funded (approximately by a factor of 3). The separate nature of the project meant that there seemed to be no mechanism for examining

whether some aspects were so much in need of investment that monies from the special project budget might be usefully shifted to boost funding levels.

Neither did there seem to be any way in which further bids for funding in this area might be made. Again it was striking that outward links to other countries were very few and did not appear to form any part of the strategy. It is hard to see how Norway can make real progress in such areas without substantial interaction with other European Countries. This might prove one way for Norway to alleviate its current low levels of research investment by tapping into European funding mechanisms and establishing formal collaborations.

Basic Biotechnology

The programme had just come to an end. The review panel heard that this had been a rather small programme, with 13 projects funded overall. An independent, mid-term evaluation of the programme noted that the level of funding was low compared to investment in such programmes elsewhere in Europe. However, on the whole this small-scale programme has been successful in generating high quality research, albeit on a very broad range of topics. This range mitigated against Norway's ability to build up strong research groups in this area because there appeared to be little complementarity within the programme. The evaluation report also made clear that many groups were inward looking, with few contacts with the rest of Europe, where investment in biotechnology, both basic and strategic, is seen as an essential way of ensuring future prosperity.

The mid-term evaluation group's main recommendation noted that innovative work in the biotechnology area can only be based on strong, curiosity-driven research. It was therefore surprising that the follow on programme was to be 'Basic industry oriented biotechnology'.¹⁴

¹⁴ The RCN commented that in 2002 RCN will start a new research program in functional genomics (FUGE) with a initial budget of 100 MNOK. RCN feels that this program is an example of a program that goes across division borders in RCN. One should note that the new program in NT is financed by NHD, not by KUF and it will not make use of money that should be reserved for curiosity driven research

Appendix B Review of RCN, Division of Natural Science and Technology - Comments to Expert's Report

The RCN and the Division of Natural Science and Technology provided general comments on the experts reports. Following this there was still some disagreement between the review panel and the RCN comments and as a result the RCN's general comments are reproduced in full in this appendix.

The reviewers did not significantly alter their conclusions on the basis of the RCN comments - in a number of cases the evidence that was provided during the review meetings appears to be at odds with the comments made by RCN subsequently.

To: **Technopolis**
From: **The Research Council of Norway - Division of Natural
Science and Technology**
Date: **30.11.01**

General Comments

The expert's report demonstrates that it is demanding to understand a complex organisation like RCN and its surroundings. Considering the rather incomplete documentation presented and the limited time available for the meeting with the experts it is not surprising that some issues are not fully understood and dealt with in the report.

B.1 The two roles of NT

NT has two main areas of responsibility:

1. Support for basic research in natural science and technology at universities and colleges financed by Ministry of Education, Research and Church affairs (KUF)
2. Stimulate industrial innovation through support of strategic research at universities and industrially oriented research institutes. This is financed by three sector ministries; Ministry of Industry and Trade (NHD), Ministry of Oil and Energy (OED) and Ministry of Transport and Communication (SD)

Basic research at universities financed by KUF

The former type of activity, which constitutes 40 % of NT budget, is very well covered in the expert's report, while the latter 60 % have not received a corresponding interest. The expert's report gives valuable advice concerning questions related to support of basic curiosity driven research at universities with emphasis on quality control and the role of scientists in decision making. We fully agree with the recommendation that curiosity driven fundamental research needs to be strengthened. The present status is however that 80 % of the money NT receives from KUF goes to researcher initiated activities without any thematic earmarking.

Strategic research financed by sector ministries

Our main objection to the expert's report is that they do not recognise the role of NT in stimulating industrial innovation through strategic research. We consider the expert's report to represent a traditional view that a generous support of basic curiosity driven research at universities is the complete answer even for industrial innovation. The sector ministries NHD, OED and SD finance 60 % of NT budget to be used for industrially oriented strategic research to develop competence within areas considered important for future developments in industry and society. (What OECD defines as *oriented basic research* and *generally directed applied research*).

A major challenge for Norway is to stimulate innovation and a long term change to more knowledge based industrial activities. Industrially oriented strategic research is

an instrument to accomplish this. The industrially oriented research institutes have an important role and NT is their main source of public financing. Although *curiosity driven fundamental research* is considered important for innovation, the sector ministries do not finance that type of research, that is a responsibility of KUF.

B.2 Co-operation across division borders in RCN

The experts state that the implementation of interaction between divisions is weak. They point in particular at the relationship between basic research and wealth creation and co-ordination between NT and IED. Our comment is that this conclusion does not take into consideration the comprehensive co-operation between these two divisions within what is called *areas of competence* (enabling technologies) i. e. ICT, biotechnology, materials technology, petroleum technology etc. For these nine areas a common process including external input from the science community and industry has described research priorities. Strategic programs financed by NT and Competence projects financed by IED are the instruments to implement this strategy.

B.3 The instruments of NT

NT has five funding instruments: Independent ("free") projects, support for advanced scientific equipment, strategic programmes (SIP/SUP), Research programmes and basic grants for Research institutes. The first four are relevant for universities and the last three for research institutes.

The experts recommend that the number of funding mechanisms should be reviewed and rationalised to prevent a fragmentation of subcritical support measures. They recommend NT to introduce a new responsive mode funding mechanism to support significant projects.

Strategic programs

NT uses a common term for Strategic university programs (SUP) whether they are financed by KUF or NHD. There is a difference we would like to clarify. To start with, both SUPs and SIPs (Strategic institute program) are intended to build up research groups around competent research leaders. They are large, long term projects based on a bottom up processes where researchers come up with the proposals. For NHD the SIP/SUPs should be within major research areas specified by the ministry, for example ICT, biotechnology or material science, and should have a long term potential for industrial value creation. For SUPs financed by KUF this is not the case. The major feedback we have received from university professors is that SUP is considered as a highly recognised funding instrument.

A SUP financed by KUF is a large investigator initiated research project, which is similar to what the experts in section 7.1 find absent; *a response mode funding stream capable of supporting the development of research teams through long term research projects*. The management of university faculties or research institutes decides which of the proposal are within the strategic areas for the institution, but they do not make a priority list. Scientific quality, of project manager and proposed project, based on evaluations from three international referees, is the criteria for selection.

Peer review and profile of free projects

We welcome advice for improvements and fully support the observation that available funds for curiosity driven fundamental research, is insufficient. We will point at two areas where we do not agree with the findings:

1. The experts find that the thematic programmes are managed exemplary while in the process for free projects scientific judgements are made by the administration. We claim that with the recent change in procedure for free projects, with two days meeting for the advisory committee, the scientists judgement is given a significant role in the process, much in line with thematic programs.
2. The characterisation of free projects as a fellowship program is not correct. For the majority of projects the scientific quality of the proposal and project manager is the main criteria, not the candidate for fellowship. Support of operating expenses and equipment is a significant role of free projects. We agree that the budget for this instrument is too low.

Review of RCN's Bioproduction and Processing Division

Summary of the Expert's Reports

November 2001
(revised December 2001)

David Shannon
Willem van Muiswinkel

With

Ben Thuriaux

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1 Executive Summary

This section presents the summary from the expert review of the Bioproduction and Processing Division (BF) of the Research Council of Norway (RCN), which took place on 4 and 5 September 2001. The report of the Evaluation of BF will form part of the background material to the wider evaluation of the RCN currently underway.

The reviewers' assessment is strongly positive. BF made a very good impression on the reviewers, who comment that whilst there are still some problems which need to be resolved, the Division appears to be well on its way to operating at a level of international best practice.

1.1 Conclusions

The relative strength and weaknesses of the division are presented in **Exhibit 1**. Comparing the performance of the Division against international best practice, the two reviewers feel that the management of the Division is good. BF appears to be managed by very competent staff, who are aware of the relevant scientific issues. The Division's strategy and structure appear to be wholly in line with current best practice, but the Division structure may need to evolve in the future if it is to deliver its aim of truly multidisciplinary programmes. At the level of the RCN, there appeared to be some tension between the Division Board and the Executive Board and the part of the administration above the division which is responsible from co-ordinating the RCN as a whole.

In terms of delivering on the change goals associated with the creation of a single research council and BF, the Division has been largely successful in developing strategic and user-directed programmes, and the reviewers are impressed with the rather unique mix of basic and applied research.

On a negative note, the reviewers highlight that whilst the funding mechanisms presently are adequate, they cannot be considered to be good practice, as the restrictions and 'earmarking' attached to these prevent the Division from delivering its full potential for adding value to the planning, co-ordination and management of research. This may also explain the relatively low amount of funding allocated through response mode funding - which is the traditional instrument of other research councils.

However, the Division has yet to develop (or be given responsibility to develop) an appropriate policy for the research institutes. In addition, whilst the portfolio coverage is relatively wide, the reviewers have the impression that at the moment some of the funds are spread too thinly and "equitably".

Finally, the reviewers are somewhat concerned about the future career of the PhD students and the post-doctorates who are now working in the funded projects. This is because there does not appear to be much in the way of funding for larger team projects, which suggests that a number of those scientists may leave the research base.

Exhibit 1 SWOT analysis for BF.

<p style="text-align: center;">Strength</p> <ul style="list-style-type: none"> • Competent staff • Successful reorganisation and extension of the Division • Unique mix of basic and applied research 	<p style="text-align: center;">Weaknesses</p> <ul style="list-style-type: none"> • Contribution of basic research is relatively low (~ 25 %) • Communication problems between Executive Board and the Division Board
<p style="text-align: center;">Opportunities</p> <ul style="list-style-type: none"> • Competence building in RCN staff, but also in institutes' staff • Increasing influence on the research of the institutes • Increasing trust in BF from policy-makers • Development of more coordinated research in Norway 	<p style="text-align: center;">Threats</p> <ul style="list-style-type: none"> • Continued earmarking of budgets by Ministries • Relative independence of some institutes (basic funding direct from Ministries) • New funding streams not co-ordinated by BF

1.2 Recommendations

The reviewers make a number of recommendations and identify the barriers to implementation so that these can be specifically addressed in any change programme. These are presented in **Exhibit 2**.

Exhibit 2 Recommendations and barriers to change.

<p style="text-align: center;">Recommendations</p>	<p style="text-align: center;">Barriers</p>
<ul style="list-style-type: none"> • Prioritise more on certain areas and increase basic research • Increase RCN staff to provide resource for strategic reflection and to deal with increasing demands • Improve cooperation between universities and institutes • Regular evaluations of programmes • Separate the survey task of certain institutes from their research work • Improve the communication between the RCN Executive Board and the management of the Divisions • Invest in the long-term career of scientists (in particular female) 	<ul style="list-style-type: none"> • History in the research groups • Number of programmes/projects which can be managed • Different scientific traditions at universities and institutes • Availability of qualified reviewers • Unclear mixture of responsibilities for institutes • History in RCN • Cost of developing new actions

2 Introduction

This report summarises the results of a short expert review of the Bioproduction and Processing Division (BF) of the Research Council of Norway (RCN). The report contributes to the much wider evaluation of the RCN commissioned from Technopolis by the Ministry of Education, Research and Church affairs (KUF).

It is one of six such evaluation reports looking at the research portfolio and organisation of the Divisions in the RCN and provides an assessment and recommendations for future development of the Divisions' research strategy and operation. The report will be appended in a separate Appendix to the overall evaluation report and will provide material both for other components of the evaluation and for a summary of the expert reviews of the RCN's Divisions.

3 Method

The aim of the Divisional review is to evaluate the strategy, organisation and functions of each of the six Divisions and the various programme elements that they cover, and to draw conclusions for the operation of the RCN from these reviews. The Divisional evaluations focus on

- The strategy adopted by the Divisions
- The structure and resources of the Division and how these are managed to support the delivery of its missions
- The choice and relevance of the research portfolio supported by the Division and the way in which these are designed and used
- The effectiveness and impact of the portfolio.

The expert members of the review team were identified by Technopolis and subsequently approved by the STD. The expert members appointed were

- **Professor van Muiswinkel** – the Vice-President of department of Animal Sciences at Wageningen University in the Netherlands. He is an expert on applied research in the culture of fish (salmon, carp and seabass) and shellfish. He was on the Advisory Panel of Experts (5th EU Framework) on Aquaculture & Fish Health, and has previously been a Member of the Editorial Board of Veterinary Immunology and Immunopathology (1987–2001) and the Journal of Fish & Shellfish Immunology (1991–95).
- **Dr D Shannon** – the Chief Scientist at the Department of Environment, Food and Rural Affairs in the UK. He is responsible for the scope, balance and quality of the Department's Research Programme (£150m per annum). He is a member of the Boards of the Natural Environment Research Council and the Biotechnology and Biological Sciences Research Council and is the Chairman of both the Risk assessment and Toxicology Steering Committee, and of the Government's Pesticide Forum.

Technopolis explained the issues that the review team would attempt to evaluate and asked BF to provide a briefing document on its activities. This was delivered to the panel prior to the review visits.

The review visit took place on 4 and 5 September 2001 and the schedule centred on a number of pre-agreed presentations, followed by a question and answer session designed to allow the reviewers to comment on the evaluation questions. As requested by Technopolis, representatives from the programme boards, present and former chairmen of the BF Division Board and representatives from the Agricultural and Fisheries Ministries were present during parts of the sessions. It should be noted that no representatives of the Executive Board (EB) or of the Director General (DG) were present during the review visits ¹

The consultant responsible for the divisional evaluations within the review (Mr Ben Thuriaux) accompanied the review team throughout the visit.

Following the visits, the peers prepared individual evaluation reports. These have been synthesised by Technopolis and validated by the reviewers. The current document forms the report of the evaluation as it was subsequently agreed with BF.

The report addresses the issues that the reviewers were asked to concentrate on and outlines a number of possible recommendations that will inform the overall evaluation of the RCN.

¹ In that respect the evaluation presents an external view of the Division and its environment based on material presented by the Division. The conclusions regarding aspects of governance and the internal workings of the Council can therefore serve only as partial indicators as they are based on the evidence presented by the Division.

4 Strategy

4.1 Strategy Development

BF has been in an evolving situation since the RCN was created. The Division is rather unique in combining basic and applied research, as well as user-directed projects for industry, which in other countries would be a separate funding body or Research Council (for example NWO-STW).

The Division was given responsibilities that in many cases could only be delivered with the support of the Ministries, which provide the bulk of the funding. The basic area of activity is defined (biological production mainly associated with food production) and the funders retain a large degree of control. Other early problems were associated with the loss of the former sectoral research councils, the difficulty of relocating staff, the establishment of new contacts with the business community and a cut in the research budget in 1994.

The Ministries that fund BF have considerable experience of research funding, and before the merger, they were responsible for most of Norway's scientific infrastructure in the fields of agriculture and fisheries. As a result of the position of the Division in relation to the funders, the strategy resembles a 'implementation framework' within which research support is funded in agreement with the funding Ministries. In this respect the Division is much more heavily constrained than would be the case in more traditional research councils, which would tend to have significantly more discretion on the strategy to be pursued and its funding allocations.

The new strategy has developed from the earlier strategy, and the value-chain programmes have been rationalised from 15 to 8. The new programmes will have a five-year duration. The new strategy also sharpens up the interaction with the institutes and places more emphasis on institute policy.

The Division began planning for the period 2000–04 in 1997. The process took around two years and required extensive consultation of all main stakeholders. This has reduced the number of research programmes to eight value-chain programmes which BF coordinates. Core-funding of the institutes transferred from the Ministry of Agriculture to RCN and split into basic funding and strategic programmes.

The Division has continued to build up the trust of its stakeholders and the transfer of further agricultural research institutes in 1999 is evidence of this, as is the fact that the strategic funding mechanisms that have been adopted, have improved practices and allowed the Division to focus its expenditure more effectively.

4.2 BF strategy

Given this difficult background, the reviewers feel that strategic direction of BF has been properly handled. Examples of good practice include:

- The early strategy to prioritise existing commitments at the expense of new ones when confronted with a sharp cut in budget in 1994, supported BF's attempts to build up the confidence of institutes and other stakeholders
- The consultative process involving several iterations with a range of stakeholders including academics, research institutes, industrial interests and the relevant Government Departments to develop the current strategy.

In general, the current strategy contains the right elements and covers the most important issues for Norway, for example, aquaculture (in particular salmon) and the attention to developments in colder areas. However, additional mechanisms will be required to implement the changes that are needed to deal with expected future needs. The 'newer' areas, such as aquaculture and genomics, seem to be more focused than the 'older' areas (for example, forestry) and for a relatively small country, such as Norway, the number of available people (specialists) can be a limiting factor.

A major evaluation of the institutes has been completed. However, it is not clear whether the institutes' evaluation will effect the funding to individual institutes, and the reviewers suggests that redistribution of funding following evaluations is an important tool to provide incentives to maintain and improve performance.

The BF strategy appears to fit in with the overarching RCN strategy but the reviewers impression is that RCN strategy seems to evolve bottom-up, based on the negotiations between the Divisions and their funding Ministries. The integration of basic and applied research is achieved effectively, and adequate care is given to strategic research in a mixed research environment. The links with other Divisions appear to be well made and are built into the strategy.

4.3 Programme Strategies

Newer programme strategies (biotechnology, aquaculture) appear to be more focused and the projects funded link closely with the stated goals and objectives. On the other hand, the more established areas (for example soil, plants and livestock) do not focus in on the stated new objectives with a Norwegian perspective. This caused one of the reviewers to argue that they could easily have been written at any point during the last 20 years for any country in Europe.

However, from a communication point of view, the current strategies, lack an overview setting out the following headings which would facilitate the analysis of the portfolio coverage

- The context in which the programme is being pursued
- Why it is necessary to focus the effort (and if politically acceptable) what is not being funded
- How the strategy will interact with other programmes around Europe
- The relationship with other players in Norway.

The driving issues are likely to be technological, social and economic such as biotechnology/molecular biology, globalisation, food safety and the environment, in particular, in relation to aquaculture. For example, intensive aquaculture is potentially a threat to the acceptability of its products in sophisticated markets, and the reviewers suggest that more needs to be done to address the issue of acceptability.

4.4 Recommendations

The reviewers recommend that

- BF should seek to obtain additional authority for developing research policy and strategy from its funding Ministries, as at the moment, the amount of earmarking prevents the Division from using and developing its competence
- BF will need to evolve its current strategies to meet the future needs of Norwegian agriculture and make its programme rationales more explicit
- The current policy requires institute evaluations to be carried out at six-year intervals. With the pace of modern science, this period is too long, and it should be reduced to no more than five-yearly intervals
- More focus on environmental and acceptability issues of intensive aquaculture.

5 Structure of Division

5.1 Discussion

The structure is streamlined and effective and the departments appear to be staffed appropriately with teams of scientists with the right degree of expertise as evidenced by their qualifications.

The Division is structured into three largely sectoral science departments and an administrative department supporting the overall activities of the Division. The four departmental Directors report to the Executive Director, who in addition, has a small team to provide advice and support. The biotechnology and food products department has strong cross-sectoral interests, but this seems to be accommodated within the structure particularly at programme level.

The decision to take a firmer grip on programme management by focusing this activity within the Division (rather than recruiting external programme co-ordinators), has allowed the departmental scientists to develop their skills and credibility with their research committees. It also provides leadership to ensure that the intentions of the Division are delivered. The use of institute staff, on secondment, to support the departmental teams is sound, and will increase understanding in both directions.

It is not clear, however, where the lead for overall science policy and strategy development resides within the Division and the reviewers argue that this activity needs a focal point if it is not to be neglected. The danger is that routine management activities squeeze out time for strategic thinking and adequate evaluation of the overall

strategy. The reviewers feel that a stronger and more readily identifiable strategic focus would enable the Division (and RCN) to fulfil its leadership role in relation to its areas of scientific responsibility.

Whilst the structure of the Division is appropriate, the strong sectoral focus of the marine and agriculture departments seems to be slightly at odds with the intention to seek synergy between the sciences underpinning aquaculture and fisheries. At present, the synergy is being achieved through the development of some integrated programmes; the current teams seem to be working effectively.

Building confidence is very important. The existence of these Departments is no doubt reassuring to the respective funding Ministries in that they are effectively continuations of the Ministries' previous research councils, and they support the development of good relationships with Divisional staff who relate directly to their interests. However, at some point in the future BF should consider other configurations that would achieve greater integration of the food end of the chain with the primary production.

Finally, the reviewers comment that as far as they can test, financial and administrative aspects appear to be well organised. All *ad hoc* requests for spending figures by various modes were delivered quickly and succinctly, reflecting a well-organised function, on a par with best international standards.

5.2 Recommendations

The reviewers recommend that

- At some point in the future, BF should consider whether new departmental configurations, which achieve greater integration of the food end of the chain with the primary production, would be beneficial
- BF should protect its responsibility for coordinating research to support food production and should guard against being used exclusively as an administrative provider of research funds

6 General Portfolio Structure

The portfolio has done a good job of addressing Government guidance within the constraints that the system imposes on the Division, and, on the whole, the portfolio structure appears appropriate, with clear elements of pragmatism and logic. The portfolio is basically sound but there is still some room for improvement, in particular, to increase the coherence of programmes' contribution to the overall BF strategy.

Roughly a quarter of funded projects can be regarded as basic research. This is relatively low for a research council. The reviewers feel that the striking mix of basic and applied suggest a portfolio of activity that is not typical of a research council's portfolio, in that relevance to production systems and national economic goals are given greater prominence than in other research councils internationally. At a national

level, however, the structure of the portfolio is not much different from that elsewhere: the portfolio covers what would normally be separately funded by Government Departments and Research Councils in the UK, France (INRA), Germany (Max Plank and Federal institutes) or the Netherlands (NWO has separate divisions for Applied and Technical Sciences and Basic Earth and Life Sciences).

The portfolio is certainly in agreement with the mission of the Division. However, it appears that the Division has more direct influence on the thematic and strategic programmes than on the basic funding, which are effectively allocated directly to the institutes without BF being able to add much value in terms of creating incentives and levers for change.²

The reviewers feel that the programme descriptions make it hard to build up a completely integrated view of the Division's strategy. In retrospect, the reviewers attribute this largely to the fact that the Division is constrained in its use of resources by the need to respond to Ministerial demands. The increasing trust from the Agriculture Ministry is welcomed, but the reluctance of the Fisheries Ministry to relinquish control is somewhat disappointing. Given the structure and the funding arrangements, the Division has successfully maintained and enhanced the basic programmes.

The structure of the portfolio can be explained in part from its developmental history. On the other hand, it also derives from the Division's main objective: to promote sustainable use of the biological resources and a viable economic development in Norway. The structure of the current portfolio reflects the earlier programme structure and picks up some of the intentions to integrate the science underpinning aquaculture and agriculture. The new priority areas such as biotechnology and aquaculture have been able to develop well constructed programmes. But some of the more traditional areas such as soils, plants and livestock appear to be separated from the food programmes.

There are effectively two sets of programmes reflecting the two main funding mechanisms

- The **eight value-chain programmes** provide the basic framework and overall structure for the strategic elements or action plans. Their primary output is research results and outcomes
- The **strategic programmes** are organised on a more departmental basis³ reflecting the divisional structure (and the funding sources). They aim to meet the strategic requirements to develop and maintain scientific competence for the parts of the research base for which BF is responsible. The institutes propose strategic programmes based on their own strategies. Along with scientific merits, the

² The division pointed out that there is a significant difference between the two Ministries in how they channel funds to the institutes.

³ Before being decided upon programmes compete against each other on a cross-departmental arena.

division evaluates the proposal in relation to its institute policy before recommendations are made to the DB.

The reviewers find it hard to link the research portfolio to the divisional strategy because it is difficult to integrate the programmes to form a coherent strategy with which to drive the Division. This is reflected in the fact that the strategy for each individual area is discussed as an action plan. The limited degree to which the Division has ultimate financial control may also prevent it from achieving the greater coherence that a strategy would prescribe.

Whilst it is possible to see links between the two sets of programmes and the strategy, it is not easy to read directly across. This ‘matrix’ dilemma is not in any sense unique and is at the heart of ‘dual funding’ systems in Universities. The question here is how to create a framework within which maximum synergy can be achieved between two different funding streams.

6.1 Specific Portfolio Issues

This section provides a broad summary of the portfolio issues identified by the reviewers. A more detailed programme by programme assessment is presented in **Appendix A**.

The **strategic programmes** seem to fulfil their purpose. They are structured in a fairly conventional manner (for example, soil, plant production, aquaculture – breeding) which helps to retain focus on discipline or area. The projects are selected in competition and with peer review and the support appears to be of adequate scale and duration. The reviewers feel that some of the projects within the programmes suffer from the ‘guided’ response-mode approach, and that whilst they appear to be suitable good individual projects, they do not always add up to fully integrated programmes.⁴

The **value-chain programmes** have great potential to impact on the chains they represent. They have significant industrial involvement at Programme Board level and through funding of projects. They are placed competitively and the industrial representatives who presented to the reviewers were strongly supportive. The reviewers feel that the concept is sound. However, examination of the projects within the value chain programmes does not suggest specific focus or funding of clustered projects. The programmes cover the value-chain but the material presented to the reviewers does not provide an analysis of where in the value-chain it would be most worthwhile concentrating research efforts.

⁴ It is difficult to test the coherence of the programmes, because in the current system, BF only controls a subset of the overall national programmes being funded in its area of responsibility. The Ministries still control their funding and largely have their own programmes particularly on the fisheries side but also in relation to animal health. Hence, some areas may appear to be under-funded in BF programmes because these areas are funded adequately elsewhere, and it may be that the programmes supported by BF form the RCN component of a fully integrated whole.

Internationalisation is an increasingly important issue for most countries and even more so in Europe as issues such as food safety and environment become supranational issues. The reviewers welcome BF support of participation in EU's research programmes. However, it is not clear to the experts that the action in this area had been adequate, and they suggest that more could be done at a national level to develop relationships with other countries. This is not fully developed in BF's strategy.

The Division has successfully addressed the issue of **interdisciplinarity** through joint programmes and projects. The programme coordinators made clear that most of the research programmes require an input from different disciplines, and sometimes industrial expertise. The area where there still appears to be room for improvement is between food and agriculture where the food interest might be a stronger driver. The Division has addressed this issue with significant success (for example, agriculture/aquaculture) but should continue its efforts perhaps with food and biotechnology, integrating more closely with agriculture.

One of the aims of creating the RCN was to **protect basic research**. Although only roughly a quarter of funded projects can be regarded as basic research, BF appears to be doing a good job in supporting the maintenance of strategic expertise and strategic research. The transfer of further agricultural institutes suggests satisfaction on the part of the Agriculture Ministry. Development of new priority programmes in biotechnology and aquaculture also demonstrates that this issue is being properly addressed, and although the value-chain programme approach tends to give weight to applied research, within these, there are sound strategic type projects. The Division staff (proportion of PhD's) and structure (focus on biotechnology) is designed to enable it to an intelligent customer for basic/strategic research in future.

6.2 Recommendations

The reviewers recommend

- The Division and the Ministry should consider the value added by delegating the distribution of core-funding for institutes to BF, without also allowing it to significantly alter the distribution of these funds or to link these to change/improvement mechanisms
- Allowing BF to have a greater coordinating role for marine and agricultural research, and in particular, to allow them to have overall responsibility for institute funding to support the development of an integrated policy in Norway
- Working with industry to identify the critical areas along the food production and processing chain where research would have maximum impact and to encourage clustering and mutually supporting projects in these areas
- Increasing the number of joint programmes and the proportion of joint projects spanning two (or more) disciplines and the proportion of proposals where the authors represent more than one discipline

- Prioritising some support for pursuing certain specific areas of research through international collaboration (for example, areas such as genomics).

7 Management and Governance

At one level the governance is straightforward; in addition to the EB for the Research Council, there is also a Division Board (DB) for each of the Divisions and a Programme Board for each of the value-chain programmes.

The DB has general responsibilities for the activity of the Division and adopts objectives and allocates budgets to various groups of activities and ensures that activities take place in accordance with its decisions. For basic and strategic funded activities, the DB takes project/programme level decisions, as advised by BF staff. For value-chain programmes, the DB allocates the budgets and accepts yearly work plans and reports. The Board represents major stakeholders and meets seven times a year (occasionally at a research institute). The DB Chairman meets other Chairmen informally and meets the Ministers of Agriculture and Fisheries at least once a year.

The straightforward process described above is modified in two ways

- The main funding Ministries (Agriculture and Fisheries), which provide 90% of the BF Budget, have their own strategies, and the Ministry of Trade and Industry has put forward a National Strategy for Biotechnology. Each year the two Ministries write a pre-discussed ‘budget letter’ to the Research Council specifying their demands and expectations regarding their budgets. BF has meetings with the Ministries, informally each month and formally twice a year, and reports to the Ministries annually against specification.⁵
- The Research Council has also prepared general and more specific strategies, including biotechnology and R&D for the food processing industry. It also takes account of the National Research priorities (White Paper on Research). The Divisions priorities and those of the RCN are expressed via the budget proposals to the individual Ministries. The DB proposes a budget proposal within limits decided by the RCN Main Board. Based on the DB proposals, the Main Board prepares a consolidated budget for the Research Council. The Main Board presents its overall priorities (in accordance with national priorities) in the budget proposal, and it also determines the framework for budget growth, which is proposed to each Ministry. Responding to the national priorities means that marine R&D is given a high priority (along with energy/environment overlap and food and health) and this has resulted in a larger budget growth for the Fisheries Ministry.

In summary, the Division’s priorities and its allocation of resources to different instruments and programmes are the result of a long process involving the Research Council’s administration, the DB, the Main Board and the funding Ministries.

⁵ The Ministries are questioning whether reporting of results is optional in terms of impact and BF is addressing their request.

The overall process appears surprisingly circuitous and has multiple overlapping components. This appears to be a direct result of the sectoral principle. However, without changing the overall system it may be possible to improve matters by building up trust between the key funding Ministries and the Division. Having had an influence on the appointment to the Divisional and Programme Boards, and influence on drafting and agreeing the Divisional strategy, it might be expected that the Ministries could focus less on detailed involvement as typified by the budget letter. The reviewers did not see the agenda for the monthly meetings or the formal twice-yearly meetings, but the degree of close scrutiny implies a lack of trust, which should be addressed. Having agreed the strategy (and been involved with the Divisional and Programme Boards), the Ministries might focus on the outputs and the evaluation of what is being achieved.

At the programme level the management appears strong, and the reduction in the total number of programmes (from 15 to 8) as well as the appointment of programme coordinators from BF staff, appear to be solid decisions.

From our discussions with the current DB Chairman (and his immediate predecessor), there is clearly a problem in the relationship between the DB and the Main Board. It appears that the Main Board is able to have a major influence on the funding and priorities flowing through to the DB without the latter having adequate opportunity to influence the Main Board, which in the words of one of the reviewers is 'more top-down than required'. There is clearly a major point of friction, which must be addressed.

In contrast, the relationships between the Board and Divisional staff are excellent and DB Members spoke (within private sessions) in the highest terms of the quality of support they received and commented that DB decisions are implemented effectively. The only negative comment expressed was regarding the time available to devote to strategic planning, and this needs attention as budgets grow. There are significant measures in place to ensure coordination with other parts of the RCN and frequent mention was made of the links with other interests and programmes.

The reviewers comment that the quality of BF staff appears to be quite high, and that whilst the reviewers did not meet all the members of the Research Board, those they did meet were up to the task.

Within the opportunities afforded by the various presentations and discussions, the Board members seem to be fully engaged and enthusiastic about the Division and its work. In relation to the value-chain programmes, it is important that applied enthusiasm is matched and guided by strong scientific input.

The presentations made to the reviewers indicate a significant degree of gender balance, but the reviewers lack factual evidence to assess this in detail. The regional dimension

is high on the strategic agenda, and the Trømsø programme on marine molecules is an obvious attempt to address regional priorities and facilities.

7.1 Recommendations

The reviewers recommend

- Increasing the amount of authority delegated to BF by Ministries to ensure that adequate use is made of the scientific competence in the Division. The degree of close scrutiny in the current system suggests an unjustified lack of trust
- Additional time needs to be set aside for the Division to devote to strategic planning, and resources to plan will need to be maintained as the research budget increases.

8 Effectiveness and Impact

In many respects the Division is in a pivotal position to have an impact on policy. It is at the interface between the Ministries and Council. It can influence the stance taken by Council in relation to the Ministry spend. The Division has been highly successful in increasing the responsibility for the research programme (or parts thereof) of research institutes and this reflects the increasing confidence of the policy makers in the Division.

On the other hand, the Division lacks authority and its powers are largely to propose. It has to accept the input from the funding Ministries – whilst it can influence them it has limited ability to challenge their detailed requirements.

The documentation provided a significant list of specific achievements. Although there was limited information in order to judge the impact of the Division, the reviewers argue that BF's activities must have a significant impact on the focus of the marine and agriculture research in Norway.

In almost all programmes, the end-users in the agricultural, fisheries or food industry can be identified, and the reviewers comment that they expected to see the most significant effects in the aquaculture sector, because Norway is a leading nation in that field.

One reviewer expects the biggest future impact to arise from the genomics and biotechnology programmes (and in particular, the work on the salmon genome data), because once the genes are known, we can start to look at modulation of function. The other reviewer argues that the aquaculture programme has much potential and the all-round strength and integration of this programme augurs well for the future.

Finally, the reviewers are somewhat concerned about the future career of the PhD students and the postdoctoral fellows (especially women scientists) who are currently supported. This is because there does not appear to be much in the way of funding

for larger team projects, suggesting that a number of those scientists will leave the research base.

The only weakness identified is the relative lack of resources devoted to international cooperation, which will be important, as in some areas, Norway needs to leverage its research efforts by accessing international partnerships.

8.1 Recommendations

The reviewers recommend

- Increasing the amount of delegation to BF by the main funding Ministries so that it can act with more authority, especially in its dealings with the research institutes and in its prioritisation of research efforts
- Increasing support for international cooperation so that Norwegian research groups can benefit from active participation in pan-European programmes
- Creating adequate support for larger projects that can sustain a research team and lead to the development of 'critical mass' in research competence to allow Norwegian research groups to be competitive internationally.

Appendix A Specific comments on portfolio

This appendix presents specific comments made by the reviewers on parts of the portfolio presented during the review.

A.1 Soil Plants and Livestock

Appropriateness

This programme is a collection of mainly worthy projects but with little synergy of relationship between them. The projects are relatively applied and linked to primary production. They are appropriate, in that they are addressing issues of fairly immediate importance, but with more planning and focus (selection) a more coherent set of projects might have been funded.

A criticism of the programme structure is its apparent lack of focus on current issues threats and opportunities for Norwegian agriculture. Much of it could have been written anywhere in Europe over the last twenty years. In contrast to the action plan, the list of strategic soil and plant projects addresses a moderately well focused range of issues surrounding sustainable farming. These projects are forward-looking and entirely appropriate for Government funding. The animal welfare projects have an ecological farming focus with some emphasis on animal health. Whilst being a limited subset of what might have been addressed (if more resources had been made available), they are appropriate and relevant.

Relevance

The programme correctly addresses the sustainable use of input factors. They have limited emphasis on animal health but we were told that this is complemented by projects financed by a financial agreement between the Farmers' Union and the Government.. The value chain programme reflects the action plan and in so doing is equally unfocused. It addresses the concerns of a range of external end-users. This programme is more relevant to the traditional agenda and is maintaining or extending technology in some senses.

Scientific Quality

The programme is likely to be of similar quality to a range of programmes elsewhere in Europe and beyond. Like them it is pursuing a traditional approach in a field in which there has not been much scientific renewal so that although relevant, it is not truly innovative science.

The reviewers commented that this does not appear to be cutting-edge research, although the science is sound and it is nevertheless important work for Norway to support.

Impact

This is a relatively large and applied programme and the reviewers expect to see some direct impact on local industries.

A.2 Market and Society (Economy and Social Science)

Appropriateness

The programme addresses a series of market, structural, and ethical questions across the bioproduction and bioprocessing sectors. The issues addressed have a national focus but are of more general relevance. It is heavily marketing orientated but quite diverse. The research coverage is more dispersed than in other countries and the reviewers feel that it is an interesting cross-sectoral approach to combine fisheries, agriculture and forestry. This has created a highly integrated research programme.

Relevance

The work is highly relevant to the Departments' strategic goals. It may need to focus a little more on the agricultural industry, and the rural economy if it is to make the transition as suggested in the strategy. It might focus more on societal issues (for example, coastal communities and who owns the sea around cages). It is not clear where the moral philosophy is being developed to underpin the ethical project and the reviewers suggested that this might be given increased prominence.

Scientific Quality

The programme comprises a range of projects with a significant focus on applied projects related to markets and marketing. This is as might be expected for a programme of this sort.

Impact

Given the applied nature of the programme and the economic importance of the project being studied the impact is likely to be high.

A.3 Marine Resources Environment and Management

Appropriateness

The value chain programme contained a wide range of topics in the marine fisheries area. The programme covers a range of work where interest from the international scientific community will be relatively high (particularly for projects related to fish stocks). Given the emphasis in the strategy on ecosystems the reviewers would have expected more emphasis on addressing the ecosystem more generally rather being so related to individual species. A wider focus on ecosystems would significantly improve the portfolio.

Relevance

The programme responds well to the Governments needs in relation to commercial fishing and is soundly constructed to deliver work that was identified as highly relevant to fisheries. On the other hand it has a strong focus on economics and might benefit from a greater environmental/ integrated ecosystem focus.

Scientific Quality

The presentation suggested that it was not intended to cover basic science in this programme and the projects focus significantly on technology and management. However, given the programme aims there was a remarkably high content of basic biology and oceanography which impressed one of the reviewers. However the other reviewer argued that although it was impressive to see these types of projects it was difficult to assess their scientific contribution to the overall programme.

Impact

The projects are soundly based and will support the commercial fishing interests and should lead to longer-term impact on improved management of fishing stocks. The programme does not fully address the environment/ecological elements of the strategy and the impact will be less in this area. The technological contribution appears to be satisfactory and will benefit the fishing industry and the economy accordingly.

A.4 Forestry – Resources and Creation of value

Appropriateness

The programme addresses a number of issues with a general focus on ecological forestry, biochemistry, molecular basis of climatic adaptation and indicators of stress. These are issues of central and international importance. The project list represents a neat set of issues and is well focussed. The economy and social projects address relevant if rather less focussed set of topics. The forestry and added value chain programme as presented seemed perhaps less well suited to this form of funding. Although the programme covers 10% of Norway's overall effort on forestry research the reviewers were told that it is an important competition arena for forest research.

The reviewers' initial impression was that the forestry work appeared to suffer from its focus on long term issues and the “three year project” approach - however the list of projects subsequently received reveals that the portfolio is rather more appropriate than the projects selected as exemplars and this reassured the reviewers.

Relevance

The research component of the programme has high relevance to a forward looking forestry programme and is in line with Divisional goals on sustainable development. It is a relatively small budget and maintaining focus is important.

The more applied side of the programme is responding to user needs and has attracted industry funding. However it has few large projects and suffers from the fact that there appear to be too many subcritical projects.

Scientific Quality

The research component of the programme is of high quality and well focussed and is at the leading edge. The industrial research component has some significant projects but many are of lower scientific significance.

Impact

The reviewer argue that this programme would have a relatively small impact both because of its limited budget and because and impact is limited to forestry and nature conservation

The programme will impact on sustainable forestry management and will contribute to the ecology of forestry systems more generally. The rhizosphere work is likely to make a significant scientific contribution in the longer term whereas the smaller and more applied projects will contribute more directly on more limited fronts.

A.5 Food Science

Appropriateness

This is a typical programme of its sort serving the needs of the SME food sector. The food industry is a significant part of the Norwegian economy and is likely to be increasingly important as adding value to basic agricultural products becomes more important.

There is a fine dividing line between encouraging companies to work systematically on their own development to encourage uptake of R&D and providing a public subsidy to individual SME's (and some larger companies). Given the policy of the Research Council the programme appears to fall on the right side of this line.

Relevance

The reviewers judged this programme as one of the two most relevant RCN interventions because of its high relevance for the fish/fish product part of the economy. The projects are well supported by the industrial players so it is relevant to industry needs.

It is not clear to the reviewers whether the programme is expected to have value in relation to Government policy e.g. on diet and health.

Scientific Quality

The scientific quality of the portfolio appeared to be sound in that they are relatively similar to work being carried out in other countries. The industry projects appeared to have little synergy and scientific additionality and were predominantly applied projects as befits an industry driven programme.⁶

Impact

The projects being funded appear to be purposeful and tend to serve the needs of the food SME's. The programme was highly valued by the "food" company presenter and appeared to be meeting the objective of engaging food industry SMEs in R&D and their technological future. The collaboration with SND (Industry Dev Fund) seemed to be working well.

Almost 50% of the projects are user controlled which might suggest significant impact but the reviewers suggested that increasing the synergy of the projects within the programme will improve the impact of the programme.

⁶ The programme co-ordinator disagreed with experts' view that there was little synergy and additionality. He argued that the programme has put more emphasis on science aspects over the past years and many of the projects would not have been started without the support from the programme. The peers would not disagree with this - statement they made is under the area of scientific quality and in terms of **scientific** novelty the additional contribution to the state of the art did not appear to be very strong.

A.6 Fisheries Technology

Appropriateness

Although the reviewers felt that this was a highly appropriate programme for a Country that has such a strong interest in fish products, they suggest that there should be room for increased international co-operation in this area as many countries do comparable research.

Relevance

The portfolio is highly relevant to the narrow field of fish harvesting technology as there is considerable scope for less damaging methods of fishing.

Scientific Quality

The reviewers feel that this is a highly technical and applied area but with limited opportunity for cutting edge science and therefore concluded that the scientific quality in this part of the portfolio was comparatively low.

Impact

As the portfolio has been described as being more about problem solving than scientific research, the reviewers expect that this programme would have a high immediate impact. The Division mentioned that the impact of this programme, and its predecessors, is quite significant in that selective fishing gear has been developed and made mandatory in fisheries internationally and that among other things, selective gears are based on research on behaviour of different fish species in relation to noise and shape and speed of gear.

However, the reviewers feel that the portfolio could be strengthened by focussing on fewer but larger projects in areas which are not covered in other international research projects.

A.7 Biotechnology

Appropriateness

The programme is very appropriate since biotechnology (and more specifically molecular biology) has become an all pervasive technology in relation to the biological sciences with enormous potential in areas as diverse as understanding disease diagnostics, vaccine development, tracing products (meat), conservation (e.g. relating caught fish to their spawning grounds) as well as in the improvement of products themselves.

The question of focus is a more difficult one. With pervasive technologies such as biotechnology, a judgement has to be made between the emphasis to be placed on special biotechnology programmes and on the extent to which the technology should

be developed in the context of the (sectoral) programmes in which it will be applied. Both are needed but there are questions about whether it is sufficient to simply maintain this level of expertise in agriculture (particularly animal health) unless it is very abundant already.

Molecular technology is so important that the reviewers expect 50% (or more) of the agricultural scientists to be using molecular approaches to problems in the near future. Turning to this specific programme the distinguishing feature is that it would focus on (a) new methods and (b) new products. The expectation is that other programmes will pick up the outputs from this programme. This approach and rationale will provide focus and critical mass and hence the opportunity to make significant progress.

Scientific Quality

The programme is of international interest and appears relatively more focussed on marine studies than other countries.

The salmon genome project is the dominant strategic project (33%) and would seem appropriate given the importance of the aquaculture industry. The other strategic projects seem to be chosen for their individual merits and by and large seem to be of high quality and relevance to Norwegian interests and fulfil the purposes of the programme. The commercial projects are more widely dispersed but the individual projects cover the range of what might be expected, and are in the mains strategic and sound.

Relevance

The programme is relevant in terms of the Council's strategy and because of the overall importance of the technology. It has had an impact on many of the Division goals and objectives.

A concern might be that indeed it is covering too wide a range of topics but does support the need set out in the action plan to enhance the National competence in biotechnology. However this is a dilemma for a small country which it is not easy to resolve.

One aspect that appeared underdeveloped, is the relationship with programmes elsewhere in Europe and beyond.⁷ In future this will be important in relation to a range of genomes of both pathogens and domestic species and requires the development of a formal mechanism.

The expertise developed in this programme should also play a key role in understanding and informing the public debate on biotechnology.

⁷ The Division subsequently provided evidence that it is involved in the BovMap EU programme and so the experts perception of underdevelopment may simply be a function of the lack of time to cover all aspects of the Division's work.

Impact

Given the rationale it will be essential to ensure that the links are established with those who would be expected to pick up the outputs so that they can have an opportunity to influence the programme and are receptive to its outputs. The evaluation of the previous biotechnology programme suggested very positive outputs (475 papers, 26 PhD, 50:1 return on resources deployed) and it might be expected that similar contributions to knowledge and technology might emerge from this programme. Overall impact will depend on good connections and exchanges and this aspect should be managed positively.

A.8 Aquaculture

Appropriateness

The recent success and potential for aquaculture in Norwegian waters makes it appropriate to have a well-funded research programme in this sector. The reviewers feel that the programme covers the most important problems in modern and is internationally important.

Relevance

The programme is highly relevant for the Aquaculture industry but also for related research.

The action plan is well structured and clearly focussed on all the important aspects of aquaculture. It might be questioned whether commercial interests might not be bearing more of the responsibility in areas such as nutrition and fish health. However, the programme befits a country with great scientific technical and economic strength in aquaculture.

The only criticism voiced by the reviewer was that BF should ensure that issues such as environmental impact and public acceptability of aquaculture are fully kept in mind, as this is likely to become an important issue in the future.

Scientific Quality

Significant elements of the programme (genomics, fish health) appear to be at the state of the art internationally and the reviewers' impression is one of scientific depth and innovation.

Impact

The growth of aquaculture in Norway has been heavily dependent on the programmes and its forerunners. This track record and the aggressive plans for cod, for example, led the reviewers to argue that this programme has the highest potential impact (short term and long term) of the entire BF portfolio.

A.9 Detailed comment on a SIPs project

At a detailed level, the reviewers single out the Protein from Natural Gas project for criticism. Protein production from oil and gas was very fully researched in the 1970s and 80's by BP (via yeast), Shell (using micro-organisms) and also ICI (methane utilising bacteria) who had a patent on methane production from ethanol. All were abandoned with the rise in oil and gas prices and more importantly because of the difficulty of freeing the resulting product from carcinogens originating in the oil (or gas) and which might get into human food if fed to animals. Economically proteins from fossil fuels have become more expensive as oils prices have risen, proteins from agricultural products have become cheaper year by year.

The reviewers did not have time to examine the project in detail but suspect that the project will need a new approach to succeed where other attempts have failed

Review of RCN's Industry and Energy Division

Summary of the Expert's Reports

October 2001
(revised December 2001)

Jim Swithenbank
Michael Maurer

With

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1 Executive summary

This section presents the summary from the expert review of the Industry and Energy Division (IE) of the Research Council of Norway (RCN), which took place on 19 and 20 September 2001. The report of the Evaluation of IE will form part of the background material to the wider evaluation of the RCN currently underway.

1.1 Conclusions – RCN and Norway

The present appraisal should be considered as an appropriate stage of development, and we hope that the recommendations will be taken in good spirit as part of a progression on a difficult learning curve. The reviewers argue that in view of the continuously changing world scene, such reviews should be carried out regularly in order for organisations to adapt and stay abreast of the game. For example, the recent concern about public security could change the market emphasis and consequently the required R&D work needed to develop products that satisfy evolving demands.

The Norwegian national innovation system has remarkable shortcomings and does not get the attention it deserves. An indication of this is that the research and development (R&D) expenditures measured as percentage of GDP are well below the average for Nordic countries and the EU, as well as OECD countries. Currently too many Ministries contribute only small amounts for their specific R&D needs, and no one has a clear responsibility for funding a research development and innovation system.

From the partial view of RCN obtained in the division interviews, it appears that:

- The RCN is not functioning in the way in which its role and mission were originally intended. The integration of basic and applied research with their differing funding philosophies and a closer cooperation of the former councils (transformed to Divisions) has not been reached, and probably cannot be reached under the current structure.
- The advisory role of RCN does not appear to be being delivered adequately. Even from the limited overview afforded to the research panel, it appears that the RCN might benefit from being reorganised. Smaller changes (like cross-membership among the various boards) would probably not be adequate to overcome the problems of the RCN.

The review also identified 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 the presence of "too many fingers in too many pies" by the actors responsible for funding research in Norway. This appears to have led to the lack of a coherent research policy.

1.2 Conclusions – Industry and Energy Division

The assessment of the R&D sponsorship strategy of the Division identified numerous strong features including a good strategy and structure with competent and motivated staff within IE. However the review also raised some questions about wider structural issues within IE and its interaction with the RCN.

Overall, the current structure of IE is wholly appropriate but raises questions about whether the Division is appropriately located within a research council and suggests that IE may need to be granted the additional independence one would expect to find, given its structure and role.

The resources provided to the Division do not appear to be sufficient given the efforts that are being made in other Nordic and OECD countries; neither are the resources provided sufficiently flexible for the RCN. This has led to a situation where:

- A significant number of IE employees are contracted in to operate programmes (and therefore paid for out of programme budgets), rather than being permanent Council employees
- The earmarking by Ministries creates some challenges within IE so that it has limited freedom in programme development and has been forced to operate programmes that seem to have questionable relevance to IE's core mission.

Furthermore, from the limited discussions during the visit, it appeared that the interaction between the EB and the Division Board (DB) is not strong enough to allow the EB to benefit from the specialised thematic competence that resides within the IE Board. It is not clear that the overall power and resource of the Executive Board (EB) is suitable to formulate or properly review an industrial research and innovation strategy for the RCN.

The relationship between IE and other Divisions appears to be relatively weak¹, in particular, there are few jointly operated programmes and there is very little evidence of mechanisms to encourage staff to move within the Research Council to encourage a sharing of best practice and different approaches.

The size of research projects funded often appears to be too small to capitalise on the research investment. The reviewers were told that the duration of a typical Research Institute (RI) project is less than 1 person year. This suggests that there are inefficiencies at the research 'bench', but also that there are too many small projects creating management problems.

The underlying philosophy of supporting RIs is not immediately obvious to the researchers, for whilst they act as sources of industry specific expertise, they contribute rather less to the development of the researchers which would contribute to future industrial competitiveness and so there could be a case for IE to support more university research.

¹ The RCN subsequently challenged the reviewers conclusion on this point and argued that there was comprehensive collaboration between the Industry and Energy and Science and Technology Divisions. The reviewers, however, feel that they were not presented with evidence for the close co-operation during the reviews.

1.3 Recommendations

The reviewers made a number of recommendations. Some deal with improvements to the *status quo*, but they also proposed some far more radical changes that should be considered within the evaluation of the RCN. The more radical proposals are presented in **section 1.3.1** whilst **section 1.3.2** deals with some of the more important incremental changes that should be considered for the RCN and IE.

1.3.1 Proposal for Radical Changes

The RCN argued that Norway lack an overall innovation policy.² The reviewers agreed and note that ‘It is extremely challenging to coordinate industrial policy, regional policy, trade policy, educational policy, labour market policy and research policy.’ (Strategy for industrial research, paragraph 3.1 (p. 20)). In their opinion this is the task of an advisory body and not of a funding agency.

The missions of the RCN should be split up into

- A council for funding curiosity-driven research along with some foresight-orientated strategic research. This should be principally funded by the Ministry of Research and Education but it would be appropriate to anticipate funding from the Ministry of Health and other Ministries, as long as they are prepared to delegate authority to the Research Council and to minimise the amount of earmarking they attach to their funding
- A funding agency/council for applied and industry-oriented R&D, with the mission to foster economic development and wealth creation (largely made up of the current IE but which will require strong links to SND and other industry support agencies)
- An independent advisory council responsible for formulating Research, Development and Innovation policy in Norway.

An independent and influential research-policy advisory-council could play a vital role in the development of national policy in this field. The RCN does not yet function as a strong advisory body for the development of national policy, and in the opinion of the reviewers does not have the independent position, structure or budget it would need to fulfil this mission

An advisory body should have members of very high reputation predominantly from academia and industry. It should give its advice to the entire government and there should be a governmental body capable of responding to their advice in a coordinated fashion. An adequate secretariat with its own staff – not integrated in a Ministry – would support the independence and quality of the advisory function.

The relationship between the two councils should enable strong cooperation on closely selected topics and this will require a mutual understanding of both the research and the innovation support traditions. With two well-organised bodies this could be easier to achieve, as with the current unified but fragmented RCN seems to be governed by peace treaties and not by a common strategy.

² RCN does not have the task (mandate) of giving general advise on innovation policy overall. However, it can give advice on national R&D policy as part of an innovation policy.

Norway should work out and implement a clear strategy to reach the OECD average within 5 years by increasing public as well as private R&D funding in a systematic way. This is crucial for the long-term economic wealth of the country and should be part of an integrated national research and innovation policy.

In order to achieve this it will be necessary to re-evaluate the benefits of the sectoral principle as this currently contributes to the high level of earmarking and lack of flexibility within the system. Research funds should be increased and concentrated in a few Ministries – predominantly those for education and research as well as for trade and industry. In any case a much better coordination of research funding is necessary which will challenge the operation of the RCN, as until recently its success has been driven by the ability of the Divisions to interact with their funding Ministries bilaterally to secure their divisional funding.

1.3.2 Proposals to Improve the Current IE System

The reviewers recommend

- Increasing IE's staffing budget to allow it to recruit permanent programme coordinators, rather than relying on temporary contractors who develop high competence in a particular area but have few incentives to transfer this knowledge within the RCN. The research competence and relevant technical expertise of programme coordinators should also be carefully examined to ensure that they understand not only the industrial issues but also the research issues associated with their programmes.
- To facilitate the transfer of skills and reduce the problems associated with cross-divisional cooperation. IE (and other Divisions) should increase staff rotation across the different Divisions of the Research Council and should also explore the possibility of seconding its staff to and from industry
- That IE be given responsibility for developing an industry support programme and that greater care should be taken to ensure that the programmes that IE runs are in line with its core mission. This would prevent the situation where unsuitable programmes are simply handed over to IE to administer
- The communication channels between the RCN EB and the IE Board should be further strengthened to allow the current EB to benefit from the specific competence of the IE Board.
- RCN Board members should be appointed on a rotation basis so that only a third of the board are appointed (or reappointed) at any one point. This would prevent the sudden loss of the experience and competence experienced by both Executive and Divisional Boards
- That IE continue to focus on increasing the size of research projects so that fewer projects are funded; currently the small projects do not allow the development of lasting exploitable competencies. Within large projects special attention should be paid to significant participation by SMEs.
- The underlying philosophy of supporting RIs should be reviewed and the RCN should investigate the Institute sector's evolutionary place in the National R&D strategy and examine whether the number of Institutes could be rationalised
- IE should continue seek to strengthen the links between universities and industry. The development of PhD students capable of contributing to both academic and industrial research should continue to be a strong focus for IE

- Increasing academic representation on DBs and Programme Boards. The reviewers suggested that a minimum of three Board members with experience of academic research should be represented on the IE Board (a similar number of Board members with experience of industrial research should be included on the Natural Science and Technology Division board)

2 Introduction

This report summarises the results of a short expert review of the Industry and Energy Division (IE) of the Research Council of Norway (RCN). The report contributes to the much wider evaluation of the RCN commissioned from Technopolis by the Ministry of Education, Research and Church affairs (KUF).

It is one of six such evaluation reports looking at the research portfolio and organisation of the Divisions in RCN and provides an assessment and recommendation for future development of the Division's research strategy and operation. The report will be appended in a separate Appendix to the overall evaluation report and will provide material both for other components of the evaluation and for a summary of the expert reviews of the RCN's Divisions.

3 Method

The aim of the divisional review was to evaluate the strategy, organisation and functions of each of the six Divisions and the various programme elements that they cover, and to draw conclusions for the operation of the RCN from these reviews. The divisional evaluations focus on

- The strategy adopted by the Divisions
- The structure and resources of the Division and how these are managed to support the delivery of its missions
- The choice and relevance of the research portfolio supported by the Division and the way in which these are designed and used
- The effectiveness and impact of the portfolio.

The two expert members of the review team were identified by Technopolis and subsequently approved by IE. The expert members appointed were Dr M Maurer (for the management aspects of the programme) and Professor J Swithenbank (for technical aspects of the programme).

- **Dr Maurer** is the chief executive at AiF, the German organisation responsible for organising applied industrial research for SMEs. The AiF comprises an industry-based innovations network covering over 100 industrial research associations, with approx. 50,000 SME, and about 800 associated research institutions; it funds DM 500m worth of applied industrial research a year.
- **Professor Swithenbank** is a research professor at the University of Sheffield in the area of Chemical and Process engineering and in the use of IT for modelling complex physical Phenomena. He is a past President of the Institute of Energy and an adviser to the Science Research Council.

Technopolis explained the issues that the review team would attempt to evaluate and asked IE to provide a briefing document on its activities. This was delivered to the panel prior to the review visits.

The review visit took place on 19 and 20 September 2001 and the schedule centred on a number of pre-agreed presentations, followed by a question and answer session designed to allow the reviewers to comment on the evaluation questions. It should be noted that representatives of the Executive Board or of the Director General were not present throughout the review visits³

The consultant responsible for the divisional evaluations within the review (Mr Ben Thuriaux) accompanied the review team throughout the visit, and the leader of the RCN evaluation (Dr Erik Arnold) was present for the first day of the review visit.

Following the visits, the two peers prepared their individual evaluation reports. These have been synthesised by Technopolis and validated by the reviewers. The current document forms the report of the evaluation after the reviewers' modified their comments to deal with RCN's comments on the draft.

Although the reviewers only looked in detail at parts of the RCN, they formed a number of impressions about the way in which the whole structure operates. These are presented in this report but it must be understood that they only form a partial picture - however, it is important to present these as they may represent converging indicators when combined with other parts of the RCN review.

The report addresses the issues that the reviewers were asked to concentrate on and outlines a number of possible recommendations that will inform the overall evaluation of the RCN.

4 Strategy

4.1 RCN History – Context

Much of Norway's recent wealth is derived from the exploitation of North Sea Oil reserves. As a result, Norway has reached its position as one of the richest OECD countries without making comparable investments in (industrial and academic) research and development (R&D) or by a sustained effort to develop the economy through industrial innovation policies.

Apart from the dependence on North Sea Oil, the economy of Norway is unusual compared with most of the developed world in that there is a huge public sector that represents more than half of the national budget. The total GNP for Norway is presently about 1400 BNOK. The total annual budget of the RCN is about 3BNOK, and the Industry and Energy Division receives about 700MNOK.

Historically, Norway's industrial strategy has been to encourage Norwegian economic development through the generation of a large number of small- and medium-sized enterprises (SMEs). The creation and commercial expansion of SMEs was to be

³ In that respect the evaluation presents an external view of the Division and its environment based on material presented by the division. The conclusions regarding aspects of governance and the internal workings of the council can only therefore serve as partial indicators as they are only based on the evidence presented by the division, division board and programme board representatives and the external industrial participants

achieved through the exploitation of new products based on research and development in the fields of Science and Technology. However, in the opinion of the review panel the specific potential of SMEs for economic development and wealth could be harnessed more explicitly (e.g. as in the MOBI programme). The main strategic principles are addressed as funding of

- Coalitions (not single firms)
- User-driven research
- Programmes to support value chains and industrial clusters (not sectors)
- Strategic industrial research.

The overall goals for the RCN strategy for industrial R&D are quite general and formulated in a way that would be a good standard for many industrialised countries. Special emphasis is put on

- An increased investment for industrial R&D
- Improved interaction between industry, universities and Institutes
- International competitiveness and co-operation.

The strategy employed has been based on funding measures related to building bridges between companies, Institutes and universities. In practice, much of IE funding finds its way to the Institutes, however, this practice does not appear to have been reviewed since its inception.

The huge role of the Institutes in Norway is particularly unusual in an international context. These were set-up in the post world war II period and there are now more than 100 Institutes, the largest of which is SINTEF with 2500 employees. The reviewers and industrial representatives we met questioned the value of maintaining the historical functions of these Institutes, and there appears to be a strong case for investigating the evolutionary place of the Institute sector in the National R&D strategy. On the other hand, some of the best Institutes have earned an international reputation for the excellence of some of their research work and this capability represents a valuable Norwegian resource.

One of the rationales for creating a joint research council appears to have been that international research on innovation suggests that the most important innovations often occur at the interface between disciplines, thus a close relationship between Divisions should be a key element of the national research strategy. However, the reviewers feel that whilst there is a fair amount of consultation across areas, the research at the interface of different disciplines (for example biotechnology) does not appear to be particularly well addressed in the RCN.

In 1998, the Executive Board (EB) of the Research Council of Norway (RCN) adopted a 'Strategy for industrial research and development' as guidelines for all Divisions of the RCN including IE. The driving force behind this strategy was IE rather than the RCN EB. The reviewers found this unusual because the integrated nature of the Council would have suggested that an overarching strategy should have been developed by the EB. As it was not a core activity within the division review, the reviewers did not investigate this in detail but they feel that this might indicate

- A need for IE to develop and implement a cross-divisional strategy (most of the other Divisions have different priorities)
- That RCN is still an addition of separate councils that have not yet achieved an integrated strategic approach
- That IE has taken an active role in attempting to increase the level of integration across RCN divisions.

The overall strategy covers the most important fields and is adequate for the future development of industrial R&D in Norway. However, it is very general and it is difficult to see how the strategy could be used to set the specific and measurable objectives that are expected to be present as part of the Council's management processes.

The reviewers argued that an important weakness of the industrial strategy is that it does not properly address the budgetary aspects, as there is no indication of the portion of the overall RCN budget which might be used to fulfil its industrial support mission. Furthermore, there does not appear to be information on guidance for the development of IE's relative future share of RCN's budget.

The reviewers feel that the lack of information on this is the result of the extremely fragmented funding structure of the RCN (there are some 16 funding Ministries). This seems to be a very complicated system that requires substantial efforts to maintain a fragile compromise structure. The reviewers feel that the current funding structure might partially explain the steady decline of the budget for IE.

The list of enabling technology and knowledge areas of the RCN again contains the topics that are internationally regarded as the most important ones for economic growth and development: biotechnology, materials technology, information and communication technology, productivity, process technology, construction and environmental technology. Of specific value for the Norwegian economy, are the additional topics of marine technology as well as energy and petroleum, which should always have a central role in strategic priority decisions. The reviewers consider that all the other above mentioned key areas should partly be focused on applications for marine and energy technologies.

Finally, the reviewers comment that on the balance of the various instruments available to RCN, there appears to be a significant amount of user-driven research within what is supposed to be a research council. Whilst user-driven research is a valuable tool, it tends to focus on the short-term interests of the users and should be complemented by long-term strategic approaches including adequate investment in the university and colleges sector and the relationship between IE and the other parts of the council with primary responsibility for further education was not clear to the reviewers.

4.2 RCN Recommendations – RCN

The reviewers recommend the following

- Specific goals should be jointly agreed and given a timeframe for delivery. The regular revision of the strategy should be done on the top level of a Council/Agency (or other responsible future body)
- On the basis of the overall strategy the division and their departments should implement programmes and set very specific and obtainable goals. The achievements of the Divisions and their departments should be compared annually with these goals
- The underlying philosophy of supporting RIs should be reviewed and the RCN should investigate the evolutionary place of the Institute sector in the National R&D strategy and whether the number of Institutes could be rationalised.

4.3 IE Strategy

Before 1993, IE was part of the Royal Norwegian Council for Scientific and Industrial Research (NTNF) founded in 1947. IE took over a portfolio of 50 programmes from NTNF, which it has gradually reduced first to 16 in 1996, and then to 10 in the recent restructuring. The reviewers feel that this is a positive step because a reduced number of programmes helps the customers from industry – especially SMEs, who are often not familiar with funding programmes and procedures – to identify the most appropriate funding routes for their projects. In addition, larger programmes typically subject applications to increased competition.

IE's primary objective is to promote innovation and wealth creation in its sector of Norwegian business. Hence the R&D efforts continue to be designed to emphasise long-term socio-economic benefits largely by stimulating an increase in the prosperity and number of SMEs. The sponsored enterprises generally provide an average of 60-65% of the funding for specific research projects.

IE is restructuring its programme to implement the overall strategy for industrially-orientated R&D of the RCN, outlined in 'R&D structure of value creation'. The reviewers feel that the current restructuring objectives appear promising. But they comment that the concept of funding 'Enabling technologies' would be a complex undertaking and would require significant effort to implement within IE. They also note that there would be a need to promote close contact and greater interaction between the user-driven research performed with funding of IE, and the strategic, industrially-orientated research of other Divisions. The reviewers feel that the fragmented structure of the RCN would make it difficult to achieve this level of integration across divisions.

IE and the Division responsible for fundamental research receive the largest budget shares of the RCN funds. There should be a close relationship between IE and the NT but despite the fact that they are collocated, the administrative links between these two Divisions do not appear to be particularly strong and this is as an important weakness, given the RCN's remit.

Overall, the reviewers feel that IE is making significant progress towards the implementation of the overall strategy.

4.4 Recommendations – IE

The reviewers recommend the following

- Special emphasis should be put on the participation of SMEs, which usually needs a proactive approach in thematic programmes.
- International collaborations should continue to be actively supported because they are a particularly important to the development of international competitiveness for smaller countries
- IE should seek to strengthen the links between universities and industry. An adequate mixture of basic as well as applied projects should be funded (the latter by IE). The development of PhD students capable of contributing to both academic and industrial research should continue to be a strong focus for IE
- The role of the Institute sector should be reconsidered. It is currently heavily supported by IE and is a valuable source of expertise, but it often creates a barrier between industry and universities, and is less active in educating the next generation of researchers.
- Creating stronger links between the administration and boards of IE and NT. This could be achieved through internal staff rotation and through the appointment of Board members with experience of other RCN Division Boards
- Stronger evaluation procedures should be integrated into new programmes and instruments, to get early indications about their strengths and possible weaknesses.

5 Structure and Management of IE and RCN

The reviewers were not aware of any countries outside Norway which had created a single body for: the STI (Science, Technology and Industry) advisory council, University Research Funding and the agency responsible for applied R&D. They felt that in larger countries it would be unrealistic to assume that all these functions could be integrated simply because of the increased complexity of larger science and innovation systems. Specifically, they pointed out that they were not aware of any country that had co-located responsibility for industrially orientated research support with a university (and institutes) research council. Typically the industrial ministry only provides indirect support to the university base and research councils support basic and engineering research with some limited overlap with industry ministries.⁴

5.1 Structure

IE has all structural elements one would usually expect from a Division that is integrated in a larger council. The structure is clear and appropriate. It contains the following

- Executive Director, reporting to the Director General (CEO)
- Three departments for the management of the programmes headed by a Director (two departments for thematic programmes and one for networking programmes)

⁴ The RCN subsequently pointed out that NHD also provides some direct funding to the universities, through the Science and Technology Division.

- Programme Boards with external members (mostly from industry) to oversee the specific programmes
- Programme coordinators for every programme, integrated in the departments and interacting with the specific Programme Board.

The three departments responsible for programmes appear to benefit from a coherent distribution of programmes which obviously benefit from synergetic effects and which allow the Director in charge to form a good overview of their activities. The reviewers (and Technopolis) were particularly interested to note that IE has created a separate department for networking activities. This is a relatively unusual step but one which is in line with current research into the systems and network approaches to supporting the innovative behaviour of firms. This arrangement allows this department to develop special activities for SMEs and to create links with other organisations like SND and SIVA, which strengthens the regional component.

In addition to the structural elements described above there were some additional features of the structure that the reviewers would only have expected if IE were an independent funding agency:

- Divisional Research Board with external members (mostly from industry) to oversee the overall work and programme of the Division
- A fourth department for strategy, evaluation and international affairs.

These additional structures are obviously valuable tools to fulfil the mission of the Division and are justified by this. However they do suggest that there are some deficiencies in the organisational structure of the RCN as a whole.

5.2 Division Management and Staff

The Executive Director of IE is the right person in the right place. He has a clear view of the future development of his Division, and on this basis gave convincing answers to all questions we asked. He is leading the Division in an impressive way. The Directors of the departments also appear to be doing good work job. The impression conveyed is that the senior management team and their staff are working with dedication and enthusiasm.

Special attention should be paid to some of the aspects of the Division however. IE employs too many temporary staff particularly as programme coordinators. Their influential position in selecting the funded projects requires a high qualification and a broad background, and it is to bring these skills in-house to share these competencies and to facilitate better in-house monitoring of programme activities.

Finally, the reviewers suggested that the Division would benefit from measures to facilitate the renewal and exchange of competencies within the Division and to increase the ability of the Division to access skills and resources in the private sector.

5.3 Budget

The reviewers argue that an effective and efficient division of a research council like IE needs more freedom (internally and from the earmarking of Ministries) to react independently and quickly, in order to manage the overall funding programme.

The Norwegian research and innovation policy does not get the attention it deserves. An indication of this is that the R&D expenditures measured as percentage of GDP are below average for the Nordic countries and the EU, as well for OECD countries. The constantly declining IE budget is not a sound basis for IE to operate, and stands in sharp contrast to the situation in other European countries where industrial R&D support is taken more seriously as a basis for increasing national competitiveness.

Currently too many Ministries contribute too small amounts for their specific R&D needs. A much better coordination of research funding is necessary. The current situation is that the RCN cannot play this coordination role because too many strings are attached to the funds it receives from different ministries.

5.4 Recommendations

- The current structure of IE is wholly appropriate but raises questions about whether the Division is appropriately located within a research council and suggests that IE may need to be granted the additional independence one would expect to find given its structure and role.
- The reviewers feel that the Division should aim to have at least two-thirds of its staff as permanent RCN employees and that the number of programme coordinators employed on a subcontract basis should be significantly reduced. This would not require additional funding and would probably reduce the total cost
- Given its intention to act as a single research council, the Division (and RCN) should increase staff mobility among the various Divisions and introduce a system to permit staff exchange and secondment to and from industry, to increase skill development.
- IE needs a steady and reliable increase to handle its funding portfolio and to deliver the changes to the competitiveness of Norway which are identified as the basis for the RCN strategy. Research funds should be increased.
- The sectoral principle appears to prevent the development and adoption of a coherence research and development policy in Norway. The costs of benefit of the sectoral principle should be reviewed and if possible funding for research development and innovation should be concentrated in fewer Ministries, which will be able to take a system rather than a narrowly sectoral perspective.

6 Governance of RCN and IE

The board structure of the RCN was felt to be overly complicated and the reviewers were not aware of any other science funding council which three board levels in one structure. In general it is far more common for similar research councils to be organised around different sub areas in which the chairperson for each area is a member of the Executive Board. For example in the UK the Department of Trade and Industry and the Science Councils are administered separately but involve joint membership of committees at all levels to ensure some co-ordination of activities.

When the major re-organisation was implemented in 1993, the decision to schedule a future review of the organisation indicated that teething troubles were anticipated, given the innovative nature of the organisation.

The reviewers were impressed by the commitment of all the people they met to their work and their sincere wish to achieve a more efficient operation. For example, they note at the meetings held with the Division Programme Board and the Programme Managers that all were concerned to a greater or lesser extent about the frictions in the present organisation and need to develop a good team spirit. The reviewers feel that the persons interviewed, all demonstrated their commitment clearly in the sincerity and effort they had put into their presentations, and the openness of the discussions.

IE is operating in a difficult and somewhat messy environment, which lacks clear governance. The Executive Director of IE is responsible to two masters: formally the Director General, and informally, there are (obviously very strong) interactions with the Division Board (DB). This creates a certain amount of tension within the organisation.

The EB appoints the members of the DB. (in some cases the review panel was told that Ministries suggest members), but the interaction of both Boards is unclear and seems to be very limited. In the view of the reviewers the Board and management structures are not properly integrated.

A general comment on the structure can be linked back to the lack of an integrated national research policy that extends from the top levels of Government to the actual R&D worker at his/her bench or drawing-board. In brief, the number of institutions attempting to control the system creates a situation, in which in the words of one of the reviewers that “there are too many fingers in the pies at each level”.

The RCN effectively receives its budget allocation from the various government Ministries with some very significant strings attached as to how the funding is to be distributed. On the other hand, a formal duty of the RCN is to advise the Government on research strategy issues. There are obvious problems here, as the current situation creates a dichotomy and a conflict of interest – the Divisions could effectively ‘defend’ their funding through the advice given to government. The other issue is that there does not appear to be a coherent recipient of RCN advice. Indeed, it appears that the fragmentation of funding actors allows each Division to provide unilateral advice to the funding Ministries, which effectively undermines the ability of the RCN to formulate a strong national research strategy.

6.1 Executive Board

The RCN has an EB and a Director General who are involved in the strategic planning of the Divisions. Each Division also has a Division Board (DB). However, the reviewers note that - based on the evidence presented to them by the division staff and division board - there does not appear to be adequate representation of the DB at the level of the EB. The reporting appears to be handled almost exclusively by the administration –from the Executive Director to the Director General and then from the Director General to the EB. This effectively reduces the communication channels and leads to a situation where there is a lack of unity within the council.

The reviewers were told that the EB has relatively little freedom to develop the budgets for Divisions (or for cross-divisional activities), except for the use of the national Research and Innovation Fund (Fondet for forskning og nyskaping).

- The funding Ministries earmark the budgets that are allocated to programmes. This leads to a situation where it is only possible to make marginal changes to the existing allocations and thus results in a budgeting system which is 'locked in' to historical allocation.
- The representative nature of the EB has led to a situation where, in the view of one of the reviewers, the EB lacks the expertise and competence to prioritise across national science, engineering and innovation activities

6.2 Division Board

The members of the DB the reviewers met took their role seriously and were engaged in advising the Division in a constructive way. However, they have only relatively limited possibilities to govern the Division because of the budgetary constraints imposed by the Ministries, and the lack of formal power to give instructions to the Executive Director of the Division.

The composition of the Division Board is fairly appropriate, but the reviewers suggest that the Board might benefit from an increase in representation from academia, so that at least two or three Board members should have some experience of academic research. They also suggest that the RCN Boards in general appear to suffer from a lack of continuity.

6.3 Programme Boards

Although the structure and organisation of the RCN has led to difficult relationships between the Executive and Division level, it appears that the grant administration management cooperate fully with the DB in an atmosphere of mutual respect.

The programme Boards play an important role in structuring their specific programme, setting priorities within their thematic frame and supervising the work of the programme coordinator. After the marked reduction in the number of the programme Boards, the overall structure is now adequate, and overcomes the administrative complexity that must have been required before the rationalisation. Again the reviewers comment that it is important to ensure that university and Institutes are properly represented at the level of the Programme Boards to ensure these can draw in the competence of the academic research base.

As a critique, however, the reviewers comment that it appears that some of the research coordinators lack adequate research experience (i.e. PhDs) and therefore cannot fully appreciate the pressures and problems of the research and development work they sponsor.

A clearer research strategy would give confidence that each programme topic operated above the critical level. An example that gives cause for concern is the steeply falling budget for oil and gas research. Presumably this is based on the idea that this is a prosperous industry that can fund its own R&D. However, the motivations for the profitability of the industry and the technological future of the country are significantly different, and this should be taken into account in the funding policy for this sector.

In general, the reviewer representing the academic community commented that he would expect a somewhat larger review panel to cover the range of expertise and experience needed to ensure optimisation in the use of the funding. One of the advantages of such panels is that they also communicate policy and give status to the people at the grass roots level due to their participation in making the decisions. Thus there is a danger that these problems could lead to a lack of confidence in the system by the technical community.

6.4 Recommendations

The reviewers suggest the following

- A clearer delimitation of responsibilities and appropriate delegation of authority – from funding Ministries to the EB and then through the DBs to the Programme Boards – would improve the operation of the system. This would require funding Ministries to reduce the amount of earmarking they attach to their funding.
- The inherent conflict of interest in advising on research funding and administering research funding should be resolved. One proposal would be to create a separate body for formulating a national research and innovation policy. Similarly, the government should seek to create an executive body capable of acting as a recipient for a national research and innovation policy advise as the current system with 16 different ministries appears to have difficulty in acting in intervening for the benefit of the system as a whole
- The members of the EB should be experienced in fields like higher education, research, industrial R & D to allow it to have a strong independent and credible position to govern the Council. It should have additional power to distribute the budget, and the constraints and restrictions the various funding Ministries attach to their contributions should be reduced.
- The channels of communication between the EB and the DB should be strengthened by ensuring some stronger representation of the Division Boards at the level of the EB.
- A system of rotating appointments for all the RCN Boards should be considered. For example, arrangements could be made to stage the appointment of Board members – the four year period of office should begin every two years for half of the members, thus ensuring some continuation.
- Increasing academic representation on DB and Programme Boards. The reviewers suggest that a minimum of three Board members with experience of academic research should be represented on the IE Board (a similar number of Board members with experience of industrial research should be included on the NT Board)
- Reviewing the research experience of the programme coordinators and make this a requirement for future programme coordinators.

7 Portfolio

Overall, the reviewers rate the portfolios of the different departments within IE very highly. The people concerned are obviously devoted to their work and carry out their tasks very well within the constraints of the system imposed on them. However, the reviewers note a number of general points that could be improved.

The reduction of the number of programmes was an important measure to make the programme administration leaner and to reduce the number of programme Boards. The new programmes allow more internal competition and selection of applications, which allows the programme Board and coordinator to shape the overall subjects within a programme in a future-orientated way, while at the same time picking high quality proposals. In this way, larger clusters of related projects can be formed, leading to synergies and a greater impact of the funding.

The research portfolio in most advanced countries is based on a major Foresight study. Although certain topics have been appropriately highlighted in Norway, this appears to have been as a result of an *ad hoc* policy, rather than as the result of an ‘in depth’ assessment of the future national/international demands.

The reviewers comment that, given that IE is part of a research council (albeit the part responsible for industrial development) there does not seem to have been a strong peer review system operating for some of the programmes.⁵ The new ‘guidelines for applicants for user-controlled innovation projects’ describe the standard structure for applications, but it is not clear to the reviewers whether there are also generally agreed procedures on the evaluation process. The reviewers feel that this process appears to be relatively informal, and depends (perhaps excessively) on the influence of the programme coordinators. In other countries assessment and selection of proposals is more strongly separated, with very clear and strict procedures on the handling of applications when they have been selected.⁶ The relatively low success rate of applications makes this issue even more important.

In this context, evidence was presented that indicated the success of many programmes, in that they resulted in the creation and expansion of a large number of SMEs so the reviewers suspect that this is not currently a great cause for concern. However, it is considered best practice to operate strong up-front quality systems, especially if IE is to deal with additional funds over the next few years.

7.1 User-driven Innovation Programmes

Currently the portfolio is restructured around a number of new user-driven programmes. All new programmes are linked to former ones, but at the moment their real internal priorities and major projects are not finalised, which makes it difficult to comment in depth on these programmes.

Attention should be paid to the size of the projects, as there has been a push to increase the size of IE's projects. In general the reviewers agreed that this is a sensible strategy as this induces interactions among a larger number of participants and creates additional benefits. But large projects are not the solution for all problems, and SMEs often find it difficult to participate or benefit from larger schemes. Small projects (but not single firm projects) are justified for instance to start unconventional or high-risk topics for example through small demonstration projects. Again, it is necessary to have the right mixture of large and small projects, both serving different needs of firms and the economic development in general.

⁵ This deficiency may, however, have been addressed by the review system initiated last summer

⁶ It remains to be seen if the recently initiated review system will be operated according to those principles

Finally, the reviewers feel that, to increase the flexibility in the system, a limited number of small industrially orientated projects might even be funded by the Division outside thematic programmes, with a special budget under the responsibility of the Executive Director.

The relative broad scope of each of the programmes allows it to support projects from an adequate number of fields but of course not from all fields. This is a trivial statement but it is important to balance modest support for small areas of the economy with stronger but still selective support for key parts of the economy. In general the user-driven programmes have the potential of finding the right balance between selectivity and broadness.

It will be the task of the programme management to redefine older subjects from the previous programmes. This may be necessary in particular in the programme ‘Energy, environment, building and construction (EMB)’ which has links to six former programmes. It is also somewhat surprising that biotechnology is integrated in a programme for the process industry – this is one area that could have benefited from cross-divisional funding and programme collaboration.

In some of the thematic programmes, industrial federations of individual firms are integrated, such as the federation of Norwegian manufacturing industries (TBL) or the Norwegian ship-owners association. Industrial federations can play an important role in formulating industrial R&D needs and in the dissemination of the results of R&D projects. They increase the awareness of the necessity for a continuous flow of R&D results, especially for SMEs with no or limited R&D capabilities. On the basis of the positive experience of industrial federations in more R&D intensive countries, one of the reviewers suggests that Norway should consider whether it can further exploit industrial federations or support the development of such federations as a means to increase SME participation.

7.2 Portfolio – Department for Energy and Process Industry

Overall, the portfolio for the Department for Energy and Process Industry is highly rated, although this largely ignores the problems attributed to external factors.

At first-sight one would expect this to be the most important IE portfolio (and possibly the National portfolio) due to the international emphasis on the environment and the major contribution of the North Sea oil and gas industry to the Norwegian national budget. However, responsibility for this situation appears to rest more with the Government than with the Division. It suggests that, outside RCN, scientific policy in this crucial area should be based on a better assessment of future needs for energy, and the means for its provision. In other respects, the Division statistics demonstrate significant success in the creation of new businesses, publications and support of PhD students.

7.3 Portfolio – Department for ICT, Service and Manufacturing

Overall the portfolio for the Department for ICT, Service and Manufacturing is highly rated by the reviewers.

Information technology is a most important and rapidly developing subject world-wide. It is, therefore, not surprising that this is one of the strongest areas on the overall portfolio. Indeed, the department must be complemented on maintaining the momentum in this field in Norway. It is also notable that a significant proportion of their funding is awarded to universities, thus demonstrating the relevance of this sector in terms of new people skills and advanced technologies. The emphasis on light materials and shipping is perceptive, and bodes well for the future of these key industries in Norway.

7.4 Department for Innovation and Technology Networks

The decision to create a specific structure to deal with the importance of innovation and network effects is highly innovative. However, the department's portfolio has suffered from having to manage programmes which do not appear to be at the core of their strategy (for example, HØYKOM) and which appear to have been imposed as a result of external pressures.

The reviewer have some short comments on parts of the programme.

7.4.1 MOBI

The strong focus on regional cooperation is a good approach to encourage more SMEs to exploit R&D for their activities. The potential of the colleges to support the development of SMEs is promising, as comparable schemes have been very effective in other European countries. Due to the great diversity of SMEs, many diffusion channels of knowledge must be used to reach them, and the experimental character of various elements of this programme is the right strategy for success.

7.4.2 VS 2010

It is surprising to have a programme that is intended to strengthen social partnerships between trade unions and the confederation of business and industry under the roof of a research council. The programme does not fit well in the overall portfolio and weakens the clear profile of IE. In the view of the reviewers, this could well be handled by an organisation other than RCN.⁷

7.4.3 FORNY

This is a useful infrastructure programme that intends to open-up additional diffusion channels from research to commercialisation. The close cooperation with SND and other partners is a valuable element. The programme fits relatively well in the overall profile of IE, but in other countries this would be handled by an innovation agency and not by a research council.

⁷ There may be some misunderstanding here, the division subsequently argued that the VS2010 is a programme for R&D in and between companies where researchers act as process consultants and where the aims among other things are productivity increase, closer international collaboration, export and turn over-increase. In addition the researchers use the company-material as basis for synthesis of knowledge both theory and methodology in the social science. Through this programme output from the social sciences become more relevant to the enterprises. The programme is initiated by the social partners and is run as a joint programme between CSSD and IE because of its dual aim. In our opinion it belongs to the core programme portfolio of RCN.

7.4.4 HOYKOM and NIN

These are not R&D programmes. HOYKOM is a stimulation action for broadband communication and NIN promotes the concept of information networks by supporting demonstrator networks.

Whilst these are valuable activities for Norway, it is not clear why IE or any other part of a research council should be the best place to manage these programmes.

7.4.5 FAKTA

The information gained by programmes like FAKTA (or its successor, KUNI) is important tools to support the development of the future research and innovation policy. The reviewers suggested that the programme provided a balance between in-house (RCN) studies and independent external research which is needed to strengthen the research base in the field of innovation policy in Norway.

7.4.6 FUNN

This special action was called the most unbureaucratic R&D funding scheme in Europe in a recent newsletter of the German Association of the Chambers of Industry and Commerce. Indeed, it is a valuable approach to supporting R&D.

-
- Its main benefits are
 - A short handling time
 - Up-front control over the total cost of the support measure (this overcomes the unpredictability of R&D tax breaks)
 - Up-front quality control to check compliance with scheme operational parameters (whereas R&D tax incentives have to audited).

The reviewers suggest that the impact of scheme should be closely monitored. The programme fits in the profile of IE and could be integrated properly within the Division.

7.5 Portfolio – Department of Strategic and International Operations

Generally the reviewers feel that it is to the credit of the IE Division to have created a clear assignment of responsibility for dealing with international affairs and to attempt to evaluate the impact of IE programmes.

Strategic studies have successfully clarified the R&D structure for value creation through the links between scientific disciplines, enabling technologies and innovation. The strategy recognises the important role of international cooperation, and this results in considerable ‘gearing’ of the funds available from the national economy. It is also noteworthy that about half of the projects in IE's portfolio has some kind of internationally linked activity.

The EUREKA element has been very successful, securing funds for 20 projects in the last year, especially in the ITC sector. However, the reviewers note that only one university project was funded, and suggest that additional efforts might be made in this area.

The area of appraisal and impact measurement is a key subject that assesses the extent to which the advances in technology result in economic output. A successful quantitative appraisal system has been developed which has analysed a sample of 48 projects out of a total of 894 projects supported in 2000. This sample comprising 143 MNOK grants support and 410 MNOK total R&D cost and economic impact assessment indicating an expected net present value of 1,8 BNOK.

Appendix A Technical SWOT analysis

The reviewer responsible for the technical part of the portfolio review presented the following summary of the Strength Weaknesses Opportunities and Threats for IE. Because it is hard to separate IE and RCN some of the points raised below apply in some respects to the RCN as a whole.

The SWOT analysis is presented here to complement the synthesis of the reviewers' assessment but it should be noted that this does not necessarily mean that both reviewers agreed on this.

Strengths

- Very substantial national income from the North Sea
- Very efficient and enthusiastic local programme management
- Clear recognition of the role of the Division in value creation
- Focused fields of study
- Excellent achievements
- Moderately good support of PhD projects
- Recognition of the need for an industrial source of research funds and hence very good 'gearing' of projects
- Very good selection of priority areas for Norwegian research and development
- Significant success in project evaluation techniques
- Strong support for Information Technology is already yielding good returns
- Significant role in EU and the trend to globalisation.

Weaknesses

- Failure of RCN to achieve a national industrial research and policy
- Confused lines of authority at senior levels within RCN
- Weak organisational structure of the Council for Scientific and Industrial Research leading to 'fights'
- Emphasis on management rather than technology
- Too many 'small' projects
- Programmes not integrated and coordinated with other Divisions
- Too much emphasis on Institutes
- Programme managers have too much direct authority over projects
- Assessor panels are too small
- University aspects of research are sadly neglected
- No academics on panels
- Limited use of IT in grant submission and project management.

Opportunities

- Feedback a greater proportion of the North Sea rewards to R&D
- Fundamental changes in the overall R&D support structure
- Implementation of a proper line management system
- Administration across the programme secretariat
- Integrate topics within larger centres
- Clearer communication with 'stakeholders' and the public through new channels
- Achieve greater efficiency through the exploitation of topic synergies
- Get greater involvement of academics in the strategy and decision making process
- Require science and engineering students to have industrial training during vacations
- Increase the emphasis on pollution and the environment
- Install the Chairmen of Research Boards on the Main Board
- Increase interaction with all levels of education including continuing education
- SMEs require easier access channels to the RCN at all levels.

Threats

- Complete collapse of the stressed organisation
- Time to rebuild the organisation
- Poor public perception of RCN and lack of public confidence
- Huge public sector
- Limited penetration of industry
- Poor investment in schools and universities
- Shortage of high calibre scientists and engineers
- Poor perception of the distinction between research and development
- Too many temporary staff in IE
- Gap in the long-term GNP in Norway
- Falling budget
- Lack of recognition of the need to pass research topics through a life cycle
- Too little 'Blue Skies research
- Evolution or Revolution!

SECTION C

Briefing material provided for the RCN Divisional Reviews

Briefing material provided for the RCN Divisional Reviews

The following sections reproduce the briefing material provided to the reviewers as preparation for their visits. The material was authored by the RCN division and provided to the reviewers ahead of the meetings.

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Culture and Society Division
Briefing material for Divisional Review

Expert Briefing Documents - Evaluation of the Culture and Society Division of the Research Council Of Norway.

KS/2001-05-29.

This paper is written for the purpose of being briefing material for expert review of the Culture and Society Division as part of the evaluation of the RNC. Due to time constraints it has been produced over a short period of time, and this has prevented a rewriting that could have reduced a certain overlap in the text. The English translation is a first draft by our translator. We apologise for this.

The Culture and Society Division of the Research Council of Norway

1.1 History, Scope and Changes in the Division

1.1.1 The situation before the Research Council of Norway and the Division were established

The Division of Culture and Society was established as the replacement for three different parts of the old research council system; two of the subcouncils in the Norwegian Research Council for Science and the Humanities (NAVF) - the Council for Research in the Humanities (RHF) and the Council for Research in the Social Sciences (RSF), and the Norwegian Council for Applied Social Research (NORAS).

The first two of these units (RHF and RSF) were traditional university- and basic research-oriented research councils with well tried routines for “responsive-mode funding”. The strengths of these councils were that they operated in close concert with the disciplines that they funded, and that they were largely controlled by the researchers themselves. This form of control meant that they enjoyed the confidence of the researchers, and provided good roots for the basic research policy that they followed. Weaknesses included highly fragmented grant awards and a structure of grants that was in many ways similar to the institutions’ own pattern of financing research. The Research Council was often spoken of as the “second route” of finance for large and small projects. The councils had a weak tradition of research strategy.

NORAS was established in order to organise the rapid growth in applied research in the social sciences, particularly in the form of research programmes financed by various government ministries. A peculiarity of the Norwegian system is that after 1970, individual ministries financed contract research in the social sciences within their own sectors to an increasing extent. Even in the 60s, there was a growing awareness in the political system of the potential of the new social sciences, as an important knowledge base for social and economic issues. By about 1980 the scope of this research had grown to such an extent that it was beginning to be regarded as a problem that individual ministries were financing research directly, rather than via a more professional apparatus. Such an apparatus was established in 1979 as a fifth council (the Council for Research for Social Planning) of NAVF, and in 1987 it was established as a separate research council, which was given the name of NORAS.

1.1.2 Problems, challenges and goals for change of the Division

During the 80s there were growing problems of co-operation and co-ordination between the two social science councils, and many people were beginning to feel that we should not be maintaining two social science research councils at all. NORAS had entered the field of operation of the basic research council via its growing support for fellowships, and in 1989 it placed an open call for applications. For its part, RSF noted that the growth in subventions tended to go to programmes, and for this reason it launched several new programmes, often in direct competition with the other council. The two councils set up several parallel programmes. When the Government established so-called ”principal areas of effort for Norwegian research (hovedsatsingsområder) during the 80s, this also was a source of conflict and problems of co-operation. No real co-operation between NORAS and RSF was set up

before the merger of the research councils. The situation was characterised by the existence of two different cultures, two methods of working and not least, two quite different ways of regarding research and research policy. Aspects that were kept distinct at council level were linked in the research system, and both councils were financing many researchers and groups.

The situation in research in the humanities was somewhat different. Unlike RSF, RHF did not have a competitor and here there was no particular need for change, other than that there might well have been somewhat stronger contact between research in social sciences and in the humanities. One of the main areas of effort (cultural studies), nevertheless, had been the source of a certain amount of conflict between the two basic research councils.

The organisational set-up of the new council should facilitate co-operation and co-ordination. Since this was primarily a matter of organisational reform, several objectives were linked to the way in which the council would actually operate.

The following goals for change for the Culture and Society Division were the most important:

- Improved coordination of basic and applied research. In the Culture and Society Division this was primarily a matter of integrating the activities of the university- and basic research-oriented council and the more applied social science council. Among other things, this would involve the creation of a fully integrated programme structure.
- Better coordination of responsive-mode and programme funding, particularly programmes for applied research.
- Active participation in the development of a joint research strategy in such areas as quality, recruitment, internationalisation, institute policy, dissemination of results and evaluation.
- Greater delegation of responsibility for implementation to institutions.
- Exploitation of the possibility of greater cooperation between research in the humanities and the social sciences.
- Development of good work-sharing practices and good cooperative relationships within the Division.

A core problem for the Division of Culture and Society following the merger of the research councils was that of creating a climate of trust in basic research groups. The merger process met with a great deal of scepticism among university-based groups, particularly in the humanities, where it was feared that the area was about to be given a lower priority and would meet with less understanding in circumstances in which applied social sciences would be strong. A similar degree of scepticism could be seen on the social science side. These problems were reinforced by the fact that as early as 1994, the Ministry considerably reduced its level of support for research, in conflict with earlier political signals, which had been issued in 1994. The research community could not understand the reasoning behind the reduction in support, and felt in particular that research programmes were the main priority of the new Research Council of Norway.

1.1.3 The set-up of divisions and issues associated with these boundaries

The Division of Culture and Society was involved in proposals for the new divisional structure; i.e. both the original proposal of the Grøholt Committee for the primarily discipline-based councils and the final choice of six, partly discipline-oriented, partly mission-oriented, councils. This was therefore a natural division and there was general political agreement regarding the final choice. Within the research community, and in some of the former research councils, however, critical voices were raised regarding the merger of humanities and the social sciences (see above).

Organisation in terms of divisions permitted much better coordination and closer cooperation between basic and applied research, and between the humanities and the social sciences. The new structure also gave other divisions significant tasks in research in the social sciences. The Division of Medicine and Health was to work in the field of health service organisation. Environment and Development would have considerable responsibility for societal aspects of environmental and development research. Similarly, Bioproduction and Processing would be working on agricultural and fisheries-relevant social science research, not least in the field of market research. The Division of Industry and Energy was also highly active, following a line that could be traced back to a growing involvement in the field of social sciences in the former NTNF. A significant task, therefore, was to establish a good division of work between cultural studies and social science research within the other sector-based division. In this respect, it was primarily the relationship with the Division of Environment and Development that caused problems, with regard to responsibility both for specific subjects and for responsive-mode funding in relevant disciplines.

1.2 Strategy

1.2.1 Introduction

The merger process raised a number of challenges and was a source of inspiration for strategic thinking within the Council. Strategic challenges were formulated in several areas. *Post hoc*, however, it has become clear that considerable resources were at first being put into:

- Dealing with relationships both with the research community and the ministries, i.e. developing relationships on a new basis and creating confidence.
- Dealing with the internal challenges of making the new organisation work, both internally within its own field of operation and in cooperation with other bodies. Few routines and conflict-resolution mechanisms were in place, and these had to be developed.
- Creating joint mechanisms, routines, forms, brochures, etc., i.e. creating the appearance of a single council.

The new Council operated on the basis of three main tasks, which were related to its three distinct roles as:

- Funding Agency.
- Advisory body, primarily for the government and politicians.
- Networking body, forging closer links between scientists, various kinds of users of research and policy-makers.

Of these, funding was naturally the task to which most time was devoted. This had been, and remained, its most important role. As far as the other tasks were concerned, the “old” research councils had had different traditions, which created a need for restructuring and reorienting on the basis of the aim of strengthening research strategy and the role of creating contacts among the various participants in the research system.

The first years of the new Council, however, were characterised by the further development of well-established methods of operation:

- Responsive-mode funding: supporting basic research via support for independent research projects.
- Basic research programmes: continuing existing programmes and initiating new programmes.
- Applied research programmes: developing relevant applied research via specific programmes in cooperation with ministries.

This basic activity were supplemented by other tasks demanding more intense efforts:

- Contributing to the development of a council policy for the research institutes and creating a mode of operation for the allocation of core grants.
- Contributing to the internationalisation of Norwegian research through active participation in international cooperative institutions and through funding of international collaboration in the different research fields.
- Developing the knowledge base necessary for a recruitment strategy.
- Developing systems for more evaluations of programmes, institutes and, in the past few years, of disciplines.
- Strengthening the role of the Council as a research strategy organ, especially *vis-à-vis* government ministries.

1.2.2 Objectives and strategy within each area of financial support.

Responsive mode funding.

One of the principal objectives of the Division is to support basic research in the humanities and the social sciences via support for independent (researcher-initiated) projects and selected programmes of research. The responsive funding, i.e. the funding of independent projects was the traditional method of support, and this was regarded as the most important instrument of supporting high quality disciplinary research in Norwegian universities. During the new Council's first few years, research budgets provided by the Ministry of Research (KUF) were severely pruned, and this necessarily caused reduced budgets for the responsive funding. At the same time, there was a need to support doctoral studies via fellowships for Ph.D. students. During these first years of budgetary cuts, the largest percentage of funding went to doctoral fellowships.

The responsive funding had been established as a form of "second budget" for the academic staff at the universities, and relatively small amounts of funding could be applied for. At the same time, panels that consisted of representatives of the various disciplines involved managed this support. While this created a situation of proximity to the disciplines, it also helped to maintain a structure consisting of many small projects, partly individual Ph.D. fellowships and partly support for smaller projects carried out by individual researchers.

The new Council wished to operate more at a strategic level, fund larger projects and give more responsibility for carrying out projects to the institutions. For this reason it wished to make changes in the committee system. In 1994 the new Divisional Board set out its proposals for changing the system by reducing the number of committees and making them more interdisciplinary. The research community regarded this in an extremely negative light - it was interpreted as a signal that the new council lacked understanding of the situation in disciplinary research. For this reason the proposal was not put into effect.

In the course of the past three or four years, the Division of Culture and Society has developed a more clearly defined strategy in this area. The financial framework for responsive mode funding has been widened to the extent that budgetary constraints permit. At the same time, its aim has been to orient support more in the direction of somewhat larger projects of potential importance for research groups, and to be more innovative. A line, in which the Research Council can take care of other funding tasks than the institutions themselves, is still

fairly controversial. University research groups also have a great need for small amounts of support to enable them to carry out important research tasks. A desire for larger projects means reducing the number of individual fellowships, while we support PhDs within the framework of larger projects. We also wish to place greater emphasis on supporting post-docs. and international cooperation.

The project portfolio has gradually changed character in the course of the past few years, in the direction of the goals we have set ourselves. However, we realised that the committee system itself was acting as a barrier to the full realisation of these goals, and for the past two years we have therefore been working on changing the whole applications processing system. This is being done in 2001, when we change from 15 committees to three, each of them with a broad multidisciplinary responsibility. Researchers are conservative, and much time and a thorough dialogue have been needed to obtain support for new funding priorities and a new committee system.

Besides providing support for independent projects within a national context, the Division has also maintained the system for support for independent projects in cooperation with the other Nordic countries. The precondition for obtaining support here is that projects should be Nordic cooperative projects. In this area efforts have been made to put support for Nordic projects into a clearer strategic context. In order to meet this objective, regular top-level meetings of the Nordic research councils have been set up.

Basic research programmes.

All three of the (sub)-councils that made up what is now the Division of Culture and Society had previously run organised research programmes. The largest programmes with primarily basic research ambitions had been established within the framework of the so-called principal areas of effort in Norwegian research (from the 80s). NORAS ran the major programme for research in organisation and management (LOS-programme), and RSF and RHF worked with the cultural studies-area and research in the area of health and environment (HEMIL). These programmes were not set up by the sector ministries, but dealt with priorities in the Government's overall research strategy.

The Research Council of Norway was established, therefore, during a period when major efforts were being put into national priority areas. In the fields of the humanities and social sciences the Organisation and Management-area (LOS) created a new research centre in addition to several applied research programmes. The cultural studies programme was innovative in the field of humanities research initiating several cooperative projects and creating a sub-program supporting a more active dissemination of results.

An important part of the Culture and Society-strategy has been to continue the work of such basic research programmes. In this respect, the context of initiating research programmes is very different in the social sciences and in the humanities.

In the humanities, sector ministries have financed no applied research programmes. In this field programmes are initiated on the basis of a dialogue with the academic community and several smaller, but strategic, programme initiatives have been launched. These have been in fields in which either the level of activity was critically low, with a need for recruitment (e.g. classical studies), or there was a need to build up research competence in a particular field (e.g. library sciences, ICT, gender research). When the Cultural studies-programme came to an end in 1997 a new programme in the same field was launched (but with slightly different

priorities). This is now the largest and most important programme in the field of research in the humanities.

The situation in the social sciences has been somewhat different (see below) in that a number of programmes have been set up with financial support from the sector ministries. Nevertheless, the area has also responded to important initiatives taken by the academic community. The two most important initiatives are a research programme and research centre for studies of Europeanisation of the Nation-state, and a programme that continues to work on important problems from the LOS Programme, which came to an end in 1996.

With the reduction in block-grant from the Ministry of Research, one of the main priorities has been to support responsive-mode funding, and the potential for initiating programmes funded by non-earmarked grants therefore has been reduced.

Applied research programmes.

The third mode of funding is programmes for applied research. Programmes of this sort are established in financial collaboration with government ministries, a *modus operandi* that was developed by NORAS and continued by the new Council. This is also the background for dividing our operations between basic and applied research programmes. The mechanism of funding was a partnership between the Council that utilised funds from the Ministry of Education, Research and Church Affairs (KUF) and funds from one or more other ministries. The funding ministries were also given the opportunity to appoint their own representatives to the programme steering committees in addition to their representatives on the council of NORAS (this policy has come to an end, the board now has no representatives of ministries).

This mode of working is closely linked to the sector principle in Norwegian research funding, whereby each ministry finances both short- and long-term research within its own field of interest. The sector responsibility was exercised by the funding of programmes. For the representatives of the ministries, the programme boards were important arenas for contact with the research groups and Research council.

Who initiated these programmes? The NORAS Council would not establish programmes on its own initiative. Programmes were most often launched after negotiations between the council and one or several ministries. The initiative could be on either side. In the course of time, several programmes were prolonged for new periods, with the result that there was a considerable degree of continuity in the programme profile.

The first change that took place after the merger concerned the funding mechanism. The Ministry of Research introduced a policy whereby it to a less degree would allow the block grant to be used in co-funding with sectoral ministries. Instead, applied research programmes were to be financed as far as possible by the sector ministries themselves. This weakened the negotiating position of the Division of Culture and Society with respect to both the funding and control of programmes. While in the final year of NORAS, the share of funding provided by the Ministry was 30-40%, the Division now fund applied research programmes to the extent of only 5% of the total involved.

In spite of the changes that have taking place in funding mechanisms, the *modus operandi* itself remains relatively unchanged. Since the merger, a number of programmes addressing social and economic issues have been set up. In this way, we have built up and maintained a significant degree of expertise in applied social science research. While in 2001 we are

receiving NOK 80 million for social science from KUF, we also receive more than NOK 170 million in sectoral ministry funding for our programmes (the vast majority of it for social science).

The programmes for applied social science research support the large institute sector outside the universities to a greater extent than does responsive-mode funding. Many institutes thus receive significant project funds from the Research Council in addition to their core grant. At the same time, these institutes have also a high level of contract research activity. Since the merger of the research councils, we have strengthened our effort to engage the universities to a greater extent, and we have been able to increase their share of the total funding.

A central aim has been to develop an active dialogue with both researchers and research users, in order to establish important new fields of effort and to raise the level of funding for applied social research. Contact with high-level representatives from the ministries has been, and remains, a vital factor, because it is at this level that we find the key to funding such programmes.

In this field, the Division of Culture and Society has introduced certain new objectives. In the first place, we stress that the funding and control mechanisms may have a tendency to overemphasise research with short-term objectives and low theoretical ambitions. Secondly, this form of funding will also mean that a large number of (often small) programmes are set up. Many small programmes mean high administration costs and transaction costs in the research centres that need to orient themselves to several programmes. This situation also contributes to a fragmented programme structure while hindering the development and consolidation of good research groups.

In 1996-97 a strategy note was drawn up, setting out five goals (summary in English, appendix), addressing the fact that the non-earmarked grant has been reduced to a considerable degree in comparison with the total funding of research in the social sciences. This type of funding will have to be increased. In addition, more efforts must be put into ensuring an even stronger long-term perspective within the programmes financed by the sector ministries.

During the past three years we have continued the process of clarification of the objectives of this field:

1. Develop and implement guidelines for the programme management process in order to establish a common framework for the different programmes.
2. One of the main strategic objectives has been to strengthen the long-term focus in addition to a moving towards a modest concentration of resources in order to ensure the development of stronger research groups in specific fields of research. Other strategic objectives have included reinforcing support for international cooperation, both between the programmes themselves and, more often, at project level.
3. Introduce wide-ranging cooperation in research strategy and in particular, increase the level of funding made available by ministries which currently fund only limited amounts of research.

In sum, we may say that we are currently focusing most sharply on the development of the programme form itself, in order to be able to provide selected fields of research with powerful stimulation. At the same time, we are to a greater extent concentrating funding, thus serving

the development or consolidation of institutions or groups with a long-term involvement in their respective fields.

Core funding of research institutes.

The Norwegian institute sector consists of a number of institutes that are independent of the universities and colleges. (In 1999, 43 % of all social science research was carried out by the institute sector. More than half of the institutes deal with the social sciences. Under the previous system, NORAS was responsible for core grants for the relatively recently established institutes in the “regions”. These had often been founded as partner institutions for existing regional colleges. The other councils, which made up the Division of Culture and Society, did not have such a responsibility.

One of the first joint strategic processes implemented by the new Council concerned the development of a common terminology and a common framework for the allocation of core grants for institutes.

Since 1995, the Division of Culture and Society has been given steadily increasing authority within this area, with core grant responsibility for 19 institutes. This means dealing with annual applications for core grants, which according to the new regulations should consist of a basic and a strategic part. The new element is the strategic part, which is intended to support strategically important development of competence in each institute.

One important challenge that faces core funding has been that the institutes are only partially subject to public-sector rules and regulations. They were established on a decentralised basis and operate in a market for research and studies. The institutes thus differ in terms of their structure, methods of working, financial set-up, etc. At the same time, and for the same historical reasons, funding comes to the Division from a number of different ministries, which place various restrictions on how their funds are to be used. This has made it difficult to treat all the institutes in the same way and to draw up a common policy for this area. Only for the regional institutes has a common policy been possible. Here well-defined criteria for allocating basic and strategic funding within particular areas, have been drawn up and applied.

This has been an innovative and interesting process, and we are currently attempting to ensure that the general funding process will enable the Division to extend this system to all the institutes in its sector.

Another extremely wide-ranging area of effort since merger, has been that of carrying out evaluations of the institutes. NORAS had already started this process. The first step taken by the Division of Culture and Society in this regard was to establish a well-defined evaluation system, with the aim of evaluating groups of institutes on a six-year cycle. Three evaluations of groups of institutes have been completed, and these have provided the institutes and the council with an enriched knowledge base for improvements both in the institutes themselves as well contributing to the development of the Division’s institute policy.

As far as research infrastructure is concerned, the Division of Culture and Society owns the Norwegian Social Science Data Service (NSD), and a relatively large proportion of our non-earmarked funds from the Ministry goes to the core grant of NSD. In many ways this institution is a unique data archive in a European context and it plays an important role in the Norwegian social science system. The Division has also been financing a Data Centre for the

Humanities for several years, and for the past few years it has been involved in the question of an infrastructure for research on language technology.

In its latest budgetary proposals, the Division of Culture and Society has suggested increasing funding for infrastructure, and in 2001 two *ad hoc* committees will study potential main objectives for such an effort, as well as ways in which it could be organised.

Achievements and impact of the funding provided by the Division

The Research Council has always been regarded as a very important source of responsive funding for independent research projects. This is undoubtedly still the case, but the council's role in the field of disciplinary research has nevertheless been threatened by the reduction of our non-earmarked block grant. Budgetary cuts, and the priorities given to fellowships for doctoral students, narrowed the opportunities of well-established senior researchers. This is now in the course of changing. During the past few years we have announced calls for proposals that have been aimed directly at larger university projects involving both PhD-students and senior researchers.

Our basic research programmes have produced significant results. The ethics programme has been given a very positive evaluation. The KULT (Culture) Programme, and its successor, Cultural Studies, have produced significant results through their establishment of broad academic networks based on important research tasks. The smaller programmes have also made significant contributions in accordance with its specific target areas. The contributions of these programmes have been limited by budgetary constraints. We have smaller amounts of funding available than the previous councils, while the Division's field of responsibility has widened, with greater expectations and demands that research should also be carried out at the state colleges.

Our applied research programmes have increased in number and in the total spending. There is great interest in social science research related to various areas of policy, and the programmes have important networking functions also in forging closer links with the user community. The programme form is quite popular with the ministries and those programmes that have been evaluated have received good "grades". A considerable knowledge base in a wide range of policy-related research topics has been built up. Some aspects of this activity have been carried out in other divisions of the council. Other divisions of the Research Council finance more than 30% of all social science research. Important fields include health services research, research related to fisheries and agriculture, research on innovation and industrial relations, and environmental research.

The goals for change related to the Division's strategic and administrative practices have already been mentioned, and in this respect we can point to a number of achievements:

- We have launched a comprehensive restructuring of our programme activities via a toolbox of guidelines for programme management, which has the double aim of ensuring a common *modus operandi* for the programmes and of strengthening the strategic role of the programme boards.
- We have developed clearer aims and have implemented a radical restructuring of the way in which applications for support for independent projects are dealt with.

- We have developed an overarching system of priority criteria for allocating institute core grants.
- We have implemented a comprehensive system of institute and programme evaluations, and drawn up a system for evaluating disciplines.
- We have maintained a high level of confidence of the academic community in the Research Council and have established a process of close dialogue with representatives of research institutions.

Our vision for the next few years is as follows:

- To give research in the humanities and the social sciences greater significance, via both improved funding and better dissemination of results and contact between research and the community.
- To raise quality by placing greater emphasis on building up good research groups in individual disciplines and encouraging multidisciplinary research. This will require an increase in funding for independent research projects from the Ministry (non-earmarked funds) and more funds from ministries that do not currently support a great deal of research. Researchers will also need to become better at organising and managing projects. Institutions will have to improve the way in which they tackle their own financial circumstances. The Council should not award small amounts of funding.
- A system of organising programmes with fewer, more broadly defined programmes working on an even longer-term time-scale, with a sharper focus on building up research competence in strong groups and with an emphasis on input from research groups.
- Research that will continue to build up international cooperation and publish to a greater extent in international journals.
- A comprehensive, integrated institute policy at Divisional level, which assumes that most institutes will fall within the field of responsibility and funding of the Division, without too many strings attached.

1.3 Governance

1.3.1 Stakeholders

Our stakeholders are:

- The research community (which are organised in four distinct categories):
(Universities, colleges, the institute sector)
- Public authorities:
(The Ministry of Education, Research and Church Affairs, other ministries, other public authorities, local government, politicians)
- Organisations and industry.
- The general public.

Our primary stakeholders are researchers. All of our grants awarded goes to research groups, and a large proportion of our contact-maintenance activity is aimed at these groups. Academic disciplines are represented on our Board, all the members of our expert committees are active researchers, and at least half of the members of our programme boards are researchers. They also play a central role in various *ad hoc* committees. We have also set up regular contact meetings with research groups, both involving the Divisional Board (meetings with university leaders), the chairman of the board (faculty meetings, meetings with the college group, institute managers) as well as a large number of meetings between the staff of the Council and its stakeholders. The academic side is thus well represented in our decision-making bodies and is an important supplier of premises for our policy development.

The other important group is the authorities, which are primarily represented via various ministries. These supply the financial resources that we manage for research, and representatives of the ministries sit on our programme boards. We draw up budget proposals for each ministry within the framework of an overall proposal from the Research Council. In the process of drawing up and following up these proposals we maintain close contact with the ministries' representatives. We also hold contact meetings with representatives of the ministries and follow-ups vis-à-vis each individual ministry.

The third group consists of organisations; these are industrial organisations in particular, but also organisations in the voluntary sector. In programmes in which this is particularly relevant, the organisations are also represented.

The fourth stakeholder is the general public. This group naturally tends to be more weakly represented but a significant number of conferences and seminars are organised, to which representatives of the research user side are invited in addition to researchers themselves. We reach a considerable number of users via our conferences, general-interest dissemination efforts such as books and TV programmes, and via web-sites, newsletters and journals.

1.3.2 The role of the Divisional Board

The Divisional Board has general responsibility for the activity of the Division, but exercises this responsibility, as would a company board rather than as a traditional council in the previous research council structure. This means that the Board adopts objectives, strategies, allocates budgets to various groups of activity and checks that the activities of the Division take place in accordance with its decisions. The Board only exceptionally assumes responsibility for financial decisions at project level, and then only on the recommendation of a lower-level body.

The Board deals with a wide range of activities. In comparison with the “old” model, the current Board plays roles and carries out tasks that used to be performed by three different councils, which included representatives of a wide range of academic disciplines and public authorities. Today’s board has few members. Two of its seven members are from the research user side, while the other five represent various academic disciplines. A balance is maintained between the humanities and the social sciences.

The activities of the Division are organised through a large number of sub-committees, to which the Board has delegated authority. All the programme boards have the authority to fund projects on the basis of a programme plan and a budget agreed by the Divisional Board. The Divisional Board agrees the final allocation of funding for independent research projects, but academic peer groups have evaluated project proposals and scientific boards or panels have processed and prioritised them.

When new programmes are being launched the Board appoints planning groups. In some cases the Director appoints planning groups.

The Board meet from six to eight times a year and in the course of a year has about 80 to 100 items on the agenda. The relationship between the Board and the Division’s administration has changed with respect to the previous structure. The members of the Board have to exercise their functions via its meetings, and for this reason the administration must develop its professional and strategic competence to a much greater extent than the old model demanded. The administration always presents proposals for adoption by the Board.

The Board participates in certain aspects of the Division’s contact activities. The whole Board attends an annual meeting with one of Norway’s four universities, while the Chairman also takes part in a large number of meetings, both with representatives of the Division’s own sub-committees (programme boards, etc.) and with other parts of the research system (institutions). The Chairman also joins parts of the Research Council’s Board meetings (budget and strategy) and has her own meetings with the Chairman of the Board of the Research Council and with the Director General.

1.3.3 Mechanisms for forging links with other divisions

Contact with other divisions takes place in the following ways:

- Contact in dealing with cases which require coordination
- Contact in process organised as joint processes

- Contact at management level via the Director's participation in weekly director meetings
- Specific processes that involve interdivisional cooperation.

The Division maintains a very large network of contacts because the other divisions also retain responsibility for research in the social sciences (and the humanities) within their own fields. For the past few years, therefore, the Division of Culture and Society has prepared annual notes that describe the cases for which we require mutual information, cases that need to be coordinated, and cases on which we are cooperating (joint cases).

During the phase of establishing the new structure, a number of conflict situations arose regarding the division of work between the divisions. The level of conflict has now been significantly reduced, in part as a result of mutual flexibility but also due to clearer definitions of how the fields of responsibility should be divided up.

A new tendency, from the point of view of the Division, is that many of the initiatives for new programmes are taken in collaboration with one or more of the other divisions. During the past few years this has been the case with the following initiatives:

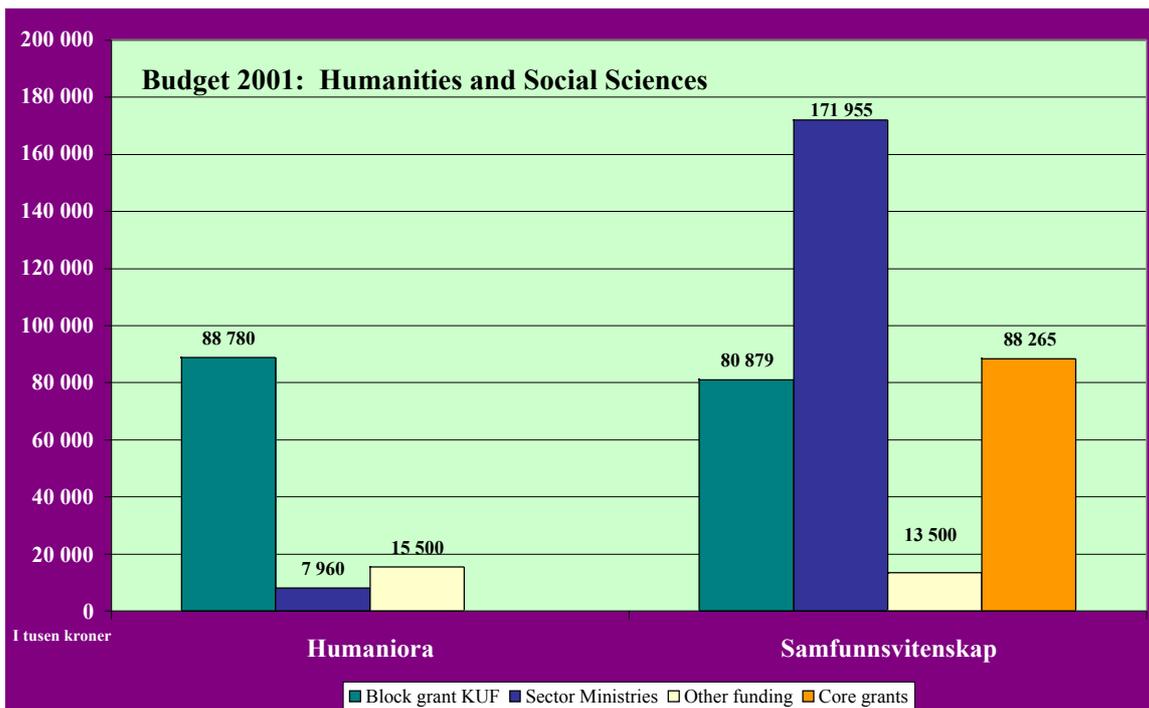
Research related to the innovation system
Ethics, biotechnology and society
Language technology
Research on working conditions

1.4 Portfolios of Activities in 2000/2001.

1.4.1 What are the main elements of the strategy?

The goal of the Division of Culture and Society is to support high quality research in the humanities and social sciences and address important cultural, social and economic issues. We do this both by supporting independent projects as well as research programmes. The programmes should both strengthen the science base and relevant policy issues.

The humanities are primarily financed by a block grant from the Ministry of Education, Research and Church Affairs, while the social sciences are partially financed by a block grant from the same Ministry, but primarily via earmarked funds from the sector ministries. The social sciences also receive a considerable amount of funding that is related to the financing of the social science institute sector. This financial structure means that these two general areas have rather different profiles from the scope of the various means of support channelled through the Division. The differences between various funding modes are due to the differences in the financing structure. This means that differences in the scope of the various funding modes are only partially a result of the Division's own priorities.



The scope of support for infrastructure has been determined by earmarked funds provided by the ministries. In allocating priorities to research projects vs. programmes, the Division has always given independent projects higher priority than programmes. This means that the Division's concerns have first and foremost been a matter of restoring and increasing the budget allocation for independent research projects. On the other hand, the Division has seen the necessity of relatively comprehensive programmes addressing critical challenges in society. This has corresponded to a strategy that has emphasised that basic research in the

humanities and social sciences should be strengthened simultaneously via support for independent projects and for specific basic research programmes.

In the general field of the social sciences, the Culture and Society Division operates a wide-ranging portfolio of applied research programmes. These have been developed in cooperation with the ministries and are primarily designed to provide answers to current needs for knowledge, but also, to a certain extent, to promote the long-term development of expertise. These programmes thus make up an important part of the Division's portfolio insofar as they contribute to fulfilling the aim of generating knowledge that can cast light on important problems and challenges facing society.

1.4.2 Responsive mode funding (independent projects)

The system for supporting independent projects is used to finance high quality projects initiated by researchers, i.e. projects that have the potential to contribute to the development of basic theory and methodology and to the academic renewal of the disciplines involved. In research of this sort, the topics studied are not under the control of the sources of finance. In the field of support for independent projects, financing may be sought for doctoral and post-doctoral fellowships, overseas fellowships, guest research fellowships and not least for large-scale projects that include several or all of these forms of support in one and the same project. Applications are accepted only once a year, on June 15, and replies are sent out in November or December. Until the processing of applications for 2001, applications for independent projects were evaluated and prioritised by 15 expert committees. Starting in 2002 such applications will be evaluated by external experts before they are given an overall evaluation and priority by one of three committees; one for the humanities, one for the social sciences, and a third for interdisciplinary research in both areas.

The volume of applications for support for independent projects has always been high. The percentage of rejections as a proportion of the total number of applications has been around 70 - 80%, while between 40 - 50% of the applications receiving the best grading has been awarded. This means a tough competition where several of the highest-ranking applications are not awarded. Funds for independent projects have largely awarded doctoral fellowships. In 1999 the proportion was 81%, in 2000 it was 70% and in 2001, 59%. The Division has followed a deliberate policy of reducing the scope of support for doctoral fellowships to a certain extent, and in their place financing more post-docs and larger, more wide-ranging projects. In 2000 135 person-years of doctoral fellowships and nine post-doc person-years were financed. In both areas, about half of the fellowships are awarded to women. Periods of study abroad are usually financed as elements of doctoral studentships and post-doctoral fellowships, but also as "free-standing" fellowships for senior researchers.

The allocation of resources among the different committees reflects the size of the discipline involved, the quality of the projects and their academic potential and more adhoc considerations relating to each discipline, e.g. the quantity of applications that they receive each year. The relative distribution of resources among the individual committees has been fairly stable for several years.

Sixty percent of the funding for independent research projects in social science goes to universities, 8% to colleges and 11% to research institutes. This pattern reflects the relative sizes of these sectors and their responsibility for basic research and the development of the

disciplines involved. The institute sector receives 11% of this type of funding because in certain areas of social research, notably sociology and economics, a considerable amount of basic research is done by the institute sector. In the humanities, 77% of the funding goes to universities, 8% to colleges and 2% to the institute sector. Once again, the distribution of funding among the different sectors is a reflection of their relative sizes and their responsibility for basic research and the development of the disciplines involved.

In the field of independent research projects, the Division also finances certain researcher-initiated efforts, which are evaluated by a specially appointed reference group. In 2000, this group dealt with studies of the science of knowledge, Ibsen Studies and Globalisation and Internationalisation. Efforts of this sort are intended to answer the need for larger-scale, well-defined research studies that do not require the researcher to be controlled by a programme committee.

1.4.3 Programmes.

The Division of Culture and Society runs two main types of programme, basic research programmes and action-oriented programmes. The first group is largely financed by a block grant from the Ministry of Education, Research and Church Affairs, and was set up to stimulate research in disciplines or topics that require special efforts for the development of theory or methodology. The Division is responsible for developing and organising action-oriented research capable of contributing useful knowledge for the development of society. Action-oriented research is generally dealt with via programmes that are largely financed by various sector Ministries. A great deal of emphasis is placed on cooperation with potential users of the results when programmes are being planned and implemented. Both basic research programmes and action-oriented programmes utilise the Research Council of Norway's general fellowship and support schemes. The programmes generally advertise their activities themselves.

In 2000, the Division of Culture and Society operated 27 programmes, 16 of which were categorised as action-oriented, one as user-controlled and the remainder as basic research programmes. Several research programmes are neither purely basic research nor applied research. Four programmes can be regarded as pure humanities programmes, while a further four involves both fields.

In 2000, the Division's programmes had a total budget of NOK 234 million. The size of the programmes varies from three to about 40 MNOK, while the level normally lies between 5 and 10 MNOK. In 2000, the programmes funded 131 doctoral fellowships, of which 34 were in the humanities. In the social sciences nearly twice as many doctoral fellowships are financed as part of the programmes as via independent research projects. In the humanities, the opposite is the case.

In 2000, in the social sciences programmes 28% of funding went to universities, 15% to colleges and 53% to the institute sector, while in the humanities, 69% went to universities, 11% to colleges and 6% to institutes. The difference between the two areas reflects the institutional structures involved in the two areas. The more applied and action-oriented character of the research programmes is also clearly reflected in the institutes' share of funding.

The table below shows how the various programmes of the Division support the different thematic priorities. It also shows how other individual activities in the Division of Culture and Society, which are not organised as programmes, support the same thematic set of priorities.

Thematic priorities	Ministries	Programme	Budget and period					
			2000	2001	2002	2003	2004	2005
The nation-state, democracy and globalisation								
AAD, UD, KRD,	KUF, KRD	International migration and ethnic relations	7 000	7 000				
	KUF, AAD, UD	Europeanisation of the nation state	7 000	7 000	7 000	7 000		
	KUF	Globalisation and internationalisation	10 000	10 000	10 000	10 000	10 000	
	AAD	Power and democracy	11 000	11 000	11 000	11 000		
	UD	Human rights and private enterprise		2 000	2 000	2 000		
Living conditions, growth and processes of marginalisation								
			2000	2001	2002	2003	2004	2005
BFD, SHD, JD, KRD	LD, AAD	Living conditions and changes in agriculture	9 000	6 000				
	KRD, MD	Housing and living conditions	4 000	4 000	4 000			
	KUF	Evaluations of the 1997 educational reform	6 500	6 500		6 500		
	KUF, SHD, BFD, JD, AAD	Welfare and Society	45 000	45 000	45 000	45 000	45 000	
Competence, education and working life								
			2000	2001	2002	2003	2004	2005
KUF, NHD,	KUF, NHD	Education, competence and wealth creation	11 000	11 000	11 000			
	KUF	Professional studies	6 000	6 000	6 000	6 000		
	NHD	BU-2000		4 000	4 000	4 000	4 000	4 000
Creation of value and the development of the public sector								
			2000	2001	2002	2003	2004	2005
AAD, KRD	KUF, AAD	Governance in Public Sector	10 000	10 000	10 000			
	KUF, KRD, MD	The local government law	6 000	6 000	6 000			
Technology development, the media and societal change								
			2000	2001	2002	2003	2004	2005
KUF, SD, NHD	KUF	Science studies	2 000	2 000				
	KUF, NHD, SD, AAD	Information and communication technology	12 000	12 000	12 000			
	LD, NHD, KUF,	Ethics, biotechnology and society		4 000	4 000	4 000	4 000	4 000
	KD	Linguistics and technology		2 000	2 000	2 000	2 000	2 000
Innovation, employment and markets								
			2000	2001	2002	2003	2004	2005
NHD, FIN,	NHD, LD, OED, MD, FIN	Employment and labour market	7 000	7 000				
	KUF, NHD, FIN, AAD	Trade, industry, finance and the market	6 000	6 000	6 000			
	NHD, LD	Travel and tourism	9 000	9 000	9 000			
	FIN	Economy and taxation	3 000	3 000	3 000	3 000		
	KRD, MD, LD, FIN, SD	Regional development	7 000	7 000	7 000	7 000		
	MD, SD,	City and society	6 000	6 000	6 000	6 000	6 000	
	OED	Petroleum policy		7 000	7 000	7 000	7 000	7 000
	FIN, JD	Economic crime		5 000	5 000	5 000	5 000	5 000
Culture, ethics and civil society								
			2000	2001	2002	2003	2004	2005
KUF, KD, BFD	KUF, KD	Classical studies	4 000	4 000				
	KUF	Ethics	5 000	2 500				
	KUF	Library research programme	3 000	3 000				
	KUF, BFD	Gender research	6 000	6 000				
	KUF, KD	Cultural studies	14 000	14 000	14 000			
	KUF, KD	Ibsenstudies	2 000	2 000	2 000	2 000	2 000	2 000
	KD	Sports and society	7 500	7 500	7 500	7 500	7 500	7 500
	KUF	Lapp studies		4 000	4 000	4 000	4 000	4 000

The nation-state, democracy and globalisation

Society is facing the challenge of growing internationalisation and globalisation. Important areas of research include how the EU and other European cooperative organs affect the most important functions and institutions of nation-states. What are the consequences for Norway of immigration to this country and how are relationships developing between Norwegians and immigrants? How is globalisation demanding new perspectives on culture, society and industrial development? How democratic institutions can be preserved and developed in the course of such a process of development is another central challenge.

Living conditions, growth and processes of marginalisation

The welfare system is facing major economic, organisational, democratic and personal challenges. Important knowledge challenges are related to the development of welfare policy and welfare systems. Important areas of research include how the welfare state, markets and civil society affect the life of the individual. How do changes in family structure affect the living conditions of children and young people, their growth and life-styles, and how can society affect the living situation of marginalised groups.

Competence, education and working life.

The development of competence and the guardianship of knowledge make up a growing and important challenge to society and working life. The knowledge management system itself is undergoing a process of change. While the formal educational and research system has long played a dominant role in the development of knowledge, now knowledge often is produced

in a context of application. The division between education and work is becoming less distinct, as is that between work and leisure.

Creation of value and the development of the public sector

The internationalisation of the economy, new technology and new types of organisation are changing the general conditions under which the public sector and working life in general operate. Core research tasks are related to modernisation and restructuring. The use of new technology, in planning, improving efficiency, management of organisations and the consequences for formal organisation and democratic development are all important topics. Others include the choice of tasks that the public sector ought to perform itself, what should be the special characteristics of the public sector's core tasks, and the division of work between the public and private sectors.

Technology development, the media and societal change

The rate of change in the development, for example, of biotechnology, information and communications technology, and transportation technology will present society with important challenges in the near future. Central tasks for research are related to the consequences of the merger of the telecommunications, data and media sectors for education, patterns of consumption, leisure habits and communications. The ethical and social aspects of the use of biotechnology will have to be elucidated. Language technology research related to IT will have an important potential range of applications, and there is a need for research that will make a range of variants of written and spoken Norwegian accessible to computer processing. Growing mobility is making great demands of efficient, environmentally friendly transport technology, and this will require research on how an integrated land-use and transport policy can be developed. An important task will be studying the relationship between efficient transport, land-use policy and environmental considerations.

Innovation, employment and markets

Industrial and innovation policies are facing significant challenges in connection with changes in the technological and market frame conditions, the growing scarcity of qualified workers, changes in competence requirements and falling growth impulses from the petroleum sector. Policy design and the application of measures in this field will have to be adapted to changes in, and understanding of, the general conditions. There is a need to strengthen the theoretical and empirical bases for decision-making in the field of industrial and innovation policy. There is a particular need for a clearer understanding of the frame conditions required for greater creation of value, in particular the relationships between industrial development, innovation, the processes involved in economic growth and the efficient utilisation of resources. Central requirements for research in the future relate to globalisation, a tighter labour market, the organisation of working life, changes in technological developments, in particular ICT, competence requirements and types of organisation, exclusion from working life and social security benefits, and the need for an immigrant work-force.

Culture, ethics and civil society

The cultural differentiation in modern society is challenging important institutions such as our language, the Church, education, research, sport, the media and art. Central research tasks are related to how such cultural institutions develop, both with respect to encouraging pluralism and greater cultural participation, and in relation to how these same institutions are liable to be affected by cultural standardisation, a tendency to "usefulness" and cultural marginalisation.

1.4.4 Core grants

The social science institute sector comprises a total of 27 institutes, and the Division is responsible for allocating basic grants to 19 of these institutes. 'The Division receives funds for basic grants for specific institutes from four different ministries. The basic grant is divided between the grant itself and the strategic institute programmes (SIP). In 2000 the total budget for these grants came to MNOK 78.084.

The way in which the Research Council allocates its basic funding is of decisive importance for the development of the institutes, since in this process lies the responsibility for encouraging the growth of strong research milieus, via:

- Performing regular evaluations of the activities of the institutes, where the results of the evaluations are utilised in connection with criteria for allocating the basic grant.
- Allocating basic grants on the basis of fixed criteria. For the regional institutes, a model has been developed in which emphasis is placed on the number of man-years of research performed, criteria for research and researcher quality, and internationalisation.
- Contributing to the development of the position of the institutes and to their adaptation to developments in industry and society in general, e.g. via strategic efforts that promote user participation and cooperation with other support measures.
- Strengthening the ability of the institutes to develop core areas in order to achieve a greater degree of division of work at national level and more cooperation with the university and college sector.

Via the process of allocating basic funds, the Research Council of Norway follows up developments both within the sector and in each individual institute. Dialogue meetings with the leaders of institutes, systematic evaluations, annual reports and strategic institute programmes are measures that enable the Research Council to improve the quality of research, recruitment, cooperative relationships and an appropriate division of work.

In line with the Guidelines for the National Financing of Research Institutes, funds have been allocated for basic grants and strategic institute programmes. As a basis for making its allocations, the Research Council obtains professional evaluations from external sources of expertise and from two basic funding committees, one for the foreign policy institutes and one for the remainder.

When basic grants are being allocated, evaluations are made on the basis of conditions that will reward scientific quality. For the regional institutes, a model has been developed that emphasises the number of man-years of research performed, criteria for research and researcher quality, and internationalisation. The strategic institute programmes are evaluated on the basis of well-defined criteria and in competition within the framework of earmarked allocations. As far as possible, we have also attempted to achieve a degree of levelling of support within this sector. More attention was paid to the strategic institute programmes in 2000.

The Division of Culture and Society bases its funding of strategic institute programmes on scientific and strategic criteria. In the course of the strategic evaluation, particular emphasis is placed on institutes' thematic, professional and organisational qualities, while the evaluation of research is made on the basis of scientific quality criteria similar to those employed in evaluating ordinary research projects. Emphasis is placed on the idea that strategic institute programmes should encourage the development of core areas of expertise within institutes, and that there should not be an unnecessary degree of overlap with corresponding areas in other institutes.

Since 1997, key data on the activities of the institutes has been collected. These data now provide us with four years of systematic key information that illustrates how a number of factors at the institutes have developed. In 2000, a committee appointed by the Division evaluated a group of four institutes. This means that in the course of the past ten years the Research Council has carried out evaluations of all the institutes that receive basic funding from the Division of Culture and Society. At the same time the institute evaluations performed between 1995 and 1999 have been assessed. The material from these evaluations and the key figures provides important basic information for the evaluation of basic grants and the development of this sector.

1.4.5 Miscellaneous R & D

Under the heading of miscellaneous R & D the Division of Culture and Society finances activities that are primarily intended to implement parts of our strategy in the field of international research cooperation, publication, evaluation and researcher training.

The Division is represented on the European Science Foundation (ESF), participates in a number of COST programmes and in the Luxembourg Income Study (LIS) databank. The Division is an active participant in the Nordic cooperative committees in the humanities and social sciences. Organised international cooperation also includes contact with the French la Maison des Sciences de l'Homme, participation in SCANCOR at Stanford University and cooperation with the European University Institute. Funds have also been set aside for pilot projects in connection with applications to the EU's framework programmes, and for improving contacts and setting up networks in relation to the COST programmes. Most international research cooperation takes place on the basis of direct personal collaboration in programmes and expert committees.

1.5 The structure of the Division and the functions of its departments

The Administration of the Division of Culture and Society consists of four departments and one staff unit. The departments are organised on the basis of a combination of responsibilities for disciplines and fields of research, primarily activities in the fields of independent research projects and programmes. All the departments are responsible for developing, initiating and implementing measures that encourage research within their particular disciplines and areas of research. Strategic tasks related to disciplines and areas of research are the responsibilities of the departments. Tasks of this sort may be either permanent or temporary in nature.

Responsibility for the three committees in the field of independent research projects is organised in this way. Staff is responsible for the institute sector and for coordinating budgets, accounting procedures and reporting. The director's secretary is also a member of Staff. The departmental structure does not correspond to the main budgetary structure, i.e. to the funding allocation structure. This means that the departmental organisation is not a structuring principle relative to the allocation of research funds, but is first and foremost organised in such a way as to create a working environment for closely related disciplines and fields of research.

The following paragraphs offer a brief description of the areas of responsibility of the individual departments.

One department ("kompetanseavdelingen") has responsibility for tasks related to philology and language, ideas, and educational research. The task of the department is to develop research related to the relationship between competence, education and the creation of value.

The second department ("samfunnsavdelingen") is responsible for tasks particularly related to sociology, government and history. The department develops research related to welfare, growth and the family, and to the development of the public sector and challenges related to power and democracy.

The third department ("kulturavdelingen") has responsibility for tasks related to art and literature, as well as archaeology, ethnology and social anthropology. The department is responsible for research on culture in the widest sense of the term; thus, core research tasks are related to media and sports research and research on intercultural conflict, cultural understanding and the multicultural society.

The fourth department ("næringsavdelingen") is responsible for tasks related to economics, innovation, industry, markets and interactions between the public and private sectors. The primary aim of research in these areas is to develop a knowledge base on technological change and industrial and innovation policy. Research tasks are industrially oriented, and their target groups are public authorities and industrial organisations, and in special cases, companies.

Departmental managers lead the departments. Staff personnel report directly to the Director of the Division. Departmental managers are responsible for coordinating the work of the departments, and they participate in the weekly management meetings and in the meetings of the Board of the Division. Departmental managers also take part in many of the meetings that

are organised as part of the work of their departments' programmes. Departmental managers have particular responsibility for strategic development within their areas of responsibility, and they contribute most, besides the director, to the design of the Division's strategy. The departmental managers also have responsibility for maintaining contact with ministries within their areas of responsibility and for contact with relevant external research institutions and organisations on matters of research policy.

Advisers are responsible for a limited number of programmes, disciplines and other activities. Responsibility for programmes implies coordinating responsibility for the activities of the area in question. This means having responsibility for providing suitable conditions for the work of developing programme plans, advertising research funds, processing applications, budgetary and financial control, strategic development, information and dissemination, reporting and, not least, preparing applications for the Board. Authority to allocate funds has been delegated to the Board, so that advisers merely prepare matters for project allocations decisions to be taken by the Board. In certain cases responsibility for coordinating a programme may be given to a person who is not employed by the Research Council. In such cases, advisers are merely contact persons with respect to the programme involved. In major programmes, research managers are often employed in part-time positions, primarily in order to contribute to the academic running of the programme.

Responsibility for academic disciplines is primarily related to the work of supporting independent research projects. This primarily involves maintaining contact with scientific groups, processing applications, budgetary and financial control and reporting. An important part of this responsibility consists of carrying out the general processing of applications for each discipline, such that the expert committees are suitably prepared to evaluate and prioritise applications relative to the strategic variables set out by the Divisional Board.

In addition to processing applications, reporting and running programmes, special advisers have the main responsibility for developing international cooperation with the EU, NOS, COST and the ESF.

1.6 Brief explanation of the programme and project management process

The launch, implementation and completion of programmes are a considerable part of the activities of the Division of Culture and Society. In order to ease the work of the management team and the programme boards, a set of guidelines for running programmes have been established. These guidelines set out unambiguous standards for the tasks and work processes involved in the programmes. The following paragraphs offer a short description of the programme and project management process as this should be implemented, according to the guidelines.

Programme boards are normally expected to place an open advertisement when a large proportion of the available funding is advertised at the start of a programme. Limited invitations are only to be offered when funding is limited and it is quite clear which research groups are possible candidates for funding. Limited invitations may also be sent out if strategic considerations suggest that particular types of institution and/or groups with a particular profile of expertise should be drawn into the process. However, the general principle is that of open invitation. The programmes are supposed to use common closing dates for applications.

The general rule is that complete applications should be submitted; however programme boards may choose between inviting researchers to submit outline projects in the first instance or submitting detailed applications. An outline phase has the objective of limiting the amount of work that applicants need to put into producing applications. Such an outline should run to one or two pages and offer a brief description of the problem, theoretical aspects, and methodology and data sources. A complete application should run to 10 pages in addition to CVs and a list of publications.

The members of the programme board or external experts evaluate applications in accordance with the following criteria:

- Academic management and project organisation
- Scientific quality, originality and importance
- Contributions of the research group
- Usefulness and relevance to culture, society and industry
- Budget, milestones and progress plan
- Candidates for fellowships.

The evaluation should take into account whether the project manager has the necessary knowledge and competence in the area of research, in national and international terms, whether the project is well organised, and whether the project manager is capable of leading the project in a suitable way. The contribution of the research group in the shape of other types of expertise, resources and infrastructure should be evaluated, as should the question of whether the research group has a sufficiently wide international contact network. Academic quality, originality and importance should be evaluated with regard to how the problems and methods are described, and to whether the project will generate new original knowledge or important progress within the field of research concerned. The relevance of the project vis-à-vis the programme is a central criterion. Finally, the programme board should consider whether the budget, milestones and progress plan are realistic in terms of the goals of the project.

In some cases, the programme coordinator or research manager should draw up a proposal for a recommendation to be dealt with by the programme board. When project outlines are being processed, selected projects should be allowed to submit complete applications. In dealing with complete applications, the programme board should draw up a prioritised list of applications in order to separate the applications that are to be funded from those that will not receive funding. The programme boards have the authority to allocate funds. This prioritisation is primarily based on the quality assessment of the individual project, but the programme board should also take into account considerations of research strategy with respect to recruitment needs, institutional and subject profile and coverage within the programme. Applications that receive funding should be evaluated annually throughout the course of the programme. Applications that are turned down should be given reasons for their rejection in line with given guidelines.

In addition to their role in processing applications, programme boards have a relatively large amount of activity in the field of dissemination and conferences.

Applications for independent research projects must be submitted by the general closing date of June 15, which is used by the whole Research Council. Applications are distributed to the appropriate committee by a process including a well-regulated collaboration with other divisions of the Research Council. Applications used to be processed by 15 disciplinary panels, each responsible for drawing up a set of recommendations for the Divisional Board. Applications were sent to expert referees only in rare cases. The Divisional Board had already provided strategic guidelines regarding the priorities to be observed by individual committees. The expert committees were not empowered to award grants, these decisions being taken by the Divisional Board. The new system means that each application submitted will be peer reviewed by external experts. On the basis of these reviews, the three committees will carry out a final evaluation and an overall prioritisation. The Divisional Board also provides these committees with strategic guidelines.

Summary

Background

Social science research has become increasingly important, playing an ever more central role in recent decades. The scope of social science research has expanded steadily, gaining correspondingly more importance for the public, the shaping of public policy and the authorities. This raises legitimate questions about the quality of social science research, the benefits derived from it, and how and the extent to which priority is given to social science research.

The ministries have developed a strong commitment to social science research, recognising a tremendous need to continue developing public services and the public sector more generally, and for producing knowledge for other sectors of society. Since the establishment of the Research Council of Norway, the ministries have posed the question of how the Research Council, given its far-reaching responsibilities, will deal with social science research.

The strong demand for social science research poses challenges to the research community with a view to developing theories and methods to ensure professional quality. Parallel to this, research communities have experienced that there is less funding available for independent, fundamental research, despite the fact that the institutions, particularly the universities, have been granted larger budgets in return for accepting more students. This is related to a pronounced reduction in Research Council funding for basic research at the same time as there is still a demand for thematic programmes and contract-based social science research. Despite the large number of research groups, the funding opportunities for long-term and researcher-initiated research reduced.

The challenges facing social science research must be understood in relation to the nature of social science, the way the research system works and the players' roles and responsibilities in terms of using and funding social science research. Professional and research policy co-operation on social science research must be developed further to deal with the fragmented, sectoralised responsibility for providing general parameters for social science research. The Research Council will reinforce its co-ordinating role in shaping and implementing a strategy for social science research.

The strategy memo identifies important areas requiring measures:

1 Basic, long-term research must be given more priority

Social science research must be used actively as a source of knowledge for politicians and civil servants, and there must be considerable activity in the university and college sector and throughout an extensive institute sector. However, the Research Council's funding for independent research has been reduced in both absolute and relative terms. There is an imbalance between funding for independent research and funding for research programmes and other theme-oriented social science research. Many social scientists are hired on short-term contracts and for time-limited studies. To ensure high-quality research, more attention must be devoted to developing the disciplines and to basic long-term research.

A number of measures have been identified:

- Support for independent projects must be increased to reinforce the development of the disciplines and to facilitate more theory-driven research.
- The research institutions, particularly the universities, must implement measures which ensure more effective utilisation of the basic resources.
- The Research Council will work more strategically in respect of the university and college sector, for example, by developing the basic knowledge needed to select policy instruments and through strategic university programmes designed to reinforce knowledge production and high-priority thematic areas.
- Action-oriented programme efforts primarily funded by the ministries must continue to make significant contributions to fundamental research, for example, by supporting post-graduate level education. Programme administration will be improved, as will the interaction between support for independent projects and programmes to ensure high professional quality.

2 Social science research should take a more interdisciplinary approach, co-operating more actively with the organisations and industry

Social science research is becoming increasingly important. A complex society in the throes of rapid change has a continuous need for knowledge about social conditions and social and cultural processes. Social science research has often been publicly funded, with the authorities as the most important user group, apart from the general public. Accordingly, it is a challenge to bring different players and public interest groups together to actively initiate and use social science research. It will be of particular interest to conduct more research in the interface between different subjects and disciplines, for example, between social science and the humanities, medicine, technology and environmental subjects, respectively.

- Culture and Society will draw up a plan of action for research on innovation processes which will pave the way for more assiduous efforts in this field, including inter- and multi-disciplinary efforts.
- The efforts to develop closer collaboration between the social sciences and the humanities will continue.
- Efforts will be made to establish more active collaboration with enterprises and industrial institutions to promote more use of social science, for example, in

relation to enterprises' business strategies and in studies of long-term parameters and institutional conditions.

- Social science studies that focus on the development of technology will be strengthened, both in terms of the parameters that apply to the application of new technology and the socio-cultural consequences of such use.
- Culture and Society will assume responsibility for initiating more regular, systematic contact between the divisions of the Research Council regarding social science and interdisciplinary research initiatives, for example, with those involved in research on health services.

3 Sectoral responsibility for research must be further developed, and sectorally-funded research must be guaranteed a long-term perspective and independence

Sectoral responsibility is a central principle in Norwegian research policy. This entails that R&D is to be an integral part of general sector policy. Thus, there is latitude for considerable variation. Nonetheless, the Research Council holds the view that several sectors could benefit greatly from getting more involved, and that all the ministries ought to work with research more systematically.

- Each ministry ought to draw up an overall assessment of its research activities, e.g. through the preparation of R&D plans by sector.
- More application of research can be encouraged through measures to improve user skills. The Research Council would like to reinforce its meeting place function to achieve this.
- Multi-sectoral collaboration on research must be improved, e.g. through the ministries' research committees. The Research Council will continue working to develop programmes/projects with participants and interest groups from several sectoral ministries. The proposed budget will be an appropriate point of departure for multi-sectoral discussions.
- The Research Council will reinforce its advisory function in respect of the ministries when it comes to preparing sectoral analyses and R&D plans, developing research efforts and, generally, in relation to the initiation and application of research.
- Co-operation between the Research Council and the sectoral ministries will ensure action-oriented research with considerable independence, aimed primarily at long-term knowledge objectives. The Research Council will continue to promote its own priorities through the use of general research funding for action-oriented research.

4 The policy in respect of institutions must be strengthened to ensure core areas, a long-term perspective and a better distribution of responsibilities

There are many research institutions involved in social science research in Norway. The research requires a modest infrastructure and social science issues can be raised in all sectors. Although there will always be many institutions in this field, it is still

important that the institutions follow a pattern. An overly fragmented and overly complex pattern can lead to too few research groups operating under parameters that can ensure high-quality. Important measures will include:

- Given more responsibility for institute core grants, the Research Council will actively strive to reinforce the knowledge base for the pursuit of an institute policy, which promotes strong research communities with the ability to assume long-term responsibilities in their fields.
- All research funding should be considered in the light of how to promote expedient parameters and infrastructure with a division of responsibility that guarantees a long-term perspective and high quality. The role of the programmes within the context of institute policy must be further developed.
- Universities, colleges and institutes alike must assume considerable responsibility for ensuring research concentrations, a long-term perspective and independence.
- The Research Council is establishing a scheme for ongoing evaluations of the institutes. The evaluations will encourage improved quality among the research communities, and will also be used as the basis for institute policy measures, e.g. the awarding of core grants.
- The Research Council will continue working to determine how strategic allocations can be used in institute policy.

5 The Research Council must reinforce its strategic and co-ordinating role

The complexity of the institutional and funding pattern calls for a strong co-ordinating player with funding, advisory and strategic responsibility. The Research Council must therefore play a stronger role in the overall picture. The Research Council must enhance in-house co-operation to achieve more targeted, co-ordinated social science research.

- The Research Council will take the initiative to reinforce the knowledge base for strategic development and setting priorities in the field of social science research, thus also reinforcing its advisory role.
- The Research Council will assume special responsibility for managing quality standards, quality assurance and evaluations.
- The work of integrating social science perspectives into the various divisions' programmes will be reinforced, and improvements will be made in the co-ordination of such programmes. Annual co-ordinating meetings will be organised between divisions and better routines will be developed for collaboration on social science research, e.g. better documentation across the divisions, collaboration on the processing of applications and more effective exchanges of information and experience.

Summary

Strategy for Culture and Society (June 1996)

Main objectives

Culture and Society will contribute to comprehensive research in the humanities and social sciences, acknowledging these areas as key sources of enhanced cognition and cultural understanding, and as bases for achieving individual and social objectives.

Culture and Society's responsibilities cover both basic and applied research. The Division is responsible for all disciplines in the humanities and social sciences. Furthermore, the Division has a broadly based responsibility for strategic basic and action-oriented (?) research in relation to key challenges facing scientific knowledge within society.

The challenges are:

- Contributing to high-quality research.
- Developing the disciplines through recruitment measures and grants for independent projects.
- Serving as a meeting place and providing advisory services.
- Help in identifying research needs and implementing action-oriented programme
- Campaigns.
- More effectively exploiting the opportunities inherent in close interaction between cultural and social science research.
- Contributing to the prudent development of research institutions within the framework of an expedient national distribution of responsibilities.
- Help ensuring that research has a range of international network and more effectively exploit opportunities for specific research co-operation.
- Contributing to comprehensive dissemination of information to the general public and users, and ensuring the prudent application of research results.

Major priorities and target areas

Enhancing basic research and international research co-operation, and improving conditions for the units that perform research

- Enhancing research in the humanities and basic social science research by supporting independent projects and research programmes.
- Elucidating the training situation in the humanities and social science research and clarifying the Research Council's part in the training of researchers.
- Laying the foundation for expedient international research co-operation.
- Help ensuring research institutes to maintain a high professional level, an adequate funding, the capacity needed to handle assignments, and integration into the national R&D system.

Meeting place and advisory services

Enhancing advisory services and the role as a meeting place and developing good interactive relations with the ministries, the research institutions and organisations.

Thematic programmes/campaigns

Continuing programme campaigns in the field of humanities research, for example, by focusing on cultural studies, including research on the multi-cultural society. A cultural studies programme should also develop applied research, emphasising the dissemination of results.

Continuing to pursue and enhance research on democracy at the local, national and international levels, especially democracy as related to processes of integration in Europe.

Continuing comprehensive research on standard of living, social welfare and quality of life, and shed light on marginalisation processes and promote research on living conditions for children, youths and families.

Enhancing research on knowledge development and -management as key factors in social development and production.

Contributing to comprehensive research efforts focused on the development of the public sector, including the production of public services.

Striving to increase research on the information society and on the cultural and social prerequisites for the development of technology.

Enhancing social science research aimed at economic development, e.g. through a plan of action for industrial social science research.

Most important policy instruments

Culture and Society's policy instruments include advice on research policy, the establishment of meeting places for researchers and users, the management of independent funding for basic research, and the initiation and implementation of applied research programmes. The Division also takes part in international organisations. Strategic efforts will be intensified.

The Division will pursue an active dialogue with the university and college sector to develop policy instruments, responsibilities and institute policy, and to enhance evaluation work. The Division will also develop a dialogue with the ministries regarding prioritising assigned research tasks, the implementation of programmes and the dissemination of results.

Partners

Culture and Society will co-operate actively with the other divisions of the Research Council. Culture and Society also work with the university and college sector, the institute sector, the ministries, particularly the Ministry of Education, Research and Church Affairs, the municipal sector and a number of special interest organisations.

Environment and Development Division
Briefing material for Divisional Review

The Environment and Development Division (ED) of the Research Council of Norway (RCN)

1. History, Scope and Changes in the Division

1.1 *A historical description of the situation before the Division and RCN were set up, focusing on the strengths and weaknesses of the different systems*

The establishment of ED originated from a situation in the former research council system, in which E & D issues had been insufficiently taken care of during the 1970's and 1980's, developing later in an improved but still not fully satisfying way by national committees and dedicated campaigns since 1988.

During the 1980's, the Ministry of Environment (MoE) had argued for a new Norwegian research council, dedicated to environmental research, due to a growing discontent with the existing research councils' handling of environmental issues. The political situation at that time, however, did not allow for another research council, and a substitute or compromise was found in a National Committee for Environmental Research (NCER), organised under one of the Councils (NAVF), but with connections to the other four councils. The Committee (1988-93) was founded as a follow-up of a White Paper on Environmental research in 1998 (St.meld. 49 (1986-87) *Om miljøvernforskning*), which in turn was one of the follow-ups of the Brundtland Commission. Other contemporary white papers (i.e. St. meld. 28 (1988-89) and 46 (1988-89)) confirmed environmental research as a national priority area.

NCER represented an improvement as compared to the previous system during:

- removal of a system with research fundings directly from different MoE departments to the researchers
- increased distance between research and governmental management
- improved possibility to view environmental research in a holistic perspective, at least regarding research funded by MoE
- more professionalised research management

Weaknesses in the NCER system could be summarised as follows:

- The Committee was not a "full" research council, with lesser legitimacy than necessary and at times conflicts with the other research councils, partly because of disagreement in the Committee construction, which also included change in power.
- too little agreement between mandate, means and instruments.
- too little authority of its own for decisionmaking
- little capability and authority to address other ministries than MoE

Parallel to NCER, the "Research Councils' Cooperation Committee" decided to launch a new 5-year (1991-95) campaign, specifically dedicated to the follow up of the Brundtland Commission report, involving all the research councils, on different topics related to *Economy and ecology*. This campaign was funded jointly by all the "mother ministries" of the research councils.

In 1988 The Ministry of Culture appointed a committee with the responsibility for arranging a research policy conference on environment and development. Later the same year NAVF was given the responsibility for the follow up of the research challenges identified in the Brundtland Commission Report, in collaboration with the other research councils. In 1988 the NAVF Board appointed *The steering committee for environment and development* – SMU. The committee functioned for a four-year period with a total budget of an about Nok 48 mill. One of its main functions was to co-ordinate research initiatives from the various divisions of NAVF and from the other research councils and to promote innovative research within and across disciplinary borders. Main instruments for research promotion were support to research projects and process-oriented and institutional support mechanisms. Mention should be made of the 5 centres for environment and development at the four universities and the Agricultural University at Ås that were established at the initiative of SMU. ED has collaborated with these centres since 1993.

Through the 1970s and 1980s there were lively discussions in Norway related to the organisation and financing of development research. Several university- and research council-reports dealt with these issues. They all proposed different mechanisms for strengthening the field, the most pronounced being to establish a separate council for development research. The *Swift-committee*, invited by NAVF to present a strategy for Norwegian development research, recommended that a special committee for development research be established (1987). The Norwegian Parliament, when debating the Government's White paper on *Development research related to developing countries* (St.meld.nr. 42 (1987 –88) agreed to the Government's proposal to establish a *National committee for development research* - NAU. This was in fact the first time that development research was discussed by Parliament as a research field in its own right, and not as part of policy debates on development co-operation. Development research was by this accepted as part of the responsibility of the ordinary research policy authorities. The National Committee was established by NAVF in February 1989 and functioned until 31 December 1993.

In addition to these activities, some environmental as well as developmental oriented programmes were carried out as part of the ordinary portfolio of the different research council, both before and after the launch of the campaigns and committees mentioned above.

All these campaigns and committees reflect a system of new research needs that the existing research council system could not handle appropriately, thus leading to an increased number of ad hoc committee solutions by the late 1980's and early 1990's. It was due time and general agreement of the need to improve and tidy up the research council system in Norway.

The Grøholt Commission (see NOU 1991:24) originally suggested one new research council, consisting of three divisions, in which environmental research should be organised together with biological sciences (including fisheries and agriculture) and health, thus taking due care of the environmental issues, but probably in a mostly natural sciences context. However, this proposal did not or only to a limited degree address developmental issues and the relationship to the developing countries.

The launch of the Research Council in 1993 completed the development of a research council system, acknowledging the current and accumulated urge for a research council addressing the scientific needs and political priorities of most sectorial ministries, including both MoE and Ministry of Foreign Affairs (MFA), in an integrated way. The need for ED was described in a White Paper in 1992 (St. meld. 43 (1991-92)) as:

ED is a vital area in terms of science, politics and society. Research in this area greatly demands multidisciplinary and new scientific connections, in particular between natural and social sciences. The development of such multidisciplinary is often more difficult when the responsibility for this research is given to *one* of the scientific areas in question. This is why the Government wants to establish ED as a specifically dedicated Division, although this should not take away the other divisions' responsibility to integrate necessary environmental issues in their activities.

The spirit of the Brundtland Commission has therefore been more successfully implemented through the current Research Council and its ED division, than what the Grøholt Commission originally suggested.

1.2 The problems and challenges, as well as the change goals of the Division

There have been several important challenges for ED; a short version could be summarised as follows:

- Establishing and implementing interdisciplinarity, in particular between the natural and social sciences.
- Balanced integration of basic and applied research.
- Creation of good relations to the research communities, both the universities and in particular the ED oriented institutes.
- Internal cooperation and good labour division within ED and towards the other Divisions.
- Developing in particular the first generation of perspective analyses, strategic plans and action plans within the ED field.
- Finding the optimal programme portfolio, in terms of scientific approach, size, number and duration, and subsequently on project level. During the ED period, there has been an intended change towards fewer and bigger programmes, to some extent also of longer duration.
- Tackling ministerial earmarkings, against the wish for independent decisions.
- Tackling expectations in the research community in a situation of reduced budgets immediately following the launch of the new Research Council
- Finding the Division's own identity among a complicated and multilevel system of boards and administration, and establish good relationships and cooperative modes towards other Divisions.
- The role as environmental driving force towards the other Divisions.
- Integrating research on environment and development, connecting the research interests of MoE and MFA, a task that however so far has been difficult to achieve.
- General lack of funding

1.3 An explanation of the current Division boundaries and why these were set as they are and a comment on issues associated with these boundaries

The current Division boundaries and responsibilities are mostly according to guidelines set by the White Paper which initiated the Research Council. The responsibilities consist also of disciplinary responsibility towards the scientific discipline *demography*, as well as the subtopics *environmental law* and *resource and developmental economics*. In the early days after the Research Council's establishment, the Division argued a lot in favour of considerable basic research responsibilities, for example for the disciplines *biological ecology* and *anthropology*, as a supplement to research for policy support. ED relevant pure scientifically

driven research, funded by the Ministry of Education, Research and Church affairs (MERCA), is taken care of within the Division by means of responsive-mode funding.

The Division's major funding ministries (but not the only ones) are MoE, MFA and MERCA. This implies that most of the environmental research funded by MoE, as well as research in connection to developing countries and Central and Eastern European countries, funded by MFA, is carried out under the ED umbrella, and mostly by means of research programmes. MFA fundings relevant for other foreign affairs policy areas (for instance Europe), are mostly implemented through the Division CS.

Supplementing the environmental research in ED, the other Divisions should also carry out environmental research connected to their own responsibility areas, funded by their major funding Ministries. This is implemented to a certain degree, but has often caused debates and conflicts among ED and the other Divisions in question, as well as among the Ministries. The division boundaries between Industry and Energy and ED deserve a specific comment in this respect. During the first years there was a common understanding that ED should play a certain role in relation to industrial oriented environmental issues. Some programmes inherited from the previous NTNF had a research profile that coincided with this view. As time passed the boundaries between the two divisions got more solid and ED realised that there were neither money nor capacity to take any initiative in this direction.

The same conflict areas are not that profound as regards to the MFA funded research connected to developing countries, although one could argue similarly also in this field.

Strategic Plan for Research on Environment and Development states that all divisions in the Council has part- responsibility for environmental research and for research in the interface between environmental concerns and development issues. The volume of the total amount of environmental research carried out through the Research Council is more important than the activities within each separate division. A research profile that reflects the combined environmental effort of the Council necessitates close collaboration across division lines. It is the view of ED that this division should function vis a vis the other divisions more or less in the same way as the Ministry of Environment vis a vis other ministries on the policy/management level. It has taken some time to shape the role of ED as an environmental driving force. We now see some "climate change" in the Council in the sense that there is growing understanding that environmental issues are a concern to all. An internal Committee will be established in the near future, headed by the Director of ED and with high level representation from the other divisions.

2. Strategy

The overall goal of environment and development research is to promote necessary conditions for a sustainable development. Environment and development research is important

- in policy formulation
- as a driving force in innovation, value creation and industrial development
- as a creator of new knowledge
- in securing improved quality of life

2.1 Adopted strategies, action plans and policy documents

On the basis of vision, goals and strategies adopted in October 1993 by the Board of the Research Council the Division Board, Division of Environment and Development (ED)

presented in December 1993 their *definitions of environment and development research* (three definitions -of environment research, of development research, of research in the interface between environment and development), *their vision* and *5 main goals and 12 strategies* for attaining these goals. The main goals were:

- to secure quality, relevance and scope in environment and development research
- to contribute to renewal and an adequate institutional structure within environment and development research
- to contribute to dissemination, publication and increased use of results from environment and development research
- to act as main promotor for securing increased support to environment and development research
- to act as main promotor of Norwegian polar research

The Board of the Research Council adopted in mars 1996 its main strategic document: *Research for the Future – Strategy for Norwegian Research and the Research Council of Norway (the FFF)*. The following national research objectives were identified:

- To achieve cultural insight, improved quality of life, democracy and welfare
- To create added value within the framework of sustainable development

Both goals were clearly relevant to the work of ED.

The *Strategy* presented four research priority areas:

- Industry-oriented research and development
- Research that promotes value creation in the public sector
- Environmental research
- Marine research

The priorities set out in the FFF were important inputs to the strategy work of ED resulting in the *Strategic Plan for Research on Environment and Development*, adopted by the Board of the Research Council in June 1996. The Plan had a five-year perspective and covered all research areas under the Research Council of Norway. The vision of the Council was to make Norway a role model for the production of knowledge about environment and development. The *Strategic Plan* is based on an *Analysis of the Perspectives for Norwegian Research on environment and Development* covering the next 10 – 15 years. The Plan identifies six research priority areas selected on the bases of explicitly defined criteria:

- Natural processes and man-made changes
- Management and use of natural resources and the cultural environment
- Environmentally-sound production and consumption
- Social change, economics and systems of governance
- The population, public health and quality of life
- Values for sustainable development

The Plan also proposes administrative measures to be used in the follow-up of the Plan.

Several other strategic documents have been produced:

- Strategic Plan for Norwegian research in the Arctic
- Strategy for development of Svalbard as a Research Platform (1998)
- Strategy for Norwegian Research in Antartica (1997)
- Strengthening research and higher education in the context of Norway`s relations with developing countries. Contribution to a strategy being developed by the Ministry of Foreign Affairs on research in relation to countries in the South (1996).

Goals and priorities set down in the *Strategic plan for research on Environment and Development* were concretised and operationalised in 1999 in the *Action plan for the Division of Environment and Development. Time for actions 1999 – 2001 (1999)*. Based on the six priority areas of the Strategic plan ED defined four thematically oriented main priority areas for its own work:

- Natural processes and man-made changes (NOK 73,8 mill.)
- Management and use of natural resources and the cultural environment (NOK 16,3 mill.)
- Framework conditions for sustainable development (NOK 23,4 mill.)
- Development and global issues (NOK 39,5 mill.)

Three priority horizontal areas were also identified:

- Polar research
- Research connected to developing countries and countries with emerging economies
- Values for a sustainable development

These three horizontal areas should be integrated in the research programmes wherever relevant.

Other action plans/policy documents:

- International Strategy for the Division of Environment and Development – Policy Document (1999). Enclosure: Overview of international programmes/organisations/institutions where the DED participates
- Recruitment plan for environment and development 2001 – 2002 (2001)

2.2 Change goals

The ED was created as a totally new structure, comprising three separate committees on environment, on development research and on sustainable development. “Full” research council functions in the traditional sense had to be built up from scratch. Much time and energy was required internally to build up a division with all proper functions that could collaborate – and “compete” – with the other divisions, and externally to develop good working relations to the research community and to relevant ministries/agencies and other important national and international bodies within the field.

One of the main reasons for establishing the Division was to create an adequate research funding structure for the follow up of The Brundtland Commission and the research challenges set out in its report “Our Common future”. To come to grips with these challenges the Division had during its first year as a main change goal to develop coherent strategies, policies and guidelines appropriate to an interdisciplinary research area covering very different disciplines, very different research topics and characterised by an unequal funding structure. 2/3 of the money was coming from the Ministry of Environment earmarked environment research while funding of development research (around 10%) was – and still is – mainly the responsibility of the Ministry of foreign Affairs.

As a follow up of the Strategic plan and the Action plan (adopted April 1999) for the ED a set of concrete objectives were adopted in an effort to reach the three-part goal of the Division: to increase the volume and strengthen the quality and relevance of environment and development research:

Volume

- Budgetary allocations to EDs programmes should increase by 30% (about NOK 44 mill.) within a 5 year period
- Budgetary allocations to independent projects should increase by 30% (NOK 12 – 13 mill.) within a period of 3 years
- Budgetary allocations to the independent research institutes should increase by 10% (NOK 9 – 10 mill.) within a period of 3 years

Quality and Relevance

1. Concentrate research efforts
2. Strengthen collaboration with prioritised international and multilateral organisations and countries
3. Strengthen co-operation between social sciences and the natural sciences
4. Better communication between researchers and users of research
1. Strive to have environmental concerns integrated in all relevant research activities in the Research Council
2. Improved co-ordination of interests and measures concerning development research within the Research Council
7. Strengthen the role of advisory body to the Ministry of Foreign Affairs
8. Strive to have environmental and developmental perspectives integrated in the ordinary disciplinary based research activities at the universities
9. Improve the co-ordination between independent research institutes and the universities
3. Produce a Recruitment plan for environment and development
4. Improve the co-ordination between research and national remote sensing programmes
5. Strive to utilise more systematically research and research results in mapping biological diversity

2.3 *Strategies for creating and managing national research capabilities*

Building research capabilities - Balance between main instruments

Research programmes have from the very beginning been the main policy instrument. That is only natural taking into consideration the problem oriented area of responsibility of the Division. The Division has both basic and action-oriented programmes. It is worth noting that in ED basic research is mainly basic strategic research. It should also be mentioned that the action-oriented programmes also might cover basic strategic research.

The majority of the research programmes are of *action-oriented programmes*. These are geared towards the public sector and shall make contributions to the enhancement of the knowledge base for societal planning on various levels of government, for the development of public sectors and for political decisions. The programmes are often co-financed from several ministries. An important change goal has been to move away from rather small programmes (around 30) financed by one or two ministries to larger programmes (at present 12) financed jointly by several ministries. The environment and development issues have to be attacked both within and across sectors and this can only be realised within the framework of larger programmes representing the interests of several users/ministries/stakeholders. The users are represented in the program boards. ED has maintained a policy of having research programme

boards with a mixed representation, but with researchers in the majority. A brief explanation of the programme and project management process is given under chapter 4.4.

Independent projects. An important change goal for the Division was to establish independent projects as one of the main mode of operation. It was a difficult task to set aside an adequate budget for this since ED did not inherit any such instrument from the previous system. Independent projects are seen as a necessary tool for securing a broadly based national research capability in this field. It is seen as a long-term strategic goal to have environment and development oriented research fully integrated into the ordinary teaching and research activities of the higher education and research institutions in the country.

Infrastructure as policy instrument in ED comprises core *funding* for six research institutes and *strategic institutional programmes* (SIP – Strategic institute programmes) for these institutes and SUP (Strategic institutional programmer) for universities. Brief information on the research institutes is given in chapter 4.3.

One of the first joint strategic processes implemented – successfully - by the new Research Council was to develop a common terminology and a common framework for the allocation of core grants for institutes. The research institutes are important actors within the field of environment and development and a substantial part of EDs budget is channelled through these institutes. To secure quality and relevance ED has regular meetings with the director and staff of the institutes and initiates evaluations of the institutes on a six-year cycle. The institutes see these processes as a meaningful way of checking whether the institute is on the right track or not.

Top priority areas for research. Being responsible for a multidisciplinary field characterised by a wide variety of disciplines, research topics and methodologies it has not been an easy task for ED to find the right balance between a policy of concentration of resources on certain priority areas and on the other hand a policy that takes care of the heterogeneity of the field. An important change goal has been to decide on a few research areas where Norway has research groups of top international quality or with the potential to be in the international forefront. During 1999 and 2000 four such areas were identified. All four are now supported through the research fund and through reallocation within the ordinary budget. These are:

- Climate change in Norway and in neighbouring areas
- Social science research related to energy and environment
- Ecosystems and populations` vulnerability to environmental change
- Development, conflict and poverty in a human rights perspective

Centres of excellence. RCN has recently started a process of establishing centres of excellence (CoE). Applications are now being reviewed, 11 of which are directed to EDs field of responsibility. The environment and development field consists mainly of rather small research groups located at various universities and research institutes. That means that virtual centres would be an interesting model in addition to the more traditional model of one-site location centres.

Balance between different types of research. Environment and development research is a problem-oriented field, drawing on a wide range of disciplines. With a few exceptions the responsibility for these disciplines rests in other divisions. Since the majority of EDs research programmes are action oriented one could easily expect that research supported by ED is *applied* with the aim of producing policy relevant research. The distinction between applied

and basic research is however often difficult to draw. Recent numbers show that approx. 40% of EDs budget is identified as basic (strategic) research. Basic research is mainly funded through research programmes and as independent projects including fellowship programs.

2.4 Achievements and impact

Achievements related to strategies and action plan. In general it is difficult to measure achievements and more particularly the impact of research funding. When it comes to goal achievements related to strategies and action plan a considerable budgetary growth could be taken as indication of a certain success. It could be mentioned that the budget has increased during the last years – but not to the degree stated in the budgetary goals on page 7. Concerning the objectives related to quality and relevance (page 7) it is fair to say that they have been reached to a rather great extent. The main funding sources seem to find it worth while to use the Division both as a funding agent, advisory body and match maker.

Use of research results. The dialogues with the ministries of environment and foreign affairs have developed and function very satisfactory. Both ministries put heavy emphasis on dissemination of research results, both as part of a running program and when the program has come to its end. Research funded through several of EDs programmes has given valuable inputs to important political processes such as the Kyoto process (SAMRAM, CICERO, Climate change, Environmental Law etc.). Important challenges within development co-operation such as corruption, good governance, poverty have drawn heavily on knowledge and expertise produced through ED-programmes financed by the Ministry of foreign affairs. Important inputs to the very recent national debate on the management of predators have come from the research programme on Changing landscape. These are only a few examples of a more general pattern – that ED funding has provided for research results that have an impact of policy formulation.

Impact on research community. Through the funding of *independent projects* the ED has contributed to competence building and increased interest and awareness in the Norwegian research community for research challenges in the field of environment and development. Through its research programmes the Division has been instrumental in focusing and co-ordinating research and creating national research networks and strong research groups within the various programme areas. The Division has also an important role as co-ordinator together with other important strategic bodies such as The Council of Higher Education within the field of development research and research related to Central-, East and South East Europe. Mention should also be made of the funding provided for the environmental research institutes obtaining funds through the EU/FP. This particular funding mode makes it possible for the institutes to engage more actively in European research collaboration. Applications from research groups within the environment field have a very high success rate.

NGOs and society in general. The funding provided by the Division impacts on society in a more indirect way. The Division has as a change goal to develop an even more active relationship with civil society through regular meetings with representatives of the main NGOs within the environment and development field. Representatives from NGOs are members of planning- and programme committees, participate at our research conferences and are as such important contributors to the ED strategic work.

2.5 *Future plans, visions and strategic choices*

As a follow up of the Action plan the Division initiated in 2000 an analyses of research needs and capacity building within the ED field, followed by a Recruitment plan for the period 2001 – 2003.

In 2001 two important projects are initiated with the overall goal to strengthen the Divisions` s strategic work:

- Vision Environment 2030
- Development research – a document Profile

Both documents will be used as a basis for future strategic work.

The Division has regular meetings with the universities and with relevant independent research institutes at leadership level to inform - and be informed - about important strategic and other matters and to discuss future challenges.

Parallel meetings are being held with the leadership of the other divisions of the Council to secure that the research needs of society are properly taken care of.

International research collaboration is seen as an increasingly important mechanism to secure an adequate future orientation in the Divisions work.

3. Governance

3.1 Stakeholders

ED stakeholders are:

- The research community (organised in three distinct categories: universities, colleges and the institute sector)

All of our grants awarded go to research groups, and a large proportion of our contact-maintenance activity is aimed at these groups. Academic disciplines are represented on our Board, at least half of the members of our programme boards are researchers and all the members of our special expert committees are active researchers. They also play a central role in various *ad hoc* committees. We have also set up regular contact meetings with research groups, both involving the Division Board (meetings with university leaders), the chairman of the board (faculty meetings, meetings with the college group, institute managers) as well as a large number of meetings between the staff of the Council and its stakeholders. The academic side is thus well represented in our decision-making bodies and is an important supplier of premises for our policy development.

- Public authorities: (The Ministry of Education, Research and Church Affairs, the Ministry of Environment, the Ministry of Foreign Affairs, other ministries, other public authorities, local government, politicians)

The second important group is the authorities, which are primarily represented via various ministries. These supply the financial resources that we manage for research, and representatives of the ministries sit on our programme boards. We draw up budget proposals for each ministry within the framework of an overall proposal from the Research Council. In the process of drawing up and following up these proposals we maintain close contact with the ministries' representatives. We also hold contact meetings with representatives of the ministries and follow-ups vis-à-vis each individual ministry.

Increased emphasis is put on dissemination of results and the impact of research more in general. Each programme is mandated to develop an action plan for dissemination of research results. We refer to chapter 4.4. for more information concerning tasks and guidelines for programme work.

- Organisations and industry.

The third group consists of organisations, mainly Non Governmental Organisations (NGOs). We have yearly meetings, and they may be represented in planning groups and program committees.

- The general public.

This group naturally tends to be more weakly represented, but a significant number of conferences and seminars are organised, to which representatives of the research user side are invited, in addition to representatives from the research community. We reach a considerable number of users via conferences, general-interest dissemination efforts such as books and TV programmes, and via web-sites, newsletters and journals.

3.2 *The role of the Divisional Board*

The Division Board has general responsibility for the activity of the Division. The Board adopts objectives, strategies, allocates budgets to various groups of activity and checks that the activities of the Division take place in accordance with its decisions. The Board only exceptionally assumes responsibility for financial decisions at project level, and then only on the recommendation of a lower-level body.

The Board deals with a wide range of activities. Today's board has seven members. Three of the members represent various academic disciplines and research institutions and the other three members the research user side.

The activities of the Division are organised through a large number of sub-committees, to which the Board has delegated authority. All the programme boards have the authority to fund projects on the basis of a programme plan and a budget agreed by the Divisional Board. The Divisional Board has recently delegated authority to fund independent research projects to a Special Expert Committee.

When new programmes are being launched the Board appoints planning groups.

The Board meets from six to eight times a year and in the course of a year have about 80 to 100 items on the agenda. The relationship between the Board and the Division's administration has changed with respect to the previous structure. The members of the Board have to exercise their functions via its meetings, and for this reason the administration must develop its professional and strategic competence to a much greater extent than the old model demanded. The administration always presents proposals for adoption by the Board.

The Board participates in certain aspects of the Division's contact activities. The Chairman of the Board attends the annual meetings with Norway's four universities and takes part in a large number of meetings, both with representatives of the Division's own sub-committees (programme boards, etc.) and with other parts of the research system (institutions), and meetings with MoE and some times MFA. The Chairman also joins parts of the Research Council's Board meetings (budget and strategy) and has his own meetings with the Chairmen of the other Boards of the Research Council and with the Director General of RCN.

3.3 *Mechanisms for forging links with other divisions*

Contact with other divisions takes place in the following ways:

- Contact in dealing with cases which require coordination
- Contact in process organised as joint processes
- Contact at management level via the Director's participation in weekly director meetings
- Specific processes that involve interdivisional cooperation.

The Division maintains a very large network of contacts because the other divisions also retain responsibility for especially environmental research. For the last years we have therefore had joint meetings with the management in the other divisions to coordinate the research activities.

During the phase of establishing the new structure, a number of conflict situations arose regarding the division of work between the divisions. The level of conflict has now been reduced, in part as a result of mutual flexibility.

A new tendency, from the point of view of the Division, is that several of the initiatives for new programmes are taken in collaboration with one or more of the other divisions.

4. Portfolios of Activities in 2000/2001

The main goal of the Division is to enhance the volume, the quality and the relevance of Norwegian environment and development research. The Division is funding research mainly through programmes. The priorities were decided upon in 1999, after long and thorough discussions with the science community, NGOs and the authorities, including all stakeholders.

In general it is important to note that the resource allocation also reflects the funding from the main ministries MoE and MFA. MoE is funding approx. NOK 200,0 mill. and the MFA approx. 60,0 mill. It is also important to note that the decision on priorities is based on White papers, research strategies developed in the various ministries, inputs from the research community, from NGOs etc as well as on discussions in the Board. Thus the administration and the Board members have to handle all these factors and considerations – which actually does not give too much room for own choices.

The main priority areas and the specific programmes are shown below:

The main priority areas of Environment and Development:

Priority thematic areas	Current programmes	2000 Budget (mill NOK)	
<i>Natural processes and man-made changes</i>	Biological Diversity – Dynamics, Threats and Management	14,1	
	Climate and Climate Change	25,4	
	Pollutants: Sources, dispersal, effects and efforts	23,8	
	Norwegian institute for nature research	21,8	
	Norwegian institute for water research	20,2	
	Norwegian institute for air research	14,9	
	Norwegian Centre for Soil and Environmental Research	4,9	
	<i>Management and use of natural resources and the cultural environment</i>	Changing landscapes. Use and management of cultural environments and natural resources	16,3
		Wild Atlantic Salmon Programme	From 2001
Norwegian institute for cultural heritage research		11,8	
<i>Framework conditions for sustainable development</i>	Sustainable Production and Consumption	7,3	
	Norwegian Energy and Environmental Policy: Constraints, Opportunities and Instruments (SAMRAM)	11,1	
	Social Science Research in Energy, Environment, and Technology (SAMSTEMT)	From 2001	
	Towards Sustainable Development: Strategies, Opportunities and Challenges (RAMBU)	From 2001	
	Programme for Research and Documentation for a Sustainable Society <i>ProSus</i> (SUP)	5,0	
	Programme for Industrial Ecology (SUP)	1,5	
	Norwegian institute for urban and	10,7	

	regional research	
<i>Development and global issues</i>	Fisheries in Developing Countries	5,5
	The multilateral system in the field of development	5,0
	Globalisation and marginalisation. Multi- and interdisciplinary research on development paths in the South	14,0
	IMR/CMI (SUP)	1,0
	Chr. Michelsen Institute	9,0
<i>Horizontal priority areas</i>		
<i>Polar research</i>	Arctic light and heat, national and international polar coordination	
	Polar issues also integrated into relevant programmes, in particular <i>Climate and Climate Change</i> and <i>Pollutants</i>	
<i>Research connected to developing countries and countries with emerging economies</i>	Cooperation programmes within higher education and research with 1) Central and Eastern Europe 2) Southeastern Europe	
<i>Values for sustainable development</i>	No specific programmes, but the topic should be integrated wherever relevant	

In addition to the amounts shown above, approx. NOK 26,5 mill are allocated to horizontal priority areas and integrated in the priority thematic areas.

The scope of support for "infrastructure" (core funding of the institutes) has (to a large degree) been determined by earmarked funds from the ministries. In allocating funds the Division has given the same high priority to programmes and "independent/responsive mode projects", and a somewhat lower priority to the core funding of the institutes. There is a good agreement between the Division and the funding ministries on the thematic priorities. The budgets offered by the ministries are, however not always in accordance with these priorities, and funds are earmarked differently.

The structure of the Division

The administration of the Division is organised into two departments (*Department on Environmental Research* and *Department of Development Research*) and one staff unit responsible for cross-cutting issues like budgets, economy, etc.

The *Department on Environmental Research* is responsible for tasks particularly related to environmental research, with emphasis on the natural sciences. The department is also responsible for polar research in general, and the institute sector.

The *Department of Development Research* is responsible for

1. Social science based programmes on environment and sustainable development
2. Research on development and aid in developing countries and in economies in transition.
3. Funding of science driven research projects on environment and development
4. Programs for recruiting personnel to research on environment and development

In both departments the activities consist of allocation of funds, participation in and facilitation of national and international networks, stimulation of dissemination and giving advice both to various branches of government and to the research community.

4.1 Portfolio of programmes

Arctic light and heat (1996-2001)

Objectives: Increase the knowledge of arctic climatic conditions, their limitations and impacts on biological processes, and how arctic organisms and ecosystems are adapted to such conditions. This requires great emphasis on good connections between biology and geophysics aiming at cross-disciplinary studies of genuinely arctic phenomena.

Scientific topics: Biological and geophysical, however, only few really integrative projects

Funding: Budget 2001: 5,5 mill NOK, 41,9 mill NOK throughout the programme period (*Ministry of Environment and Ministry of Education, Research and Church Affairs*)

Project portfolio: A total of 34 projects, involving in particular NPI, UiB and UiTø, but also other Norwegian universities and research institutes.

Impact: Much excellent research has been carried out, a few articles are even published in journals as *Science* and *Nature*, for instance on results indicating that the Arctic ice cap is melting twice as fast as previously expected.

Biological Diversity – Dynamics, Threats and Management (1997 – 2007)

Objectives: The main objective of the programme is to improve the pool of basic knowledge for the sustainable use of biological resources and the preservation of the distinctive character and diversity of nature.

Scientific topics: The background for the programme is the Convention on Biological Diversity and the intended national action plan on biological diversity. It has a broad angle of approach with a wide framework for several disciplines and will particularly concentrate on interdisciplinary research as a tool for solving problems. The programme fields embrace research into all kinds of natural environment, including terrestrial, marine and limnic, as well as arctic areas. The programme is concentrating on research directed at natural and semi-natural ecosystems as a basis for analysing anthropogenic (man-made) impacts, and the effect of measures to counteract undesirable changes within these systems.

Budget 2001: 17,4 mill NOK. (*Ministry of the Environment (80 %), Ministry of Foreign Affairs, Ministry of Education, Research and Church, Ministry of Agriculture and the Ministry of Fisheries*).

Research Portfolio: At present the programme is financing about 45 different projects, ranging from 50 000 to 1 347 000 NOK, with mean around 400 000 NOK. The Steering Board's ambitions are to lower the number and increase the sizes of projects through emphasising interdisciplinary co-operation between natural and social science relevant to the management of nature. All kinds of research institutions are represented in the programme's portfolio, both public and private.

Impact: Publications in international journals, and input for the Norwegian authorities and policymakers for decisionmaking.

Climate and Climate Change (KlimaProg) (2002 –2011).

Objective: The main objective of KlimaProg is to ensure that Norwegian natural science climate research is carried out at the highest international level. The program shall enable Norwegian researchers to conduct research within certain prioritised research challenges

outlined in the program plan. The aim is to achieve major breakthroughs in at least three of these areas.

Scientific topics: The research programme is a continuation of former research programmes. The programme covers natural science research that seeks to increase the understanding of the climate system and climate changes. It is a focused and goal-oriented programme with the intention to deliver results that lend themselves to further application.

Funding: Budget 2001: 25,8 mill NOK. (*The Ministry of the Environment, The Ministry of Education, Research and Church Affairs*)

Research portfolio: The ongoing research is to a large extent (about 70% of the budget) organised through four larger coordinated projects with participants from several interdisciplinary research groups:

- *Regional Climate Development under Global Warming (RegClim)* has as an overall goal to estimate, by statistical and dynamical methods, probable changes and uncertainties in the regional climate in Northern Europe, bordering sea areas and major parts of the Arctic given a global climate change.
- *Past Climates of the Norwegian region (NORPAST)* investigates natural climate archives (including marine sediments, lake sediments, speleothems, glaciers etc.) from terrestrial and marine sites in the Norwegian region. A main objective is to identify patterns and frequencies of natural climate variability in this region and contribute to the understanding of the mechanisms behind this variability.
- *Coordinated Ozone and UV Project (COZUV)* deals with changes in the stratospheric ozone layer and the UV radiation at the ground. It is aimed at studying processes leading to ozone depletion in the Arctic and at mid-latitudes during winter and spring, improving predictions of the ozone layer due to climate changes and changes in ozone depleting substances, and understanding the distribution of UV radiation under different atmospheric conditions.
- *Norwegian Ocean Climate Project (NOClim)* focuses on the stability, variability and monitoring of climate processes in the Nordic Seas and the adjacent regions. Proxy climate parameters, instrumental observations are used to study the circulation and thermodynamics in the region.

In addition, the programme funds 16 smaller independent projects. The Programme also has the scientific responsibility for two research groups of excellence funded through other sources.

Wild Atlantic Salmon Programme (2001 – 2010)

Overall goal

To bring new knowledge that contributes to protection and enhancement of the natural populations of Norwegian wild salmon. The programme should also provide information to enhance the development of models for a flexible and adaptive management of the species.

Three thematic areas are identified:

A: “Natural production of salmon – variation in time and space”.

B: “Threats against Atlantic salmon”

C. “Wise use and management of salmon”

Four areas of general concern:

- Application of new theories and methods, an increased effort within quantitative modelling, a clearer regional-geographic strategy, and strengthened co-operation between disciplines, faculties and institutions.

- The programme is basically founded in ecological/biological disciplines, but enhances contributions from other disciplines as well, for instance economy and social sciences, primarily in multidisciplinary projects. Major contractors for the programme are universities and national research institutions.

Funding: Budget 2001: 5.0 M NOK. The planned annual budget is however of app. NOK 20 mill. (*Main financial partner is The Ministry of Environment, but it is also expected contributions from other relevant official and private institutions and funds, such as the aquaculture, hydropower and agricultural/rural tourism sectors.*)

Projects: So far, the programme has supported approximately 15 projects, primarily within the research areas A and B. Much of the support is for special first-year activities, aiming at establishing networks involving national and international teams, testing of new methods and considering the potential in old data series. Average support for each project is so far relatively limited.

Since the programme is in its infancy, no report is available on impacts and results from the program.

Pollutants: Sources, dispersal, effects and efforts (ProFo) (2000 – 2005)

Objectives: The main goal of the research programme is to improve the general understanding of the fate of pollutants, their sources, pathways, exposure and effects on biota and environment. The research activities intend to support environmental actions and management. The research shall also support national goals regarding environment and international work on reduction of long range transported pollutants.

Research areas:

- Contaminants of national priority, new hazardous substances and radioactive components.
- Regional and local pollution issues, both contaminants and nutrients.
- Long range transported components, with focus on contaminants and nitrogen.
- Contaminants in arctic and Polar Regions.
- Noise and experiences of noise.
- Methods and models for monitoring of the environment, risk evaluations and abatement strategies.

Funding: Budget 2001: 25,1 mill NOK. (*Ministry of environment, Ministry of agriculture, Ministry of fisheries, Ministry of oil and energy and Ministry of industry and trade.*)

Project portfolio: The programme is this year funding 53 projects covering all the six research areas mentioned above. However, the profile of the project composition is in accordance with the funding amount and scientific wishes of the financial partners. For the two last years beyond 105 projects were applied for, while 26-28 were given assignment each year.

The programme is a continuation of former programmes covering mainly the first four mentioned research areas. Thus, this research activity has provided considerable results brought about to scientific circles as well as the financial authorities.

Norwegian Polar research

Norwegian Polar research is co-ordinated through the Norwegian National Committee on Polar Research (<http://www.nilu.no/avd/troms/nncpr/>), appointed by the Research Council. NNCPR has made several strategic plans (on research in the Arctic, the Antarctica and Svalbard as a research platform), initiates evaluations and research programmes, evaluates proposals and gives advice concerning Nordic Antarctic Expeditions, reports annually to the Interministerial Committee on Polar issues, co-ordinates nationally and internationally polar

research initiatives, including multilateral organisations and bilateral agreements. The activities include also efforts to maintain and strengthen information on research issues in general on Svalbard, through Svalbard Science Forum.

Changing landscapes. Use and management of cultural environments and natural resources (2000 – 2007).

Objectives:

Provide knowledge, which improves the national competence and capacity to support the development of a holistic, long-term management of cultural environment and natural resources. The research shall increase our ability to develop management strategies, which contribute to welfare production and enhancing multiple market and non-market values of importance to society. Through this the research shall provide a salient contribution to operationalising the concept of sustainability.

Three programme areas are identified:

1. *Knowledge about the biological, physical, psychosocial, and cultural resources of the natural and cultural environment.*
2. *Knowledge about effects of changes in commercial activities and societal processes*
3. *Knowledge about prerequisites for sustainable management and commercial development*

Target groups:

The programme targets several important groups of actors: environmental-, agricultural-, and donor-aid agencies, business communities based on natural and cultural environments, national and international research communities, organisations and the public.

Funding 2001:17,6 MNOK (*The Ministry of Environment, the Ministry of Agriculture, the Ministry of Foreign Affairs and by the parts in the agreement between the farmers and the government (Jordbruksavtalepartene)*).

Sustainable Production and Consumption (1996-2001)

Objective: to generate knowledge about sustainable patterns of production and consumption, particularly in an industrialised country like Norway

- to improve the decision-making processes in administration, private enterprise and in the society as a whole
- to raise awareness among consumers and producers and thereby achieve changes in attitudes and behaviour.

Background: Achieving sustainable development will require efficiency in production and changes in consumption patterns. There is a demand to improve the knowledge base related to production and consumption patterns consistent with nature's carrying capacity, and safeguard the chances for future generations' access to social welfare and a good quality of life

Thematic priorities:

- Theoretical and ethical aspects on the concept of sustainable production and consumption.
- Developing knowledge to meet the political authorities demand for analytical means and instruments for sustainable production and consumption.
- Case-studies on how to move a system (firm, household, industry, municipality, local community) towards sustainable development.

Funding: Budget 2001: 7,3 mill NOK (*Ministry of Environment, Ministry of Agriculture, Ministry of Children and Family Affairs*)

Towards Sustainable Development: Strategies, Opportunities and Challenges (Rambu) (2001-2010)

Objective: to generate new social science and transdisciplinary based knowledge about preconditions, steering options and political instruments to advance sustainable development. To give substantial contributions both to the decision making processes and to the development in science.

Thematic priorities:

- preconditions and strategies to advance sustainable management of natural resources
- evaluation and development of political instruments for sustainable development
- study knowledge production and use of knowledge for sustainable development
- culture, every day life and sustainable consumption patterns

Crosscutting perspectives:

- systems
- transitions
- gender

Funding: Budget 2001: 1,0 mill NOK (*Ministry of Environment, Ministry of Children and Family Affairs, Ministry of Agriculture*)

Norwegian Energy and Environmental Policy: Constraints, Opportunities and Instruments (SAMRAM) (1996-2000)

Objective: to build up and maintain the knowledge base for Norwegian policy for sustainable development related to production and use of energy, in Norway and in a regional and global perspective. Two secondary objectives:

- The research shall give increased knowledge about conditions and instruments for effective policy in the field of energy and environment.
- The program shall build up and further develop competence in this area at Norwegian research and educational institutions in order to enable these institutions to deliver well qualified candidates who can help the users to utilise research based knowledge.

Thematic priorities

- Political, economic, social and cultural conditions for environmental and energy policy.
- International conditions and Norwegian policy options.
- The role of the energy and power markets in a sustainable development.
- Valuation of the environment and environmental effects.
- Policy instruments and policy strategies.
- Technology options and physical planning.

Funding: Budget 2001: 0 mill NOK (*Ministry of Petroleum, Energy, Ministry of Environment*) – (see also SAMSTEMT)

Social Science Research in Energy, Environment, and Technology (SAMSTEMT) (2001-2010)

The SAMRAM-program will be terminated in 2001 and followed by a new program called “Social Science Research in Energy, Environment, and Technology” (SAMSTEMT). It has the same objectives but the foci have changed a little.

Thematic priorities:

- energy markets and energy use
- technology, energy planning and infrastructure
- multilateral environmental agreements and climate policy

Funding: Budget 2001: 11,0 mill NOK (*Ministry of Petroleum and Energy, Ministry of Environment*)

Cooperation programmes within higher education and research with

2) Central and Eastern Europe

3) Southeastern Europe

Objective: through collaboration with the countries in the target regions, to contribute to the restructuring of these societies with the aim of securing democratic and economically sustainable development.

The programmes supports projects within higher education and research between Norwegian institutions and institutions in the target countries. Within both programmes a separate fellowship programme is established.

Structure: The Norwegian Council of Higher Education and the Research Council of Norway have established a joint programme board for the two programmes. There is a joint secretariat for the programmes, the Council of Higher Education has the responsibility for the projects within higher education and the Research Council has the responsibility for the research projects.

1) Cooperation programme with Central- and Eastern Europe (1997-2001)

Priorities:

Geographical: Priority is given to cooperation between institutions in Norway and institutions in North-West Russia and to cooperation between institutions in Norway and the Baltic countries.

Subject areas:

- Environmental protection and environmental technology, Northern Russia
- social sciences in the Baltic States
- Economics and administration
- The Russian part of the Barents Region
 - medicine and health
 - language and culture
 - further development of the Norwegian Pomor University Centre

Funding: Budget 2001: 9,0 mill NOK (*Ministry of Foreign Affairs*)

2) Cooperation Programme with South Eastern Europe (2000-2004)

Priorities:

Geographical. Target countries are Bosnia-Herzegovina, Montenegro, The former Yugoslav Republic of Macedonia, Albania, Croatia and Serbia.

Subject areas:

- social science and humanities
- Economy and management
- Law and human rights
- Subject areas that can be indirectly connected to democratic- and economically sustainable development have relevance. Possible fields of research could include areas such as agriculture, fisheries, marine biology and areas where the Norwegian scientific community can contribute to developing the scientific skills of participating countries within certain interest areas. Environmental considerations are important.

Funding: Budget 2001: 7,5 mill NOK (*Ministry of Foreign Affairs*)

Globalisation and marginalisation. Multi- and interdisciplinary research on development paths in the South (1998-2007)

Objectives: to develop expertise and stimulate critical public debate in the long term, which can serve as foundations for shaping an integrated policy towards the South and international cooperation on development aid.

Thematic priorities: Globalisation and marginalisation has been chosen as the underlying theme of the programme, with 6 thematic areas:

1. Globalisation and marginalisation
2. Poverty
3. Economic policy and commercial and industrial development
4. Political development: democracy, human rights and conflicts
5. Health, education and population growth
6. The environment and resource management.

Funding: Budget 2001: 17,5 mill NOK (*Ministry of Foreign Affairs, Ministry of Education, Research and Church Affairs*)

The Multilateral System in the field of Development (1999-2004)

Objective: The research programme focuses on the role of the multilateral system, its function and application in the field of development. Important points for study include the relationship between the multilateral system and new developmental trends, as well as how the various multilateral organisations operate as a system, both in establishing and in co-ordinating their operational activities at the country level.

Background: The programme has been launched following a perceived need for strengthening the development of theory concerning organisational aspects, concerning the dynamics of negotiations processes, and with regard to how various actors take part in and influence multilateral organisations and the multilateral system. In addition, more needs to be known about how multilateral organisations function as arenas for the establishment of norms and standards, and how the multilateral system can serve as a tool for management and regulation. The program supersedes the programme *Multilateral Development Assistance* (1993 – 1998).

Funding: Budget 2001: 6,0 mill NOK (*Ministry of Foreign Affairs*)

Fisheries in Developing Countries (1996-2002)

Objectives: to:

- enhance knowledge of fish and aquatic resources in order to ensure long-term sustainability in the exploitation of fish as a food source, thereby contributing to the viability of fisheries communities;
- build competence in fisheries management, in order to contribute to an improved understanding of the relationship between fisheries and viable local communities;
- develop the competence of Norwegian research and management institutions, taking the existing Norwegian academic competence in fisheries as the starting point.

Background: The Research Programme on Fisheries in Developing Countries was adopted by the Research Council of Norway in 1996, following an initiative by the Ministry of Fisheries in a report on strategies for developing country-related research in the fisheries sector (1993) and the Research Council report on fisheries in developing countries (1995). The beneficiaries of the programme are the development and fisheries management communities in Norway as well as in relevant developing countries. The major participants and contributors to the programme are Norwegian academic institutions.

Funding: Budget 2001: 2,1 mill NOK (*Ministry of Foreign Affairs, Ministry of Education, Research and Church Affairs; Ministry of Fisheries*)

4.2 Responsive mode funding

Independent project funding

The Division allocates each year 10 MNOK (from the Ministry of Education, Research and Church Affairs) to projects selected through an open competition. The objective is to stimulate and support scientific excellence within and between disciplines and thematic fields of substantial importance for the research on environment and development. Projects which are relevant to the Research Councils thematic programmes are not eligible to this funding.

Program for recruiting personnel to research on environment and development

The Division allocates each year 13 MNOK (Ministry of Education, Research and Church Affairs) to fellowships within research on environment and development. The objective is to secure recruiting of high quality personnel. The emphasis has been on doctoral fellowships. Now the post.doc.fellowships are getting a bigger part of the funding.

Program for recruiting female scientists to environmental research

The program was initiated by the Ministry of Environment in 1988 as a follow up of a White paper on environmental research in 1987. The fellowship programme was first operated by the NCER under NAVF, with ED as responsible body from 1993. The principal goal of the programme was to increase the participation of women in environmental research and more particularly to increase the number of women researchers at the environmental research institutes. About 50 fellowships have been granted under the programme, the majority as PhDs, but also some Postdoctoral fellowships. The programme has been open to all disciplines, but the natural scientists have been by far the most active in using this possibility for competence building. The fellowship programme has run for 13 years, a programme period that in fact is quite exceptional. A very positive evaluation in 1997 recommended another 10-year period since there are still few women researchers at the institutes. The Ministry of Environment endorsed the proposal, but has later decided to discontinue its support to the fellowship programme from 2003. ED has now (2001) decided to take a more active role in recruiting women researchers (see Recruitment plan for environment and development 2002 – 2003).

CGIAR Fellowship Programme

The Norwegian Government, through the Ministry of Foreign Affairs, is a major contributor to the CGIAR system. The annual support to CGIAR exceeds NOK 50 million. The CGIAR, established in 1971, is an informal association of fifty-eight public and private sector members that supports a network of sixteen international agricultural research centres. The World Bank, the Food and Agricultural Organization of the United Nations (FAO), and the United Nations Development Programme (UNDP) are cosponsors of the CGIAR.

As of year 2001, the Ministry of Foreign Affairs has agreed to provide NOK 2 million annually to encourage researchers based in Norwegian institutions to take up residency at CGIAR research institutions in order to promote international research co-operation in general and to form links with CGIAR institutes in general. The fellowship programme actually started in the autumn of year 2000, with the Research Council of Norway advancing the funds while awaiting support from the Ministry. Seven researchers have so far been awarded

fellowships under this programme. Residence periods at CGIAR institutions vary from a few weeks up to two years.

Other activities

In addition to these programmes the Division also supports the development of the disciplines and subdisciplines **Demography, Environmental law, Development economics, Resource economics** as well as a large project on **Norwegian development aid history**.

4.3 *Infrastructure; Institutes and institute policy of ED*

The Norwegian institute sector consists of a number of institutes that are independent of the universities and colleges. The Division is responsible with respect to the institute policy for 9 institutes, and is responsible for allocating core funds to 7 of these, totally 95 mill NOK from three different ministries. See table in the appendix for further information about the institutes. The institutes represent a total turnover of 573 mill. NOK and a staff on 756 man-years, The scientific staff represents 545 man-years. The rest of the turnover comes from other sources in the Research Council and other “users”. The other “users” are mainly ministries and other public institutions. 6 of the institutes are responsible for most of the applied environment research in Norway.

The main goal of the Division is that the institutes should be national centres of competence within their fields of knowledge, and deliver knowledge based on research on an international level.

The Council has developed a common terminology and common framework for allocation core funds to the institutes. The division uses these principles, which were confirmed by the Government in 1994.

The way in which the Research Council allocates its core funding is of decisive importance for the development of the institutes.

The Board of the Environment and Development Division bases its institute policy on advises from a special advisory committee (Basisbevilgningsutvalget). The committee gives advice in questions related to institute policy, especially in budget questions. This means dealing with annual applications for core funds, which according to the common principles consist of one part for basic operations and one part for strategy, Strategic Institute Programs, SIP. The committee focuses their work on SIPs, which make up about 1/3 of the core funding, and is the part where the Research Council may influence the development of the institutes. External experts evaluate the SIPs.

As a part of the quality control all the institutes have been evaluated the last years. The institutes will be evaluated on sex-year cycle. The overall conclusion is that they all play an important role as national centres of competence in their special fields. In addition dialog meeting with the leaders of the institutes and annual reports help the division to improve the quality of research, recruitment and co-operative relationship.

Challenges:

- _ More co-operation between the institutes and between the institutes and the universities.
- _ More weight on the SIP-part of the core funding, especially on SIPs, which include different institutes.
- _ Increase international networks and publishing.
- _ Help the institutes to face a marked.

Institutes under the division of Environment and Development:

Name of institute	Short name	Funding ministry	Turnover [Mill. NOK]	Core funding [Mill. NOK]	Other funding from the Research Council [Mill. NOK]	Staff [Man-years]	Scientific staff [Man-years]
<i>The Institutes of Environment:</i>		MD	501,1	89,2	61,8	653	473
Norwegian Institute for Urban and Regional Research, Norsk institutt for by- og regionforskning	NIBR	MD	58,2	10,7	17,6	81	65
Norwegian Institute for Air Research, Norsk institutt for luftforskning	NILU	MD	94,3	14,9	11,8	123	106
The Foundation for Nature Research and the Culture Heritage Research, Stiftelsen for naturforskning og kulturminneforskning including:	NINA-NIKU	MD	180,1	33,6			
Norwegian Institute for Nature Research, Norsk institutt for naturforskning	NINA	MD	124,5	21,8	18,3	147	116
Norwegian Institute for Cultural Heritage Research, Norsk institutt for kulturminneforskning	NIKU	MD	55,6	11,8	1,4	71	51
Norwegian Institute for Water Research, Norsk institutt for vannforskning	NIVA	MD	117,5	20,2	8,7	155	94
Norwegian Centre for Soil and Environmental Research, Senter for jordfaglig miljøforskning	Jordforsk	MD og LD	51,0	9,8	3,9	77	41
<i>Others:</i>							
Chr. Michelsens Institute, Chr. Michelsens Institutt	CMI	UD	42,0	9,0	7,6	48	32
The Fridtjof Nansens Institute, Fridtjof Nansens Institutt	FNI	KUF/KS	16,1	5,1	4,5	32	23
CICERO – Center for International Climate and Environmental Research, Oslo, CICERO Senter for klimaforskning	CICERO	KUF/KS	13,8	5,0	4,9	23	17

The funds from KUF are allocated by the Culture and Society Division.

NINA and NIKU are two institutes working on different sectors, but collected in one foundation.

MD: The Ministry of environment

UD: The Ministry of foreign affairs

KUF: The Ministry of Education, Research and Church Affairs

LD: The Ministry of Agriculture

Strategic University Programmes (SUP)

ProSus

“Program for Research and Documentation for a Sustainable Society” (ProSus) is a research program established by the Division for Environment and Development. The program was evaluated in 2000 and is now a strategic university program at the University of Oslo for the period 2000-2005. The principle goal of ProSus is to produce knowledge for the realisation of a sustainable society. The main purpose is:

- to conduct strategic research and documentation for the realisation of a sustainable society at the local, national and global levels
- to monitor Norway's development with respect to the Rio Declaration, Agenda 21 and the guidelines of the United Nations Commission on Sustainable Development (CSD).
- to disseminate information on futures research directed toward sustainable development and on the debate over global ethics.

Industrial ecology

NTNU has been given a mandate by the Norwegian Parliament, involving a multidisciplinary production of knowledge to bridge the gap between the technology/natural sciences on the one hand and the social sciences/humanities on the other. Given the fact that Industrial Ecology is an important, but fairly new field there is a substantial need for research education and research activity, particularly through PhD-projects. The RCN has therefore decided to support the research at ***The Industrial Ecology Programme (IndEcol)*** at NTNU through two Strategic University Programmes (SUP). The aim of the strategic programmes is to ensure a better balance and interaction between the various disciplines represented in Industrial Ecology, and for high level knowledge production related to research problems and themes which are of crucial importance in industry and society as a whole.

Development, conflict and poverty in a rights perspective

As a follow up of the identification of top priority research areas in 2000 two leading research institutes within the field of development and of human rights research were invited to present a joint proposal for a joint strategic five year institutional programme (SUP). The principal goal is to bridge the gap between development studies and traditional human rights research by building first-class research capacity in the field of human rights in development. Chr. Michelsens Institute (CMI) and The Norwegian Institute of Human rights (NIHR) are now collaborating under the heading *Accommodating difference. Human rights, citizenship and identity in diverse societies*. The two institutes will be pooling resources, capacity and competence, but each institute will also use this opportunity to widen and strengthen its own research base.

4.4 Brief explanation of the programme and project management process

The launch, implementation and completion of programmes are a considerable part of the activities of the Division of Environment and Development. Programmes may be initiated by the Division Board and administration, at the initiative of research groups, at the request of ministries in close dialogue with the Council, by political decrees or as a response to some research needs expressed by an NGO.

The ED Board adopts programme plans and action plans for all programmes and reviews yearly reports from the Programme Boards as a basis for next years funding. The Programme Action plan should contain the following areas:

- background
- objectives
- Priorities and instruments
 - thematic priorities and strategic instruments
 - quality
 - user-orientation
 - applied research
 - multi/disciplinary research
- plan for recruitment
- national and international co-operation
- Plan for information and dissemination of research results
- Budget
- Evaluation

All programmes do a self-assessment at the end of the programme period. An external review panel evaluates some programmes. In most cases programmes also carry out a mid-term evaluation, either as a self-assessment or as an external evaluation.

In order to ease the work of the management team and the programme boards, a set of guidelines for running programmes have been established. These guidelines set out unambiguous standards for the tasks and work processes involved in the programmes. The following paragraphs offer a short description of the programme and project management process as this should be implemented, according to the guidelines.

Programme boards are normally expected to place an open advertisement when a large proportion of the available funding is advertised at the start of a programme. Limited invitations may be sent out if strategic considerations suggest that particular types of institution and/or groups with a particular profile of expertise should be drawn into the process. However, the general principle is that of open invitation. The programmes are supposed to use common closing dates for applications.

The general rule is that complete applications should be submitted; however programme boards may choose between inviting researchers to submit outline projects in the first instance or submitting detailed applications. An outline phase has the objective of limiting the amount of work that applicants need to put into producing applications. A complete application should run to 10 pages in addition to CVs and a list of publications.

The members of the programme board evaluate applications on the basis of external referees and in accordance with the following criteria:

- Academic management and project organisation
- Scientific quality, originality and importance
- Contributions of the research group
- Usefulness and relevance to the programme
- Budget, milestones and progress plan

- Candidates for fellowships.

To stimulate international research co-operation projects collaborating with high quality international research groups are given preference when all other criteria are satisfied and are at the level of other applicants.

The evaluation should take into account whether the project manager has the necessary knowledge and competence in the area of research, in national and international terms, whether the project is well organised, and whether the project manager is capable of leading the project in a suitable way. The contribution of the research group in the shape of other types of expertise, resources and infrastructure should be evaluated, as should the question of whether the research group has a sufficiently wide international contact network. Academic quality, originality and importance should be evaluated with regard to how the problems and methods are described, and to whether the project will generate new original knowledge or important progress within the field of research concerned. The relevance of the project vis-à-vis the programme is a central criterion. Finally, the programme board should consider whether the budget, milestones and progress plan are realistic in terms of the goals of the project.

In some cases, the programme coordinator or research manager should draw up a proposal for a recommendation to be dealt with by the programme board. When project outlines are being processed, selected projects should be allowed to submit complete applications. In dealing with complete applications, the programme board should draw up a prioritised list of applications in order to separate the applications that are to be funded from those that will not receive funding. The programme boards have the authority to allocate funds. This prioritisation is primarily based on the quality assessment of the individual project, but the programme board should also take into account other considerations of research strategy such as recruitment needs, international collaboration etc. Applications that receive funding should be evaluated annually throughout the course of the programme. Applications that are turned down should be given reasons for their rejection in line with given guidelines.

In addition to their role in processing applications, programme boards have a relatively large amount of activity in the field of dissemination and conferences.

Applications for independent research projects must be submitted by the general closing date of June 15, which is used by the whole Research Council. Applications are distributed to a special Expert Committee for independent research projects by a process including a well-regulated collaboration with other divisions of the Research Council. The Expert Committee evaluates the projects on the basis of external referees.

“Strategic institute programs” funded in 2001:

Institute/the name of the program:	Duration	Funds in 2001 [1 000 NOK]
NIBR:		
Environment and development: Institutions for a sustainable development.	1999 - 2003	650
Social and welfare in connection with sustainable development.	2001 - 2005	1 500
Urbanisation and regional development – preconditions and strategic changes.	2001 - 2005	1 500
Environmental impact assessment - joint program.	2001 - 2005	500
<i>Sum, SIP, NIBR</i>		<i>4 150</i>
NILU:		
Organic toxic species; chemical analysis, dispersion and environmental effects	2000 - 2002	800
Oxidation and changes in UV	1998 - 2001	1 200
Transport and transformation of atmospheric pollutants from the local to the regional scale	1998 - 2001	500
Earth observations.	2001 - 2005	600
Environmental impact assessment - joint program.	2001 - 2005	300
<i>Sum, SIP, NILU</i>		<i>3 400</i>
NINA:		
Pollution ecology, joint program NINA-NIVA.	1996 - 2001	1 020
Land use	2001 - 2005	3 060
Human impact: Consequences of use and harvesting.	2001 - 2005.	3 360
Ecosystem dynamics and biodiversity.		
Costal ecology. Ecosystems and human activities.	2001 - 2005	1 040
Environmental impact assessment - joint program.	2001 - 2005	300
<i>Sum, SIP, NINA</i>		<i>8 780</i>
NIKU:		
Landscape as cultural heritage.	2001 – 2005	2 190
Cultural heritage – buildings, constructions and objects.	2001 - 2005.	1 890
Knowledge of materials as base for a conservation strategy.	2001 - 2005	1 890
Environmental impact assessment - joint program.	2001 - 2005	300
<i>Sum, SIP, NIKU</i>		<i>6 270</i>
NIVA:		
Pollution ecology, joint program NINA-NIVA.	1996 - 2001	1 020
Hydrological impact on environment and pollution.	1997 - 2001	620
Transport and significance of nutrients and organic materials in fjords and estuarier. Transfjo.	1997 - 2001	1 020
Aggregation, sedimentation, transport and retention in zones with mixed water. ASTRI.	1999 - 2003	950
Environmental impact assessment - joint program.	2001 - 2005	300
<i>Sum, SIP, NIVA</i>		<i>3 910</i>
Jordforsk:		
Sustainable agriculture.	1997 - 2002	800
Waste ecology.	1997 - 2001	2 000
Wastewater	1997 - 2001	1 300
Environmental impact assessment - joint program.	2001 - 2005	300
<i>Sum, SIP, Jordforsk</i>		<i>4 400</i>

<i>Sum, SIP MD</i>		<i>30 910</i>
CMI: Urbanisation and development in Africa.	1999 - 2003	600
The role of producer services in economic development.	1999 - 2003	450
Corruption and reform.	2000 - 2002	600
<i>Sum, SIP CMI, UD</i>		<i>1 650</i>
SIPer and joint programs, KUF/KS		
FNI: EUs role in international environment and resource policy.	1998 - 2001	850
International regimes on the fields of environment and resources. Implementing, conflicts and synergy.	1999 - 2001	800
FNI/NUPI		
Russian north policy – federal preconditions and strategy.	2000 -2002	580
CICERO/FNI: An effective climate policy. International frames and Norwegian approach.	1999 - 2001	760
Alternatives to the Kyoto-protocol: Possibilities and consequences.	2001 -2003	700
<i>Sum SIP and joint programs for FNI, NUPI, CICERO. Funds from KUF allocated by KS</i>		<i>3 690</i>

Medicine and Health Division
Briefing material for Divisional Review

Evaluation of the Research Council of Norway Briefing Material prepared by the Medicine and Health Division

1 History, Scope and Changes in the Division

Technopolis' request:

- A **historical** description of the situation before the Division and RCN were set up, focusing on the strengths and weaknesses of the different systems
- The problems and challenges, as well as the **change goals** of the Division
 - In the fields and institutions supported by the Division
 - In the work of RCN
- An explanation of the current Division boundaries and why these were set as they are and a comment on issues associated with these boundaries

1.1 A general description of the Council for Medical Research (CMR), as of 1992

The Medicine and Health Division (MH) of RCN has its roots in the former Council for Medical Research (CMR), one of four subcouncils (and departments) in the former Norwegian Research Council for Science and the Humanities (NAVF). To a large extent, the establishment of MH can be viewed as following up a course of development that had already started in CMR.

The area of responsibility was defined as supporting research in medicine, dentistry, psychology, basic natural science and veterinary medicine (when relevant to human medicine), nursing science and physiotherapy. Project support was given to researchers from various backgrounds (pharmacists, lawyers, social scientists, etc.) as long as the project in question was relevant to medicine or health related problems. Support was given to both basic and applied research, also within research programmes. Considerable attention was focused on multidisciplinary research within programmes and on accepting researchers outside the "medical community" as being important for the development of the healthcare sector and therefore relevant to the Council's funding. CMR defined its tasks as *funding, evaluating, and planning strategies*.

In 1992, CMR's budget amounted to MNOK 147,421, accounting for about 20 per cent of NAVF's budget. About 2/3 of these revenues were derived from the Ministry of Education, Research and Church Affairs (68 %), 1/6 from the Ministry of Health and Social Affairs, and the rest from other ministries and private industry.

About 40 per cent of the budget was allocated to "discipline-oriented research"; 40 per cent to 10 programmes within the main target areas at that time (Health, Environment and Living Conditions - HEMIL: 6, Biotechnology: 1, Oil and Gas: 2 and IT: 1); and 20 per cent to 7 other programmes. Five review panels for discipline-oriented research projects and 18 programme committees (including one co-ordinating all HEMIL programmes) were in charge of project evaluations. The budget for the year 1992 for discipline-oriented research and all CMR programmes is presented below.

Discipline-oriented research	MNOK, 1992
Review panel I for Basic Biomedical Research	10.60
Review panel II for Basic Biomedical Research	10.00
Review panel III for Basic Biomedical Research	12.80
Review panel IV for Clinical Research	12.25
Review panel V for Public Health and Health Services	5.35

Research programmes	MNOK. 1992
Information technology	4.40
Biotechnology (incl. EMBL)	10.60
Hyperbaric medicine	3.00
Cold climate research	2.70
Health, Environment and Living Conditions (HEMIL)	1.30
Occupational health	4.50
Epidaemiology	8.90
Health services research	8.30
Health and environmental pollution	6.70
Disease prevention and health promotion	5.70
HEMIL and developing countries	5.50
Mental health	10.05
HIV/AIDS	3.20
Medical ethics	2.40
Medical research on women	1.15
Sports Medicine	3.60
Nursing	0.50
Infant mortality and SID	3.00

The Council (Board), consisting of 10 members (11 after psychology was transferred), was responsible for the overall budget and had the final "vote". The chairs of the five review panels for discipline-oriented research were all members of the Council.

About 80 per cent of the budget was distributed to the universities and university hospitals. In 1992, CMR financed about 580 projects.

CMR had initiated a Committee on Research Ethics (which subsequently became the National Committee for Research Ethics in Medicine) and also a research programme on Medical Ethics. It had taken the problem of dishonesty in research seriously and established its own committee to prevent these problems and to give advice on how to solve conflicts of this nature. Furthermore, a programme for Consensus Development Conferences was established to bring research results into the public debate arena and to act as a major communications arena for the general public.

The administration consisted of 16 people: 1 director, 1 deputy director, 7 "research co-ordinators" (one assigned to information work), and 7 "secretaries". The department was administratively under the auspices of the Director General of NAVF, but all items relating to scientific strategies, new research initiatives, etc. were the purview of the Council.

Strengths

- Close contact with the research community – mainly university researchers;
- Strong acceptance for national research strategies presented by the Council in the research communities (universities);
- Ability to interact with politicians;
- Rich in new initiatives (inspired by international contacts): establishing post-doctoral grants/fellowships, RMF groups, a Virology Centre, special career grants for women, etc.;
- Close contacts with international organisations which provided input for strategic development.

Weaknesses

- Responsible for a broad variety of small programmes, small grants and detailed follow-up;
- Employer for all doctoral and postdoctoral fellows, and a large number of researchers;
- Responsible for all accounting (all invoices from project researchers);
- Insignificant co-operation between the five existing research councils;
- No formal links to relevant industry to promote goal-oriented economic development.

Challenges

- Increase interest in and the funding of research in the Ministry of Health and Social Affairs;
- Increase the total budget;
- Develop the strategic functions even further;
- Strengthen the quality of the administrative work;
- Broaden the scope of responsibilities, especially in respect of commercialising research results and industry-relevant research (patents, etc.).

1.2 Goals of the new organisation

To the Medicine and Health Division (MH), the new organisational model seemed like an endorsement of a trend that had already started. The new name seemed to formalise a **broader scope of the research responsibilities** than those handled by the original CMR.

The **integration between basic and applied research** was to be given more attention, as was the **”usefulness” of research to society**. MH’s new role as a **formal adviser** on national research policy required more focus. MH also felt the **need to take the commercialisation aspect of research** more seriously than before.

The old organisation had developed a large number of sub-committees involved in assessing research proposals. One goal was **to reduce this number** and thereby **ensure better quality control**, and **more rational use of peers’ time**, as well as to **develop improved and equal standards** for assessment methods.

A major effort was undertaken to discuss and **establish an organisational body** (both for the administration and for the Board’s subordinate committees) that could enhance/match the Division’s goals and at the same time integrate the different functions of providing advice, handling grant applications and serving as an important meeting place for researchers, ministries and other users of research.

The administration of MH was set up with three departments based on three main research areas (with some practical adjustments). This was in contrast to other divisions that based

their structure on funding modes (programmes, disciplinary research, infrastructure). The new staff was recruited mainly from the former CMR, but also from NTNF (3) and NORAS (1). The director was recruited externally. Eighteen positions were allocated to the Medicine and Health Division.

1.3 Division boundaries

As mentioned above, the boundaries for MH's activities were to a large extent a confirmation of the direction the old CMR had developed. A few research areas needed closer scrutiny and discussions to settle which division should be responsible for them. These were *Health issues in developing countries*, which was "transferred" to MU (Environment and Development); *Health services research*, and *Alcohol and drug abuse*, previously co-operation areas with NORAS, and now included in MH's portfolio. In addition, MH's programmes on *IT* and on *Work and Health* were expanded to include/add two similar programmes from the "old" NTNF (IE).

Comments:

The new organisation of the MH division did not seem like a threat to the "old" CMR. On the contrary, it seemed like a continuation of the work that was currently in focus. The new challenges were related to the stronger emphasis placed on RCN's strategic and advisory roles. Also there was to be a change in the interaction between the Division's Research Board and the administration. The Division's Research Board could no longer "instruct" the MH administration (director) on scientific matters.

Some problems occurred when the RCN was first established, but they were perhaps of a different nature than what had been foreseen. At an early stage in the establishment of the RCN, it was assumed that the divisions would be of more or less equal size, and that MH would represent about 10 per cent of the total. This was not the case, however. MH became a relatively "marginal" division within the new structure, with a share of only 5.7 per cent of the total budget, and a loss of influence appeared to accompany the change.

2 Strategy

Technopolis' request:

- A description of the **strategy** of the Division, how it addresses the change goals and how it has itself changed over the lifetime of the division. For example:
 - What is the strategy in relation to creating and managing national research capabilities in the Division?
 - What is the strategy in relation to different types of research (basic/applied/disciplinary/innovation-related, strategic etc)?
 - How is research infrastructure handled?
- An overview of the **achievements** and **impact** of the funding provided by the Division. Claims about the results of its portfolio might include:
 - Extent of goal achievement and contribution to Divisional Strategy
 - Use of research results as part of policy formulation
 - Impact on the research community
 - Industrial Impact
 - Delivering needs of stakeholders
- Future plans, visions, and the way Division strategy is expected to evolve in the future

2.1 Strategy development

The Medicine and Health Division's strategy is laid down in three documents:

- I Research for Health and Quality of Life – The Strategy for Medicine and Health 1996–2000
- II Key Figures for Medical and Healthcare Research (*Nøkkeltall for medisinsk og helsefaglig forskning 1999* – available in Norwegian only)
- III From Words to Action – The Plan of Action for Medicine and Health 1996–2000 (prolonged)

The original strategy (I) states the values and overall goals for MH. It describes the boundaries of the Division's responsibilities and the general principles which apply to the Division's priorities. (The document contains an English summary.) The target areas, as described in this strategy, are:

- long-term basic research
- clinical research
- response to the health-related needs of society
- commercial exploitation of research results
- advisory services
- dissemination and communication.

“Key Figures” (II) is a bi-annual publication which provide statistics and information on budget distribution, funding and output statistics for medical and health research in Norway in general and for the RCN. The statistics are based on external sources, mainly from NIFU, and the RCN's own data base. The aim is to establish a knowledge base for MH's strategic work.

The current strategy is presented in the Plan of Action (III) (translated for the evaluation panel). A short version of the Plan of Action is discussed below.

Comments

These documents, read chronologically, represent the core of the changes and developments over the lifetime of the Division. From an early stage of the RCN, it became apparent that

myths about the economic situation of medical research had to be dispelled. Facts were needed, so a series of studies was produced to provide a general baseline in addition to MH's own budget analysis.

2.2 Present strategy

The Plan of Action is based on a strategic analysis (a SWOT analysis: Strengths, Weaknesses, Opportunities, Threats). This analysis focuses on the apparent status of Norwegian medical and healthcare research and the apparent status of the MH Division's strategic functions (in 1998). The analysis of the situation of medical and health-related research in Norway concluded as follows:

- *Budgetary trends are negative*: only minor budgetary increases in the past 10 years; research conditions in hospitals are deteriorating; the universities lack necessary equipment and money; new technologies, both in research and in patient treatment, are being introduced more rapidly than ever before.
- *Norway's research efforts are lagging behind internationally*: other countries (Norway's co-operation/trade partners) are generally stepping up their research efforts.
- *Problems related to recruitment*: fewer and fewer physicians, psychologists and dentists are choosing to pursue a career in research. It will become impossible to find qualified personnel for certain academic positions unless this trend is reversed.
- *Norwegian research might have less impact than that of other countries, but it does have certain special opportunities*: bibliometric studies indicate an overall low impact of Norwegian research, but there are some exceptions. Medical and health researchers do not do too badly at the national level.

The ultimate goal is that Norwegian medical and health-related research should reach the top Scandinavian level within 5 to 10 years and, in so doing, contribute to ensuring that national healthcare services continue to be among the best in the world. To achieve this, Norway needs to:

- focus more strongly on basic research;
- focus more strongly on gene technology and information technology to keep up with the fast pace of technological developments;
- make sure that Norwegian health professionals are engaged in research to ensure their own professional development and secure up-to-date services for the general public;
- exploit Norway's national research advantages more effectively, especially its "surveyable population", and national health and disease records;
- establish a stronger link between research and health policy.

The Plan of Action addresses the goals of the changes. It states four performance areas and specifies a set of goals for each area. The performance areas may be summarised as follows:

- Promote high research quality:
 1. More internationalisation
 2. More top-level research
 3. More innovative research

- Help ensure good research conditions:
 1. Increase allocations
 2. Improve recruitment
 3. Ensure more working capital
- Help ensure that research is applied and used:
 1. Communications and dissemination
- Contribute to optimal national research policy:
 1. Improve the empirical basis
 2. Achieve greater influence

The performance areas are related to the (then ongoing) work to establish a performance management system for the RCN. Each goal stipulates specific actions, and each action has a designated person (in the MH administration) in charge of follow-up and reporting. A few additions have been made since the document was printed, both to comply with the overall performance management system for the RCN, and in response to experience gained along the way.

Developing the Plan of Action, along with the follow-up plan, also resulted in measures to improve the Division's strategic functions. These were based on an internal performance analysis. It was decided to focus on the following areas:

- goal-oriented efforts
- communications with politicians and the ministries
- communication with the general public
- relations with the research community
- influence on the research system
- collaboration with the other divisions in the RCN

2.3 Achievements and impact of funding

2.3.1 Achievements related to funding policies

The programme structure has been reorganised. Fourteen programmes have now been reduced to nine programmes. The purpose of the new structure was to improve the rationale of the overall structure, to increase the size of the programmes and to reduce the number of "work units". Increasing the size of programmes gives the programme boards greater flexibility in their work, and enables the follow-up of the Division's goals related to larger grants and stronger focus on major themes.

New funding modes have been developed to emphasise the goal of directing an increasing proportion of the budget to larger grants to researchers who produce high-quality research and to prepare for the establishment of Centres of Excellence (Fund for Research and Innovation). In addition, the number of larger grants is on the rise in general. Specific funding modes to increase collaboration and contacts internationally have also been focused, and the spending has increased in these areas.

The recruitment strategy has succeeded in increasing the number of postdoctoral grants, although the negative trends for healthcare professionals pursuing a career in research has not yet been reversed. The number of student fellowships has increased as a consequence of the changes in strategy.

There has been an increase in allocations to basic research (independent projects), even though the overall budget increase has only been directed towards the research programmes.

2.3.2 Achievements related to the way MH works

Working with the Plan of Action is in itself an example of a change of direction towards more goal-oriented work. Short reports on every "action" are made twice a year. In this respect, the dialogue with the Division's Research Board concentrates on achievements more than on how things are done. The results are good: 12 of the 15 explicit goals set for the year 2000 were reached on time (more or less), and two-thirds of the 15 goals with a longer time span are well underway.

The Division now spends more time on systematic and frequent contact with politicians and decision makers in the ministries. Several memoranda have been prepared for politicians and ministries. New tasks have been requested: research-based evaluations of important health services reforms; a plan of action for cancer research; committee participation in planning research funding for regional hospitals, etc. The increase in budget allocations from the Ministry of Health and Social Affairs may also be interpreted as a positive signal regarding the Ministry's reliance on MH's efforts.

More active interaction with the media has resulted in more than 40 "commentaries" on radio and TV and in the newspapers during the past year, in addition to journalists' reporting from conferences and research results related to medical and health issues. MH has produced several new publications, for instance "Medicine and Health Anno 2020 – a Research Odyssey" and "From Basic Research to Good Health" (in print).

A new initiative was undertaken for joint actions on the part of research communities - where the Division took on a moderator role in order to present a national plan for functional genomic research (FUGE). The Division's involvement in regular joint meetings with the university hospital directors and the deans has also proved useful to all parties.

Systematic communications with the researchers and research institutions involved in MH's strategies have created a better understanding of the Division's way of thinking and its common goals. This relates in particular to the efforts regarding stricter funding priorities, larger grants (total funding), collaboration between research groups, internationalisation demands, the need to increase working capital to change the inappropriate balance between salaries and money to spend on research.

Improved personal relations have contributed to positive collaboration across divisions. Joint bilateral research efforts have been established between MH and all other RCN divisions.

Systematic follow-up of management procedures has improved the quality and punctuality of MH's daily routines and expanded workload capacity without increasing the number of administrative personnel.

Comments:

A survey was carried out among MH's users by an independent institution last year. The study indicated that respondents were generally pleased with MH's strategy and performance.

2.4 The future

An evaluation of all Norwegian basic research in biology (including medicine) provided important advice on future strategies in this field. This merits special consideration. The Division has decided to initiate evaluations of clinical research as well as public health and health services research in the coming year.

Basically, MH foresees a continuation of the direction of the ongoing work. More focus will be placed on research priorities, collaboration between various research traditions (across disciplines), and the joint efforts between health policy and research policy. MH will also attempt to improve communications. Among other efforts, extended use of the Internet may help explain management procedures and strategies in a better way and thereby create more transparency in the organisation.

In future, many areas of MH's present strategy will call for "more of the same". A new strategy for RCN is due this fall, and the Division's Research Board has decided to devise a new strategy of its own. Both will present opportunities to summarise achievements and provide impetus for future priorities.

The present evaluation of RCN will undoubtedly also engender new ideas and provide relevant advice regarding the development of future strategies.

3 Governance

Technopolis' request:

- A summary of the **stakeholders** for the work of the Division and how their interests are served as users, clients and in the governance of the Division
- A description of the **governance** of the Division, especially explaining the role of the Division's Research Board
- The (formal and informal) mechanisms that create links to other divisions of the RCN and how these contribute to co-ordination across RCN

3.1 Stakeholders

The MH stakeholders are:

- *The research community*

Most important are the researchers at the four universities (within the faculties of Medicine, Psychology, Dentistry and others). Researchers at "external" institutes with health-related profiles are also stakeholders, but the "institute sector" plays a lesser role for MH, both portfolio-wise and strategically, compared with the other divisions.

Researchers are served in three main functions: as users (policies, research results, conferences, etc.), as clients (applicants), and as "governors" (serving on different boards and committees and as peers). They apply for and receive funding; they take part in the development of new research areas when so requested or in their capacity as representing their organisations/institutions; and they are important in the governance of the Division by serving on programme committees, the Research Board, etc. They are stakeholders, both on an individual basis and at an institutional level, where they are represented through the deans, the research deans or the administrative personnel. This contact is fostered through regular meetings within the different functional areas. The institutions are often asked to suggest members for different governing or *ad hoc* committees/boards. The research community is thus an important source of personnel when strategies are made and implemented.

- *The Government*

The Ministry of Education, Research and Church Affairs (MoERCA), and the Ministry of Health and Social Affairs (MoHSA) are the most important bodies, but also others like Ministry of Trade and Industry (MoTI), Ministry of Environment (MoE), Ministry of Government Administration (MoGA), and Ministry of Foreign Affairs (MoFA) are relevant.

The ministries supply the financial resources that MH manages, and they are often represented on programme boards. In addition, the ministries receive research policy advice related to their respective sectors. Meetings are held regularly to present and discuss budgets and annual reports. MH has a formal responsibility to serve the MoHSA on behalf of the RCN. Several additional activities and contacts have developed due to this or because the MoHSA has specific needs that MH can meet (see the briefing on *Strategy*).

- *The healthcare system*

Most important are decision makers at different levels, and (part-time) researchers in hospitals and primary care.

They are also served in numerous functions, i.e. as users, clients and participants in governance. The dissemination of research results that can be of practical use is of special relevance here, and conferences are an important means for achieving this goal.

- *The general public*
Health-related issues are highly topical for the general public, newspapers and politicians.

Schooling journalists (as well as researchers) on the importance of communicating research activities and results is part of MH's strategy. Participation in the general public debate on these issues is also encouraged. Organisations and interest groups are regularly included on invitation lists for conferences. *Ad hoc* meetings also occur, and some interest groups serve on programme boards/committees. Regular meetings are held with other research funding organisations for the mutual exchange of information and to forge possible strategic alliances or co-operation.

- *Relevant industry* (pharmaceutical, biotechnological, IT, etc.)
One particular research programme has as its goal the exploitation of the commercial potential of medical research. Partners in private industry may qualify for funding. Representative(s) of industry serve on boards at both the divisional and programme level.

3.2 Description of governance

The Division's Research Board has the overall responsibility for the research activities within the Division's sphere of responsibility. The Board adopts objectives, strategies and overall budgets. It appoints subcommittees and allocates funding for them and for other activities, and it makes sure that the activities of the Division take place according to plan. The programme boards are responsible for their yearly budgets. The administration has no formal funding authority. However, the administration is often delegated the responsibility to follow up a variety of tasks based on Board discussions.

The Division's Research Board consists of seven members and three deputies. Members are appointed by the RCN Executive Board and do not represent the institutions for which they work. However, a broad spectrum of research competence and experience, as well as a varied institutional scope, is represented. Members are appointed for a four-year period. They may be reappointed, but cannot serve for more than two consecutive periods.

The MH Research Board meets six or seven times a year, covering about 80 to 120 agenda items each year. Agendas and all preparations, including introducing the item and presenting the proposals at the meeting are handled by the administration. The members of the Board perform their functions through the meetings, meaning that the administrative personnel also require professional and strategic qualifications. MH is currently in the process of establishing the routines for the relationship between the administration and a new Board (the third). The tendency is towards more responsibility for the administration. There is usually close contact between the director and the chair of the Research Board between meetings, and the chair of the Research Board often takes part in the Division's meetings with universities, ministries etc. The chair also takes part in the RCN's Executive Board meetings (budget and strategy) and meets with the chairs of the other divisional research boards and with the director general of the RCN.

MH's activities are organised through a number of sub-committees with specifically assigned tasks. At least once a year the Division's Research Board meets with the chairs of programme boards or other committees.

The director is responsible for the activities of the Division. Every year, a work programme is drawn up by the Division, based on the Plan of Action and Performance Management System. The work programme requires acceptance from the director general.

3.3 Creating links to other divisions

Contact with other divisions takes place in the following ways:

- contact in dealing with matters that require co-ordination
- contact through projects organised as joint processes
- contact at management level via weekly directors' meetings
- specific processes that involve interdivisional co-operation

Formal links are established through a few shared programmes/target areas:

MH/Industry and Energy	Commercialisation and capital gains from medical research
MH/Bioproduction and Processing	Food and health
MH/Science and Technology/Industry and Energy	Medical technology
MH/ Science and Technology NT	Research equipment
MH/Culture and Society	Ageing
MH/Environment and Development	GAVI/"poverty diseases"
MH/all divisions	Ethics, society and biotechnology

Formal contacts have also been established through the participation of the chairs of all the division's Research Boards at RCN Board meetings when matters relating to strategy and budget issues are discussed, in addition to the chair's meetings with the chairs of the other Research Boards and with the director general of the RCN. Informal contact takes place through several managerial processes and co-ordinating groups. The director general and the directors of each division have lunch meetings at a bilateral level.

Examples, co-ordinating groups:

- Centres of Excellence, Biotechnology, ICT Forum, Gender and Equality Research.

Examples, project groups (development):

- programme organisation, RCN strategy, international strategy, Scientific Fraud/Dishonesty;
- personnel related issues, electronic work procedures, new web site for research (www.forskning.no).

Examples, general management/procedures:

- budgets, annual reports, application procedures, research contracts.

Management of "main target areas", "main thematic initiatives" and "ministry contact" have been set up with one divisional director responsible for a given area across the RCN.

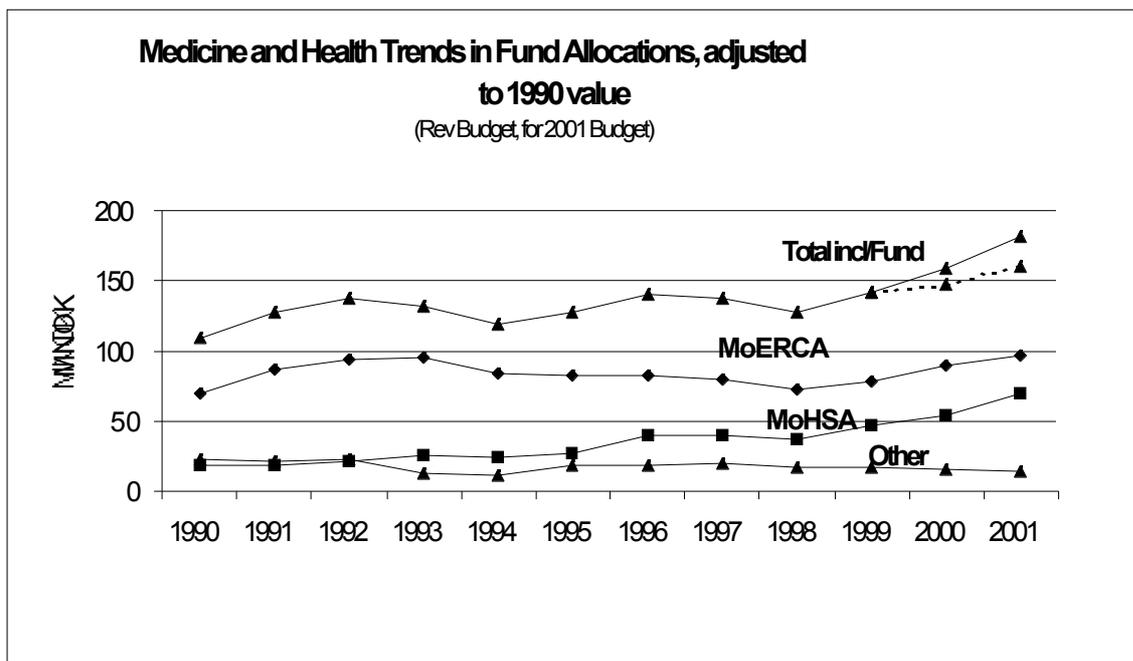
4 Portfolio of Activities

Technopolis' request:

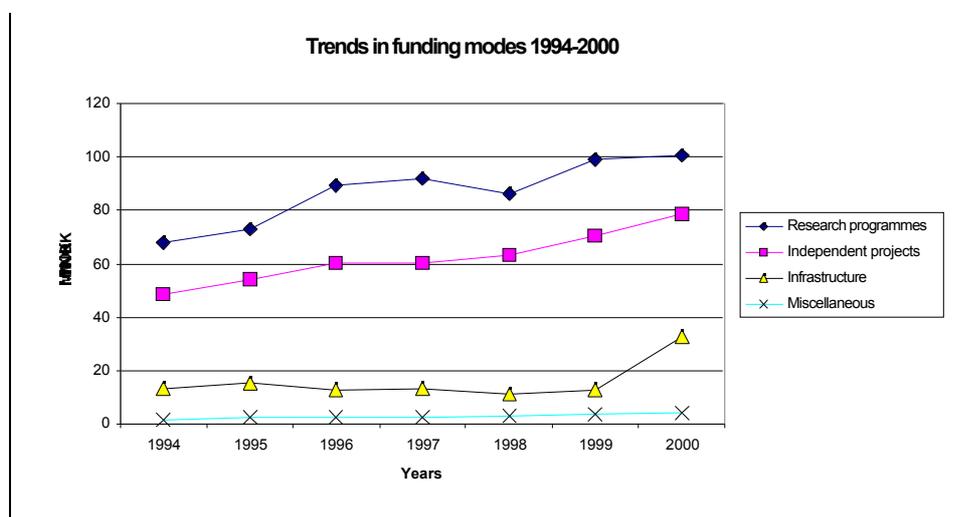
- An explanation of how the strategy is reflected in the programme and project **portfolios**
- An explanation of the **structure of the Division** and the function of the different Departments
- A summary of the **content and structure of the research portfolio** per department. This will need to explain the use and allocation of resources and the portfolio breakdown between different funding modes (e.g. programmes, infrastructure support and disciplinary support). The summary for each part of the research portfolio needs to give a qualitative and quantitative description of the type of projects supported and the results and impact produced
- A brief explanation of the programme and project **management processes**, especially project selection criteria and co-ordination processes with other Divisions and stakeholders

4.1 Portfolio

This report will, first, present the overall revenues and the overall content and structure of the research portfolio, then discuss the portfolio in relation to the different funding modes. Finally, it will present the management processes as they are generally carried out in MH. It should be pointed out that the MH budget is not broken down according to departments.



Two ministries are of particular importance for MH research, the Ministry of Education, Research and Church Affairs (MoERCA) and the Ministry of Health and Social Affairs (MoHSA). The increase in the overall budget allocations stems from an increase in MoHSA's allocations and the new "Fund for Research and Innovation" established by the Storting (Norwegian parliament) and administered by MoERCA. Medical and health-related research is one of four thematic priority areas in last year's White Paper on Research. The ordinary MoERCA allocations reached a peak in 1992, before the establishment of the RCN.



Comparing the different funding modes in recent years shows a stronger emphasis on infrastructure support and support for independent projects.

The distribution of funds to *independent projects* shows a relatively strong focus on basic biomedical research.

Review Panels Independent Projects	MNOK (2000)	MNOK (2001)
Review panel I for Basic Biomedical Research	24.4	25.4
Review panel II for Basic Biomedical Research	15.1	16.1
Review panel III for Clinical Research	17.4	18.4
Review panel IV for Public Health and Health Services	14.2	16.0

As of 2001, MH is running nine research programmes, compared with 14 previously. However, the new programmes have "inherited" projects from the former programmes. Accordingly, the proportion of the budget used for the different funding modes has not been significantly altered.

MoHSA is the primary contributor to the research programmes.

Programme funding	MNOK (2000)	MNOK (2001)	Funding ministries
Commercialising Ideas from Medical Research	8.0	12.0	TI
Molecular Medicine and Gene Technology	10.2	10.2	ERCA
IT in Medicine and Health Services	11.0	11.0	ERCA, TI, HSA
Environment and Health	8.4	7.8	ERCA, E, HSA, TC
Health Services and Health Economics	15.6	15.8	ERCA, HSA, F
Health and Society	16.2	15.6	ERCA, HSA
Work and Health	8.0	9.7	ERCA, HSA, NHO
Mental Health	18.3	21.3	ERCA, HSA
Point of Care Clinical Research and Alternative Medicine	9.7	11.3	HSA

The contents of each programme (summary from programme plans) are presented in Appendix 1.

The number of programmes have been reduced over the years. The Plan of Action called for a more systematic reorganisation of the programme structure. An overview of this change of

structure is presented in Appendix 2. A brief presentation of the previous 14 programmes is shown in Appendix 3.

Year	Number of programmes	Budget MNOK	Sources of funding *)
1994	16	68.0	ERCA, HSA, TI, CFA, JP, LGRD, CA, TC
1997	14	91.5	ERCA, HSA, TI, E, CFA, LGRD, CA, TC
2000	(13) 9	100.0	ERCA HSA, TI, F, LGRD, E, TC

*) Abbreviations are shown in Appendix 2.

The number of projects financed by MH has been relatively stable over the years. There has been an increase in the number of larger projects. The intention to reduce the number of smaller, ordinary grants has been fulfilled to some extent. The reason that the number of small grants seems to have increased over the past two years is that the figures include stays abroad and student fellowships. The efforts to increase international collaboration (through the funding of stays abroad) and recruitment strategies (students fellowships, etc.) have increased the number of project within these categories.

Size of project grants (NOK)	1995	1996	1997	1998	1999	2000
< 99,999	292	260	197	156	167	198
100,000 – 299,999	226	275	319	277	255	241
300,000 – 499,999	127	162	195	223	204	240
> 500,000	37	31	34	50	66	115
Total projects funded	682	728	745	706	692	794

4.2 Structure of the Division/departments

The administration of MH has a total of 18 positions (20 employees - 3 part time) and is organised in three departments and one staff unit.

The MH executive management group has one formal meeting each week. This is a forum for internal decision making, planning, and discussions of strategy follow up. To minimise the boundaries between departments, many tasks are carried out in projects across the Division as a whole. Budget co-ordinating responsibility is, for instance, allocated to one department head, international strategies to another, communications and strategy projects to a third, etc.

4.2.1 Staff

Personnel: 1 executive director, 1 special adviser, 1 executive officer

The executive director's work focuses on strategy, politics, contact meetings and co-operation with a number of relevant institutions and organisations. In addition to the general managerial tasks of the executive director, preparations of the Division's Research Board meetings, different tasks connected with statistics, the follow-up of Plan of Action and Performance Management, recruitment policies, and more *ad hoc* projects are administrative staff functions.

4.2.2 *Department for basic research*

Responsible for biomedical basic research, strategy development for this field, molecular biology initiatives, infrastructure scientific equipment investments, in addition to cross-cutting tasks related to budget, (long-term budget planning, annual budgets), accounting etc, contacts with NT.

Personnel: 1 director, 3 advisers, 2 executive officers

The department is in charge of the following activities:

- two basic research review panels (independent projects)
- programme committees for: Environment and Health; Molecular Medicine and Gene Technology
- infrastructure: Major grants; MH groups
- planning, strategy, budgets, co-ordinating budget functions for MH, and co-ordinating the administrative process of assessing applications.

4.2.3 *Department for clinical research*

Responsible for clinical research (medicine, dentistry, psychology), strategies for clinical research, co-operation with university hospitals, scientific fraud, cross-cutting tasks related to international activities (EU, EMRC, etc), health research related to "poverty diseases" in development countries, administrative budgets.

Personnel: 1 director, 2 advisers, 2 (1_) executive officers

The department is in charge of the following activities:

- one review panel (independent projects)
- programme committees for: Point of Care Clinical Research and Alternative Medicine, IT in Medicine and Health Services, Mental Health
- infrastructure: Advanced Research Programme, Centres of Excellence
- international strategy tasks: EU (QoL), ESF/EMRC, the Global Forum for Health Research
- scientific fraud.

4.2.4 *Department for public health and health services research*

Responsible for epidemiological and public health research, health services research, social science (and humanities) research related to MH, psychology (except neurology and clinical), strategies for these fields, research-based evaluations of healthcare reforms, cross-cutting activities related to the Division's co-operation with Ministry of Health and Social Affairs and strategies for same, RCN strategy tasks, Communications (the Internet, communication grants and courses, publications), administrative/managerial systems.

Personnel: 1 director, 3 _ advisers, 2 (1_) executive officers

The department is in charge of the following activities:

- one review panel committee (independent projects)
- programme committees for: Work and Health, Society and Health, Health Services and Health Economics, Commercialising Ideas from Medical Research (MEDKAP);
- research-based evaluations (contracted): General Practitioner Reform, Health Services for the Mental Health "Reform"
- infrastructure: Cancer research

- cross-cutting tasks related to strategies, MoHSA, INFO, contact with Culture and Society.

4.2.5 Staff qualifications

Including the executive director, directors, senior advisers and advisers, the professional staff consists of 14 people. The professional staff all have university degrees at a master's level or higher (medicine, dentistry, pharmacy, nutrition, physiology, biochemistry, molecular biology, sociology, economics, engineering), four hold doctorates (medicine, physiology, molecular biology, nutrition). The other staff, six executive officers, have a variety of technical, IT and office management skills.

The present executive director was recruited in 1997, while the three departmental directors were all recruited from the former NAVF. Four advisers/senior advisers have experience from NAVF, 1 from NORAS, 1 from NTNf, and 4 have been recruited externally. Four of the executive officers have experience from NAVF.

External training

For the past few years, MH has set up an annual "human resources development plan", including external and internal training. Several staff members have received funding for external training/courses, covering subjects such as information technology, language, evaluation, management and economics at university level. Budgets for these activities were NOK 143,000 in 1999, NOK 139,000 in 2000 and NOK 129,000 in 2001. In addition, the professional staff receives external training through participation in a variety of conferences, seminars and meetings related to the research being supported or research policy questions.

Special excursions have been arranged for the Division's executive management group and the Division's Research Board to NIH in Washington, MRC, OST and the Wellcome Trust in London, as well as to the other MRCs in Denmark and Sweden.

4.3 Management processes

4.3.1 Grant applications

Procedures related to the administrative processing of applications are organised as a single cross-divisional project within MH. Processes are reviewed every year to improve efficiency. The main application deadline should preferably be used for all applications, with a few exceptions (stays abroad, guest researchers, student fellowships and the MH/IE-programme). Around 700 applications are assessed every year.

Applications are coded, registered in the computer, compiled in "books", and then distributed to the appropriate evaluating committee (relevant programme board or review panel). These committees function as peer review groups. All members mark all the applications they have received, while one or two of the group members are appointed as "special referees" for each application. The final ranking of projects within each committee takes place after discussions in committee meetings. Guidelines for the evaluations are established, and selected priority-related guidelines from the MH Research Board are presented in a memo. An evaluation form has been developed to serve as a work sheet for the evaluator. It is also used to give feedback to unsuccessful applicants.

Questions of impartiality are the focus of attention and formally treated at every meeting of any of the Division's subcommittees.

Review panels for independent projects:

- Review Panel I for Basic Biomedical Research (biochemistry, gene technology, genetics, immunology, microbiology etc)
- Review Panel II for Basic Biomedical Research (anatomy, physiology, pathology, pharmacology, toxicology etc)
- Review Panel III - Clinical Research (medicine, dentistry, psychology)
- Review Panel IV – Public Health and Health Services (public health, epidemiology, psychology, behavioural research, health services research, ethics, health related social science etc).

The Review Panels are appointed by the MH Research Board for a three-year period. No member can serve for more than two consecutive periods. The universities and major research institutions are invited to suggest panel members.

4.3.2 Programme management

As part of MH's Plan of Action, the structure of the programmes was reorganised last year. The previous 14 programmes have been reduced to nine programmes. The purpose of the new structure is to improve the rationale behind the overall structure, to increase the size of the programmes and to reduce the number of "work units".

MH initiates programmes for a number of different reasons:

- a need to strengthen a specific research field
- a need for networking
- a need for special communication in respect of a research field
- a need for a multidisciplinary approach to a problem area
- a need to initiate new projects that will not evolve from the research community.

Most MH programmes can be characterised as action-oriented, aimed primarily at covering politically focused problems. However, MH also has basic research programmes and user-driven programmes in its portfolio. Most programmes cover basic and applied research projects alike.

Initiatives may arise from strategic discussions in MH's review panels, ideas generated in the research community (universities), initiatives from the ministries, initiatives from special interest groups or ideas generated by the administration or Research Board.

Researchers are involved in presenting a platform for decision-making processes, before a programme idea is brought to the Research Board. Usually a programme board is then appointed (by the Research Board), and its first task is to suggest a programme plan, which requires the endorsement of the Research Board. A Programme Board is initially appointed for a two-year period, then usually re-appointed for the remainder of the planned duration of the programme.

The administration serves as a secretariat for the programme boards. However, the idea is to employ an external senior scientist (often in a part-time position) to act as "supervisor" or research co-ordinator (according to the programme's specific needs). The goal is to obtain a division of labour between the administration and co-ordinator, according to their skills.

The programmes handle grant applications in the same way as "independent projects", i.e. the programme boards serve as peers. Project proposals are accepted primarily at the main

application date (15 June) every year. The main difference between the two is that relevant, important projects with a lower quality evaluation are sometimes given an opportunity to present a revised (improved) version of their proposal. Projects are selected through a ranking process focusing on quality and relevance to the programme's goals. The Programme Board also initiates projects in areas pertaining to the programme goals, when so required.

Programme boards:

- Commercialising Ideas from Medical Research
- Molecular Medicine and Gene Technology
- IT in Medicine and Health Services
- Environment and Health
- Health Services and Health Economics
- Health and Society
- Work and Health
- Mental Health
- Point of Care Clinical Research and Alternative Medicine

4.3.3 Special grants

Two additional application deadlines are employed for special grants (minor grants) for student fellowships, stays abroad and guest researchers. A committee, consisting of the chairs of all four Review Panels and three other members, evaluate and rank the projects, then finalise their decisions within a set budget. As of 2001, the procedures have been modified slightly. MH now asks the universities (at faculty level) to rank the applications by priority within each grant category.

Special Grants Committee

- student grants, stays abroad, guest researchers

4.3.4 Infrastructure support

Pursuant to the Division's strategy, an increasing proportion of the funding is being directed towards larger grants to research groups that have proven they can produce high-quality research. To emphasise this, new funding modes have been developed. So far, these applications have been treated differently from the ordinary applications. These are all larger grants provided to stimulate high-quality research and/or specially targeted areas in response to special calls for proposals. Special international peer review groups have been set up to handle the evaluation and ranking of applications. Peers have been selected on the basis of suggestions made by the administration after consulting with other medical research councils (Sweden, Denmark and the UK, in particular).

The portfolio in this category consists of:

Major grants – MNOK 1.0 (up from MNOK 0.8) for three years, 15 projects in process. This coming year, the ordinary review panels will be responsible for major grants.

The Advanced Research Programme (ARP) – a special effort with its own steering committee which recruits young researchers with outstanding international potential. ARP gives individual researchers extensive support, both in terms of follow-up and money (MNOK 1.0 to 1.5 per year for up to two three-year periods). Eight researchers have been selected thus far.

MH Groups – established as a measure to prepare for CoE in response to the Government's new Fund for Research and Innovation. Each grant amounts to MNOK 2.5 to 3.0 per year for a five-year period. Six groups have been established.

Cancer Grants – established to follow up the Action Plan for Cancer Research that contains a total of MNOK 100. Projects receive MNOK 1.0 to 3.0 per year for a three-year period. Eight projects have been selected.

Food and Health Grants – collaboration projects between nutrition/medicine and food production researchers. MNOK 0.5 to 1.0 for a three-year period. Six projects selected so far.

Larger grants for **Research Equipment** for medical research are included in a joint RCN programme administered by NT. Infrastructure support does not include **core institute funding**, an important funding mode for other divisions.

4.3.5 Miscellaneous

To encourage the dissemination of research results and to increase media interest, a few special grants are provided every year to researchers and journalists who want experience from the other side, working for a few months in media organisations or research environments, respectively. Research communications courses are set up and financed for the same purpose.

MH has established a committee to give advice and prevent dishonesty in medical and healthcare research. This initiative will probably be followed up by the Government's establishment of a national committee to cover problems of this type for all Norwegian research as of 2002.

The Division is in charge of two assignments regarding research-based evaluations of health reforms. These are the "Assigned Doctor Reform" and the "Plan of Action for Mental Health". The Ministry of Health and Social Affairs has commissioned these assignments. Annual funding amounts to about MNOK 3.5 and 5.0 for the evaluations, respectively, both for a five-year period.

Appendix 1

Medicine and Health Division's programmes in 2001 – programme plan summaries

Commercialising Ideas from Medical Research (2001 – 2005)

High political priority is being given to the commercialisation of ideas from medical and healthcare research. The programme *Commercialising Ideas from Medical Research - MEDKAP*, was established to promote commercialisation based on ideas from medical and healthcare research. The programme is a joint initiative being taken by the Research Council's Industry and Energy (IE) and Medicine and Health (MH) divisions. The programme's main objective is defined as being:

To promote wealth creation by increasing the commercial exploitation of research results derived from medical and healthcare research to make safe products which can help improve public health.

The programme will have the following means available to accomplish that objective:

- Fund all or part of the R&D work required to develop and verify scientific and technical concepts;
- Assess the feasibility of patents in connection with the project and support initial patent protection (priority patent);
- Identify market potential and buying criteria;
- Evaluate other possible sources of funding, if any, and ensure the project is made aware of them;
- Provide expertise for commercialising ideas.

The programme will have proactive, flexible programme management, at the same time as it will entail limited financial risk. The programme will be funded by the Ministry of Trade and Industry (NHD) and the Ministry of Health and Social Affairs (SHD). The programme period has provisionally been stipulated as 2000 to 2005.

Molecular Medicine and Gene Technology (2001 – 2005)

The genetic information contained in DNA is encoded by the sequence of its four building blocks A, C, G, T. Determination of the sequence of these chemical entities in the total human genome is approaching completion, and an entirely new world of information has now become available to scientists in medical biology. New challenges and possibilities are encountered in all areas of medicine: diagnostic, preventive and curative.

Two challenges are particularly pertinent to all medical scientists, both globally and within Norway. One is to participate in establishing and exploiting all the available new knowledge that can be generated from the sequence of the human genome. Because of the rather difficult situation for basic medical research in Norway this is a serious task. No less important is the challenge to provide Norwegian patients with the new possibilities for healthcare. This will rest on the successful transfer of the medically relevant knowledge from the medical scientists to the physicians working in clinical medicine either inside or outside hospitals.

The programme has two goals: To support peer review-selected research projects in the molecular medicine area, and to build bridges connecting basic medical research and clinical

research, thereby contributing to the general insight and understanding of medical molecular biology among clinicians.

Four aspects of biomedical research in Norway seem important to improve:

- Norwegian research has too little international collaboration
- the number and quality of publications from basic Norwegian medical science are unsatisfactory
- the gap between molecular medical research and clinical medicine is too large
- the potential for industrial exploitation of research data is not sufficiently utilised

The aim of the programme is, through support for establishment and further development of top competence in molecular medical and gene technology research, to contribute to enhancement of knowledge and novel concepts which in the final end will improve diagnosis, prevention and treatment of disease. We seek to reach these goals by

- supporting research which may give increased understanding of the function and interaction of gene products in the control of physiological and pathological processes
- supporting development and use of diagnostic and therapeutic tools in disease
- enhancing research on which biomedical industries can be based
- promote collaboration in research at local, national and international levels
- increase the possibilities for M.D.s to build up competence in molecular biology by giving priority to projects which promote their research in high quality basic research environments, the purpose being to reduce the gap between basic medical research and clinical medicine
- support collaborative projects between basic medical and clinical research environments for creation of conceptual and technological achievements

The programme will support research in central areas of molecular biology where highly competent people already can be found, thus eliciting further important contributions from Norwegian research. In addition, the programme will promote new activities in areas where research in Norway is weak. Examples of such fields are:

- bioinformatics – basic and applied
- structural biology – single and complex molecules
- molecular genetics focusing on the identification of genes associated with disease
- stem cell biology
- gene therapy – principles and technology

IT in medicine and health services (2001 – 2005)

Electronic information systems are making their way into most areas of the health sector, yet many questions around technological and organisational issues remain unanswered.

Moreover, the general terms and conditions which apply to this area are in constant flux.

Research and development must address a vast number of far-reaching tasks. To make genuine headway in this field, the Medicine and Health Division has decided to concentrate its efforts on a few specific areas. The selection of target areas for this programme was made with the needs of the health care system in mind. It also takes account of the areas in which Norwegian researchers have the potential to carve out a niche for themselves in the international arena. In addition, the selection exhibits regard for the results derived from the self-assessment of the programme "IT in medicine and health services" (1995 to 2000) conducted by the previous programme committee.

One of the most striking challenges facing this programme will be to promote research and development on services that will be feasible as broadband capacity becomes widely available to the health sector. Governmental policy aims at establishing a national health network and stimulating the availability of broadband capacity throughout the country in the next few years. Electronic networks will open opportunities for improving co-operation between healthcare personnel inside and outside hospitals, and between healthcare personnel and patients. Norwegian industry and researchers in the area have certain advantages that give them a good chance of succeeding on the international arena in the field of medical information technology, where there is a clear need to increase competence and the dissemination of expertise. The programme is intended to make important contributions to Norway's health care system through the development and application of IT solutions and products based on existing and future user needs. The programme is designed to improve skills and encourage innovation in Norwegian industry.

The programme has three seminal goals. The first is to establish minimum one centre in one or more of the programme's target areas (treatment-oriented systems, ICT facilitated networking and co-operation or systems for planning and control). This goal calls for an increase in the programme's fiscal parameters. The second goal is to increase the number of doctoral fellowships to 6 per year and the number of post-doctoral fellowships to 2 to 4 per year. At least 2/3 of these grants should be made within the programme's three main target areas. The third goal is that the projects conducted under the programme should result in 10 new patent applications or other forms of protected intellectual property rights (IPR) related to ICT in health services.

There are three main themes in the programme. The first is treatment-oriented information systems which focus on electronic medical records and collateral images. The use of electronic medical records are now very common outside hospitals, but the transition has begun within hospitals as well. The advent of this type of ICT opens new horizons for improving diagnostics and treatment, as well as for the exchange of information between different treatment centres. Very little research has been done thus far in this area. The second main theme involves ICT facilitated networking and co-operation (telemedicine). The lack of more co-operation in the health and social services sector results in less than optimal utilisation of the resources available in the sector. The last main theme refers to planning and control systems, focusing on the development of various types of indicators and systems for managing shared health data.

Environment and Health (2001 – 2005)

Man is exposed to a large number of environmental factors, indoors as well as outdoors. Many of these factors may have adverse effects on people's health and quality of life. Among the potential risk factors are pollution caused by traffic, consumer chemicals, building materials, various sources of radiation and hazardous substances in food. Pollution may, for example, contribute to the development of cancer, allergies, respiratory diseases and reproductive problems.

Most people spend a great deal of time in various indoor environments. Owing to a steady stream of new materials used in building and decoration, less ventilation, moisture/mould damage, etc. people are being exposed to an ever increasing number of chemical compounds indoors. In addition, exposure to dust mites and microbiological agents is on the rise. Emissions of environmental contaminants and other chemicals, including endocrine

disrupters, and air pollution such as gases and particles from road traffic, are among the main risk factors outdoors.

There is a tremendous need to generate more knowledge about associations between environment and health. This applies to exposure-related conditions, as well as to environmental factors' toxic properties and their effects on human health. Gene – environment interactions and the effects of combinations of various environmental factors further complicate the situation. It is essential that Norway have active research communities working in this field in order both to benefit from international knowledge production and to address problems specific to conditions in Norway.

Environment and Health follows up important research-related challenges identified in the Norwegian National Environment and Health Action Plan. The research results produced under the programme will be relevant for several user groups. For example, several sectoral authorities need research-based knowledge in this area as grounds for political and administrative decisions. The area enjoys high-priority status at the international level, for example, through the European Science Foundation and the EU's research programmes.

The programme's paramount objective is:

- *To obtain knowledge that can help mitigate the adverse effects on human health of physical, chemical and biological environmental factors.*

There is a pressing need for research in all areas of relevance to *Environment and Health*. Nonetheless, the programme will devote special attention to certain topics:

- Moisture in buildings;
- Air pollution in cities and towns;
- Chemicals that are hazardous for human health and the environment, with special emphasis on endocrine disrupters;
- Low-dose exposure and the interaction between different environmental factors.

The following targets have been drawn up for the Programme Committee's work:

- Of the total number of fellowships provided under the programme, the percentage of post-doctoral fellowships will be increased from 19 per cent in 2001 to 25 per cent by 2004.
- Over a three-year period, the programme will initiate at least two high quality interdisciplinary projects dealing with the associations between the indoor climate and health.
- During the programme period, the Programme Committee will initiate at least two fellowship projects at the doctoral or post-doctoral level to examine the interaction between genetic and environmental factors.
- By the end of 2002, the programme will establish an annual meeting place where relevant representatives from the administration and politics can meet researchers and the Programme Committee.
- During each year of the programme period, at least two programme projects will be presented in popular form through the media.

Health Services and Health Economics (2001 – 2005)

Health services research will be a comprehensive, key field of research over the long term. The need for and standards applied to health services are accelerating at a pace equal to that of technological development, new improved treatment opportunities, changing demographics and other conditions. New groups of patients are entering the arena in the field of psychiatry as well as in somatic services. Social and socio-economic considerations, as well as consideration for individuals, call for broadbased research and studies.

Health Services and Health Economics research is highly diverse, making it difficult to draw sharp lines of delimitation. Health services research is primarily concerned with the general parameters applying to the organisation and administration of various health services. The research often involves several subjects or disciplines, requiring that it be addressed from a multi- or inter-disciplinary angle of approach.

The paramount objectives for the programme period are to:

- stimulate health services research
- help recruit researchers to this field
- help ensure the research is firmly anchored in a variety of research communities.

The Programme Committee intends to concentrate available resources on a few main topics: *Health Economics, Mental Health Work and the Organisation and Administration of Health Services*. Emphasis will be attached to building up research groups and networks, and to forging links to academia.

The target group for the research results is broad-based and heterogeneous. In addition to the research community *per se*, the target group includes politicians, the public health administration, healthcare providers, patients and the general public. It is vital to disseminate the results widely since the programme targets an area of study so closely related to today's health policy reality.

Health and society (2001 – 2005)

Epidemiological research indicates that number of individuals with chronic, complex disorders is on the rise in our society. The causes and risks associated with ill health are complex and must be seen in relation to genetic factors, the environment, living standards and individual coping abilities. Many health problems can best be dealt with through health-promoting and disease prevention measures. Opportunities to understand and influence development trends may have an impact on preventive medicine and on the use of health services. Such research challenges are the focus of the research programme Health and Society.

The government administration and treatment systems are among the key target groups, and contact with volunteer and public organisations, such as patient and information organisations, as well as with the general public, will be an essential aspect of the programme's activities.

Activities under the auspices of the programme may be divided into three concepts: health-promoting and disease prevention work, cultural perspectives and participation.

The programme identifies three main scientific challenges:

(i) to describe key parameters for good health and social welfare, given the development of society today, (ii) to identify and describe areas of special importance to health and social welfare in which there is a lack of empirical knowledge, and (iii) to learn about prudent, effective ways to run health-promoting and disease prevention work.

Among the organisational challenges, the programme recognises the need to build up and link research groups in this field and to develop interdisciplinary approaches to problems. Further, it is crucial to create channels to facilitate contact between research and teaching and between research and the general public.

Among the programme's targets are: enhancing the share of substance abuse research based on a preventive approach, improving the work done on cultural perspectives in relation to health and disease, improving research on preventive instruments associated with social inequality and health, and improving the communication of results from such research.

Work and Health (2001 – 2005)

The current rapid technological development alters exposure factors at work. There is little knowledge whether the development of information-communication technology will increase demands at work, such as time pressure, demand for being accessible throughout the day, or demand for competence. It seems that divisions between work time and leisure time may be erased. This may challenge the need for rest and restitution, but there is currently little knowledge of consequences for health. It seems that there is an increase in the number of people that are excluded from working life by factors that may be related to health. There seems to be an increase in the number of disability pensioned people. There is little knowledge of work factors that determine the ability to cope with new challenges, factors which determine ability to work, or factors which determine retirement with disability from work.

In spite of many years of research, the mechanisms of many chemically induced health effects are still unknown.

The development of new methods in basic biological research has opened up new possibilities that allows new research on causes and mechanisms. This program will give high priority to research on *mechanisms* of work-related health effects.

The working life has a need for competence in scientific evaluation of health effects of interventions and “natural” changes.

Topics given priority for the program are:

- Health consequences of new work demands: new forms of organizations and production processes that follow from information-communication technology.
- Strengthening research on mechanisms of work-related health effects:
 - Musculoskeletal disorders
 - Chronic pain conditions
 - Respiratory diseases
- Research on the association between health and participation in, and exclusion from, working life, e.g. adjustments and rehabilitation and processes of exclusion from working life. Interdisciplinary research projects that examine associations between several potential causative factors, mechanisms or coping strategies, will be given priority.
- Physical and chemical exposures:

- Development of biomarkers for exposures and effects
- Development of research on health effects of interventions and changes.

The program seeks to enhance the standard of the research in this field by increasing the number of groups that perform long-term research at the international front and the number of scientists with Ph.D.-level competence.

Mental Health (2001 – 2005)

Mental health problems are very common. Prevention, treatment, care and the safeguarding of people with mental problems is extremely resource intensive, financially as well as in terms of human resources, for the individual and the family as well as for society at large.

There is a pressing need for mental health research in Norway. This is partly because we still know too little about the causes and effects of mental problems, and partly because of the inadequacy of public measures aimed at prevention and treatment. However, a problem that Norwegian research is often spread among several small research communities and that is a problem. Further, there is a need to enhance communication between research and clinical medicine.

The paramount goals for the Research Council's Mental Health Programme is to promote high-quality Norwegian research of relevance to mental health. One of the goals is to ensure that this research will help improve public health and promote the quality of the health services available to people with mental problems. The research funded by the programme should, on the whole, support both a basic and an applied target.

Targets/efforts:

- Enhance ties between different types of research and
- Promote co-operation between researchers and, not least through researcher networks. Develop researcher networks which produce exceptionally high-quality research. Set up a collaboration and planning group for psychiatric epidemiological research in 2001. Evaluate the researcher network on the psycho-biological aspects of gastro-intestinal problems in 2002.
- Enhance research of relevance to ordinary clinical practice. Organise a strategy conference on clinical research by 2002.
- Enhance research among children and young people. Organise a researcher conference on research on children and young people by 2003.
- Take an initiative to promote research in the field of forensic psychology/forensic psychiatry by 2004. Organise a conference in this field by 2004.
- Specify the delimitations between the spheres of the mental health programmes and other programmes in Medicine and Health in 2001.
- Promote the internationalisation of research.

In addition the programme should:

- Raise awareness regarding the gender perspective and promote research on the mental health of girls and women.
- Enhance recruitment to mental health research.
- Ensure the user's perspective is taken into consideration.

High-priority fields of research include biological and psycho-biological research, epidemiological research, clinical research, research on the mental health of children and

young people, research on ethnic minorities and indigenous peoples, substance abuse research and research in the fields of forensic psychology and forensic psychiatry.

In addition to the points above, the programme should:

- organise annual researcher conferences (the Øyer Conference);
- hire a research manager with special responsibility for implementing the above-mentioned measures.

Point of Care Clinical Research and Alternative Medicine (2001 – 2005)

Norway is particularly well suited for top international-level point of care clinical research. The country's advantages are not fully exploited at present. Such research is necessary to learn how to apply resources where they will maximise health dividends.

Alternative medicine has gained widespread popularity without the methods being scientifically proven. Nor is there any research to confirm the usefulness of implementing a large number of measures in the public health service. These are major challenges facing the Programme for Point of Care Clinical Research and Alternative Medicine. The paramount objective is, above all, to enhance expertise and quality in this field of medical research. Clinical research should be incorporated and made a natural part of clinical activities. One of the most important target areas is to enhance the recently established centres of expertise in clinical research and expertise in alternative medicine.

The programme is also intended to enhance quality through its application processing routines and other activities. This work requires that far more interest and public funding be devoted to this aspect of medical research. This programme presents goals and guidelines to apply to the planning of these efforts up to 2005.

Appendix 2

Medicine and Health Division's new programme structure (as of 2001)

New programme 2001	Previous programme(s) (thematic basis)
Commercialising Ideas from Medical Research	<ul style="list-style-type: none">• Commercialising Ideas from Medical Research• Commercialising Biotechnology (IE)
Molecular Medicine and Gene Technology	<ul style="list-style-type: none">• Cell and Gene Technology
IT in Medicine and Health Services	<ul style="list-style-type: none">• IT in Medicine and Health Services
Environment and Health	<ul style="list-style-type: none">• Indoor Climate and Health• Environmental Contamination and Health
Health Services and Health Economics	<ul style="list-style-type: none">• Health Services Research
Health and Society	<ul style="list-style-type: none">• Alcohol and Drug Abuse Research• Health Promotion and Disease Prevention• Health and Illness in a Cultural Perspective
Work and Health	<ul style="list-style-type: none">• Work and Health
Mental Health	<ul style="list-style-type: none">• Mental Health
Point of Care Clinical Research and Alternative Med.	<ul style="list-style-type: none">• Applied Clinical Research• Alternative Medicine

Appendix 3

Brief presentation of the previous 14 programmes

The following abbreviations are used in the tables below:

ERCA	Ministry of Education, Research, and Church Affairs
HSA	Ministry of Health and Social Affairs
JP	Ministry of Justice and the Police
LGRD	Ministry of Local Government and Regional Development
CFA	Ministry of Children and Family Affairs
E	Ministry of Environment
TC	Ministry of Transport and Communications
TI	Ministry of Trade and Industry
A	Ministry of Agriculture
F	Ministry of Finance
CA	Ministry of Cultural Affairs
Dir Alc/Drug	Directorate for the Prevention of Alcohol and Drug Problems
Dir Health	Directorate for Health, later Norwegian Board of Health
NHO	Confederation of Norwegian Business and Industry

all budgets are given in 1000 NOK

The Advanced Research Programme (1997 -)

Ministry /Year	1997	1998	1999	2000	TOTAL
ERCA	1 000	4 000	4 000	2 500	11 500
Private Sources			2 000	1 000	3 000
ERCA - FUND				2 500	2 500
TOTAL	1 000	4 000	6 000	6 000	17 000

Three researchers were selected and financed in this period. In 2001 another five will be included. As of year 2000 The Advanced Research Programme is counted as *infrastructure support* instead of *research programme*.

Programme for Commercialising Ideas from Medical Research (1995 – 1999)

Ministry /Year	1995	1996	1997	1998	1999	TOTAL	2000
F	600	1 500	1 500	3 000	2 295	8 895	3 000
F – IE Div							5 900
TOTAL	600	1 500	1 500	3 000	2 295	8 895	8 900

15 projects have been financed during this period. From year 2000 the programme was merged with "Commercialising Biotechnology" (Industry and Energy Division). It is still an MH-responsibility.

Programme for Cell and Gene Technology (1995 – 2000)

Ministry/year	1995	1996	1997	1998	1999	2000	TOTAL
ERCA	8 500	8 500	8 500	9 200	10 200	10 200	55 100
TOTAL	8 500	8 500	8 500	9 200	10 200	10 200	55 100

About 85 projects have been financed.

Programme for IT in Medicine and Health Services (1995 – 2000)

Ministry /Year	1995	1996	1997	1998	1999	2000	TOTAL
HSA	500	2 000	2 000	2 000	2 000	1 500	10 000
ERCA	3 000	3 500	3 500	3 500	3 500	3 500	20 500
TI	5 100	6 000	5 000	6 000	5 850	6 000	33 950
TOTAL	8 600	11 500	10 500	11 500	11 350	11 000	64 450

About 70 new projects during this period.

Programme for Indoor Climate and Health (1994 – 2000)

Ministry /Year	1994 - 1999	2000	TOTAL
HSA	14 500	2 300	16 800
LGRD	9 600	1 900	11 500
ERCA	2 000		2 000
Dir Health	1 000		1 000
”NHO”	2 000		2 000
Jotun AS	270		270
Astra Norge AS	600		600
TOTAL	29 970	4 200	34 170

48 projects have been financed

Programme for Environmental Contamination and Health (1996 – 2000)

Ministry /Year	1996	1997	1998	1999	2000	TOTAL
HSA	1 000	1 000	1 000	1 500	1 700	6 200
ERCA	2 000	1 500	1 500	1 500	1 500	8 000
E		2 000	2 000	1 950	2 100	8 050
TC		500	400	300	300	1 500
A			400			800
Hydro		400	400	400		1 200
TOTAL	3 000	5 400	5 700	6 050	5 600	25 750

40 projects were financed in this period.

Programme for Health Services Research (1994 – 2000)

Ministry /Year	1994	1995	1996	1997	1998*)	1999	2000	TOTAL
HSA		4 000	4 000	4 000	5 000	6 900	9 625	
ERCA		2 000	2 000	2 000	4 000	4 000	4 000	18 000
F						2 000	2 000	4 000
TOTAL	4 000	6 000	6 000	6 000	8 500	12 900	15 625	

(*) from 1998 incl 2 large grants allocated health economics)

About 60 projects in addition to the larger infrastructure grants to health economics (University of Oslo and University of Bergen).

Programme for Alcohol and Drug Abuse Research (1996 – 2000)

Ministry/year	1996	1997	1998	1999	2000	TOTAL
HSA	3 450	2 450	3 450	2 450	3 450	15 250
JP	400					400
Dir Alc/Drug		2 100	1 550	1 000		4 650
TOTAL	3 850	4 550	5 000	3 450	3 450	20 300

Around 30 projects have been financed in this period.

Programme for Health and Illness in Cultural Perspective (1996 – 2000)

Ministry/Year	1996	1997	1998	1999	2000	TOTAL
HSA	4 000	5 920	4 950	1 550	3 500	19 920
TOTAL	4 000	5 920	4 950	1 550	3 500	19 920

20 projects and two infrastructure grants (University of Oslo and University of Bergen).

Programme for Health Promotion and Disease Prevention (1997 – 2000)

Ministry /Year	1997	1998	1999	2000	TOTAL
HSA	4 000	3 000	6 400	7 300	20 700
ERCA	2 000	1 800	1 800	1 800	7 400
CFA	300				300
TOTAL	6 300	4 800	8 200	9 100	28 400

50 projects were financed in this period.

Programme for Work and Health (1994 – 2000)

Ministry /year	1994	1995	1996	1997	1998	1999	2000	TOTAL
HSA	4 000	4 000	4 000	4 000	4 000	2 000	2 000	24 000
LGRD	4 000	4 000	4 000	4 000	4 000	2 500	4 000	26 500
CFA	1 500	1 500	1 500	1 500	750	750		7 500
”NHO”				500				500
TOTAL	9 500	9 500	9 500	10 000	8 750	5 250	6 000	58 500

47 research projects and five contracted reports were financed in this period.

Programme for Mental Health (1996 – 2000)

Ministry /Year	1996	1997	1998	1999	2000	TOTAL
HSA	9 100	9 100	12 100	19 300	16 200	65 800
ERCA	4 900	4 900	2 100	2 700	2 100	16 700
TOTAL	14 000	14 000	14 200	22 000	18 300	82 500

110 projects were financed in this period.

Programme for Alternative Medicine (1997 – 2000)

Ministry/year	1997	1998	1999	2000	TOTAL
HSA	1 550	2 000	2 250	2 250	8 050
TOTAL	1 550	2 000	2 250	2 250	8 050

13 new projects have been financed in this period.

Programme for Applied Clinical Research (1996 – 2000)

Ministry/year	1996	1997	1998	1999	2000	TOTAL
HSA	7 000	7 000	6 500	7 450	7 450	35 400
TOTAL	7 000	7 000	6 500	7 450	7 450	35 400

70 projects have been financed in this period.

English summaries – programmes MH (7 of 9)

Health Services and Health Economics

The programme *Health Services and Health Economics* has been adopted for the period from 2001 to 2005. Health services research will be a comprehensive, key field of research over the long term. The need for and standards applied to health services are accelerating at a pace equal to that of technological development, new improved treatment opportunities, changing demographics and other conditions. New groups of patients are entering the arena in the field of psychiatry as well as in somatic services. Social and socio-economic considerations, as well as consideration for individuals, call for broadbased research and studies.

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- help recruit researchers to this field
- help ensure the research is firmly anchored in a variety of research communities.

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The target group for the research results is broad-based and heterogeneous. In addition to the research community *per se*, the target group includes politicians, the public health administration, healthcare providers, patients and the general public. It is vital to disseminate the results widely since the programme targets an area of study so closely related to today's health policy reality.

IT in medicine and health services

Electronic information systems are making their way into most areas of the health sector, yet many questions around technological and organisational issues remain unanswered. Moreover, the general terms and conditions which apply to this area are in constant flux. Research and development must address a vast number of far-reaching tasks. To make genuine headway in this field, the Medicine and Health Division has decided to concentrate its efforts on a few specific areas. The selection of target areas for this programme was made with the needs of the health care system in mind. It also takes account of the areas in which Norwegian researchers have the potential to carve out a niche for themselves in the international arena. In addition, the selection exhibits regard for the results derived from the self-assessment of the programme "IT in medicine and health services" (1995 to 2000) conducted by the previous programme committee.

One of the most striking challenges facing this programme will be to promote research and development on services that will be feasible as broadband capacity becomes widely available to the health sector. Governmental policy aims at establishing a national health network and stimulating the availability of broadband capacity throughout the country in the next few years. Electronic networks will open opportunities for improving co-operation between healthcare personnel inside and outside hospitals, and between healthcare personnel and patients. Norwegian industry and researchers in the area have certain advantages that give them a good chance of succeeding on the international arena in the field of medical information technology, where there is a clear need to increase competence and the dissemination of expertise. The programme is intended to make important contributions to Norway's health care system through the development and application of IT solutions and products based on existing and future user needs. The programme is designed to improve skills and encourage innovation in Norwegian industry.

The programme has three seminal goals. The first is to establish minimum one centre in one or more of the programme's target areas (treatment-oriented systems, ICT facilitated networking and co-operation or systems for planning and control). This goal calls for an increase in the programme's fiscal parameters. The second goal is to increase the number of doctoral fellowships to 6 per year and the number of post-doctoral fellowships to 2 to 4 per year. At least 2/3 of these grants should be made within the programme's three main target areas. The third goal is that the projects conducted under the programme should result in 10 new patent applications or other forms of protected intellectual property rights (IPR) related to ICT in health services.

There are three main themes in the programme. The first is treatment-oriented information systems which focus on electronic medical records and collateral images. The use of electronic medical records are now very common outside hospitals, but the transition has begun within hospitals as well. The advent of this type of ICT opens new horizons for improving diagnostics and treatment, as well as for the exchange of information between different treatment centres. Very little research has been done thus far in this area. The second main theme involves ICT facilitated networking and co-operation (telemedicine). The lack of more co-operation in the health and social services sector results in less than optimal utilisation of the resources available in the sector. The last main theme refers to planning and control systems, focusing on the development of various types of indicators and systems for managing shared health data.

Mental Health

Background. Mental health problems are very common. Prevention, treatment, care and the safeguarding of people with mental problems is extremely resource intensive, financially as well as in terms of human resources, for the individual and the family as well as for society at large.

Perspectives and challenges. There is a pressing need for mental health research in Norway. This is partly because we still know too little about the causes and effects of mental problems, and partly because of the inadequacy of public measures aimed at prevention and treatment. However, a problem that Norwegian research is often spread among several small research communities and that is a problem. Further, there is a need to enhance communication between research and clinical medicine.

The programme's goals and paramount strategies. The paramount goals for the Research Council's Mental Health Programme is to promote high-quality Norwegian research of relevance to mental health. One of the goals is to ensure that this research will help improve public health and promote the quality of the health services available to people with mental problems.

The research funded by the programme should, on the whole, support both a basic and an applied target.

Targets/efforts:

- Enhance ties between different types of research and
- Promote co-operation between researchers and, not least through researcher networks. Develop researcher networks which produce exceptionally high-quality research. Set up a collaboration and planning group for psychiatric epidemiological research in 2001. Evaluate the researcher network on the psycho-biological aspects of gastro-intestinal problems in 2002.
- Enhance research of relevance to ordinary clinical practice. Organise a strategy conference on clinical research by 2002.
- Enhance research among children and young people. Organise a researcher conference on research on children and young people by 2003.
- Take an initiative to promote research in the field of forensic psychology/forensic psychiatry by 2004. Organise a conference in this field by 2004.
- Specify the delimitations between the spheres of the mental health programmes and other programmes in Medicine and Health in 2001.
- Promote the internationalisation of research.

In addition the programme should:

- Raise awareness regarding the gender perspective and promote research on the mental health of girls and women.
- Enhance recruitment to mental health research.
- Ensure the user's perspective is taken into consideration.

High-priority fields of research include biological and psycho-biological research, epidemiological research, clinical research, research on the mental health of children and young people, research on ethnic minorities and indigenous peoples, substance abuse research and research in the fields of forensic psychology and forensic psychiatry.

Organisation and policy instruments. In addition to the points above, the programme should:

- organise annual researcher conferences (the Øyer Conference);
- hire a research manager with special responsibility for implementing the above-mentioned measures.

Environment and Health

Man is exposed to a large number of environmental factors, indoors as well as outdoors. Many of these factors may have adverse effects on people's health and quality of life. Among the potential risk factors are pollution caused by traffic, consumer chemicals, building materials, various sources of radiation and hazardous substances in food. Pollution may, for example, contribute to the development of cancer, allergies, respiratory diseases and reproductive problems.

Most people spend a great deal of time in various indoor environments. Owing to a steady stream of new materials used in building and decoration, less ventilation, moisture/mould damage, etc. people are being exposed to an ever increasing number of chemical compounds indoors. In addition, exposure to dust mites and microbiological agents is on the rise. Emissions of environmental contaminants and other chemicals, including endocrine disruptors, and air pollution such as gases and particles from road traffic, are among the main risk factors outdoors.

There is a tremendous need to generate more knowledge about associations between environment and health. This applies to exposure-related conditions, as well as to environmental factors' toxic properties and their effects on human health. Gene – environment interactions and the effects of combinations of various environmental factors further complicate the situation. It is essential that Norway have active research communities working in this field in order both to benefit from international knowledge production and to address problems specific to conditions in Norway.

Environment and Health follows up important research-related challenges identified in the Norwegian National Environment and Health Action Plan. The research results produced under the programme will be relevant for several user groups. For example, several sectoral authorities need research-based knowledge in this area as grounds for political and administrative decisions. The area enjoys high-priority status at the international level, for example, through the European Science Foundation and the EU's research programmes.

The programme's paramount objective is:

- *To obtain knowledge that can help mitigate the adverse effects on human health of physical, chemical and biological environmental factors.*

There is a pressing need for research in all areas of relevance to *Environment and Health*. Nonetheless, the programme will devote special attention to certain topics:

- Moisture in buildings;
- Air pollution in cities and towns;
- Chemicals that are hazardous for human health and the environment, with special emphasis on endocrine disruptors;
- Low-dose exposure and the interaction between different environmental factors.

The following targets have been drawn up for the Programme Committee's work:

- Of the total number of fellowships provided under the programme, the percentage of post-doctoral fellowships will be increased from 19 per cent in 2001 to 25 per cent by 2004.
- Over a three-year period, the programme will initiate at least two high quality interdisciplinary projects dealing with the associations between the indoor climate and health.
- During the programme period, the Programme Committee will initiate at least two fellowship projects at the doctoral or post-doctoral level to examine the interaction between genetic and environmental factors.
- By the end of 2002, the programme will establish an annual meeting place where relevant representatives from the administration and politics can meet researchers and the Programme Committee.
- During each year of the programme period, at least two programme projects will be presented in popular form through the media.

Molecular Medicine and Gene Technology

The genetic information contained in DNA is encoded by the sequence of its four building blocks A, C, G, T. Determination of the sequence of these chemical entities in the total human genome is approaching completion, and an entirely new world of information has now become available to scientists in medical biology. New challenges and possibilities are encountered in all areas of medicine: diagnostic, preventive and curative.

Two challenges are particularly pertinent to all medical scientists, both globally and within Norway. One is to participate in establishing and exploiting all the available new knowledge that can be generated from the sequence of the human genome. Because of the rather difficult situation for basic medical research in Norway this is a serious task. No less important is the challenge to provide Norwegian patients with the new possibilities for healthcare. This will rest on the successful transfer of the medically relevant knowledge from the medical scientists to the physicians working in clinical medicine either inside or outside hospitals.

The programme *Molecular Medicine and Gene Technology* has two goals: To support peer review-selected research projects in the molecular medicine area, and to build bridges connecting basic medical research and clinical research, thereby contributing to the general insight and understanding of medical molecular biology among clinicians.

The Programme Committee wishes to draw your attention to four aspects of biomedical research in Norway which we feel it is important to improve:

- Norwegian research has too little international collaboration
- the number and quality of publications from basic Norwegian medical science are unsatisfactory
- the gap between molecular medical research and clinical medicine is too large
- the potential for industrial exploitation of research data is not sufficiently utilized

The aim of the programme is, through support for establishment and further development of top competence in molecular medical and gene technology research, to contribute to enhancement of knowledge and novel concepts which in the final end will improve diagnosis, prevention and treatment of disease. We seek to reach these goals by

- supporting research which may give increased understanding of the function and interaction of gene products in the control of physiological and pathological processes
- supporting development and use of diagnostic and therapeutic tools in disease
- enhancing research on which biomedical industries can be based
- promote collaboration in research at local, national and international levels
- increase the possibilities for M.D.s to build up competence in molecular biology by giving priority to projects which promote their research in high quality basic research environments, the purpose being to reduce the gap between basic medical research and clinical medicine
- support collaborative projects between basic medical and clinical research environments for creation of conceptual and technological achievements

The programme will support research in central areas of molecular

biology where highly competent people already can be found, thus eliciting further important contributions from Norwegian research. In addition, the programme will promote new activities in areas where research in Norway is weak. Examples of such fields are:

- bioinformatics – basic and applied
- structural biology – single and complex molecules
- molecular genetics focusing on the identification of genes associated with disease
- stem cell biology
- gene therapy – principles and technology

Commercialising Ideas from Medical Research

High political priority is being given to the commercialisation of ideas from medical and healthcare research. The programme *Commercialising Ideas from Medical Research - MEDKAP*, was established to promote commercialisation based on ideas from medical and healthcare research. The programme is a joint initiative being taken by the Research Council's Industry and Energy (IE) and Medicine and Health (MH) divisions. The programme's main objective is defined as being:

To promote wealth creation by increasing the commercial exploitation of research results derived from medical and healthcare research to make safe products which can help improve public health.

The programme will have the following means available to accomplish that objective:

- Fund all or part of the R&D work required to develop and verify scientific and technical concepts;
- Assess the feasibility of patents in connection with the project and support initial patent protection (priority patent);
- Identify market potential and buying criteria;
- Evaluate other possible sources of funding, if any, and ensure the project is made aware of them;
- Provide expertise for commercialising ideas.

The programme will have proactive, flexible programme management, at the same time as it will entail limited financial risk. The programme will be funded by the Ministry of Trade and Industry (NHD) and the Ministry of Health and Social Affairs (SHD). The programme period has provisionally been stipulated as 2000 to 2005.

Point of Care Clinical Research and Alternative Medicine

Norway is particularly well suited for top international-level point of care clinical research. The country's advantages are not fully exploited at present. Such research is necessary to learn how to apply resources where they will maximise health dividends.

Alternative medicine has gained widespread popularity without the methods being scientifically proven. Nor is there any research to confirm the usefulness of implementing a large number of measures in the public health service. These are major challenges facing the Programme for Point of Care Clinical Research and Alternative Medicine. The paramount objective is, above all, to enhance expertise and quality in this field of medical research. Clinical research should be incorporated and made a natural part of clinical activities. One of the most important target areas is to enhance the recently established centres of expertise in clinical research and expertise in alternative medicine.

The programme is also intended to enhance quality through its application processing routines and other activities. This work requires that far more interest and public funding be devoted to this aspect of medical research. This programme presents goals and guidelines to apply to the planning of these efforts up to 2005.

Science and Technology Division
Briefing material for Divisional Review

The Division of Natural Science and Technology of the Research Council of Norway

Briefing material prepared by the Division of Natural Science and Technology (NT) for the Evaluation of the Research Council of Norway (RCN)

1. History, Scope and Changes in the Division

Technopolis request:

- A **historical** description of the situation before the Division and RCN were set up, focusing on the strengths and weaknesses of the different systems
- The problems and challenges, as well as the **change goals** of the Division
- An explanation of the current Division boundaries and why these were set as they are and a comment on issues associated with these boundaries

1.1 The situation before the Research Council of Norway was established

The *NT*-division of the RCN was established mainly as a continuation of two different parts of the old research council system; a sub-council: *Council for Research in the Natural Sciences (RNF)* in the Norwegian Research Council for Science and the Humanities (NAVF) and sections of the *Royal Norwegian Council for Scientific and Industrial Research (NTNF)*. The previous research councils were all engaged in natural science and technological research relevant to their mandate and sector of responsibility, with one exception, the Council for Applied Social Science (NORAS). Both the Norwegian Fisheries Research Council (NFFR) and the Norwegian Agricultural Research Council (NLVF) had a special responsibility for this type of research within their sector, and this activity is mainly taken over by the Division of Bioproduction and Processing (BF) in the RCN.

Council for Research in the Natural Sciences

The first of these units (RNF) was traditionally a university- and basic research-oriented research council with well-tried routines for “responsive-mode funding”. RNF also played a central role in the recruitment of young researchers to natural science, with focus on basic science and the universities. The strengths of RNF were that it operated in close concert with the disciplines that it funded, and that committees of researchers within the discipline made decisions on project grants. This meant that it enjoyed the confidence of the researchers, and provided good roots for the basic research policy that they followed. Weaknesses included a highly fragmented system of grant awards and a structure of grants that was in many ways similar to the institutions’ own pattern of financing research. The RCN was often spoken of as the “second route” of finance for large and small projects.

In the course of the 80s program research was encouraged by the ministry and RNF developed a more goal-oriented research strategy, which placed more emphasis on launching research programmes in fields of importance to society as a whole (e.g. petroleum research, energy research, informatics, genetic engineering and materials

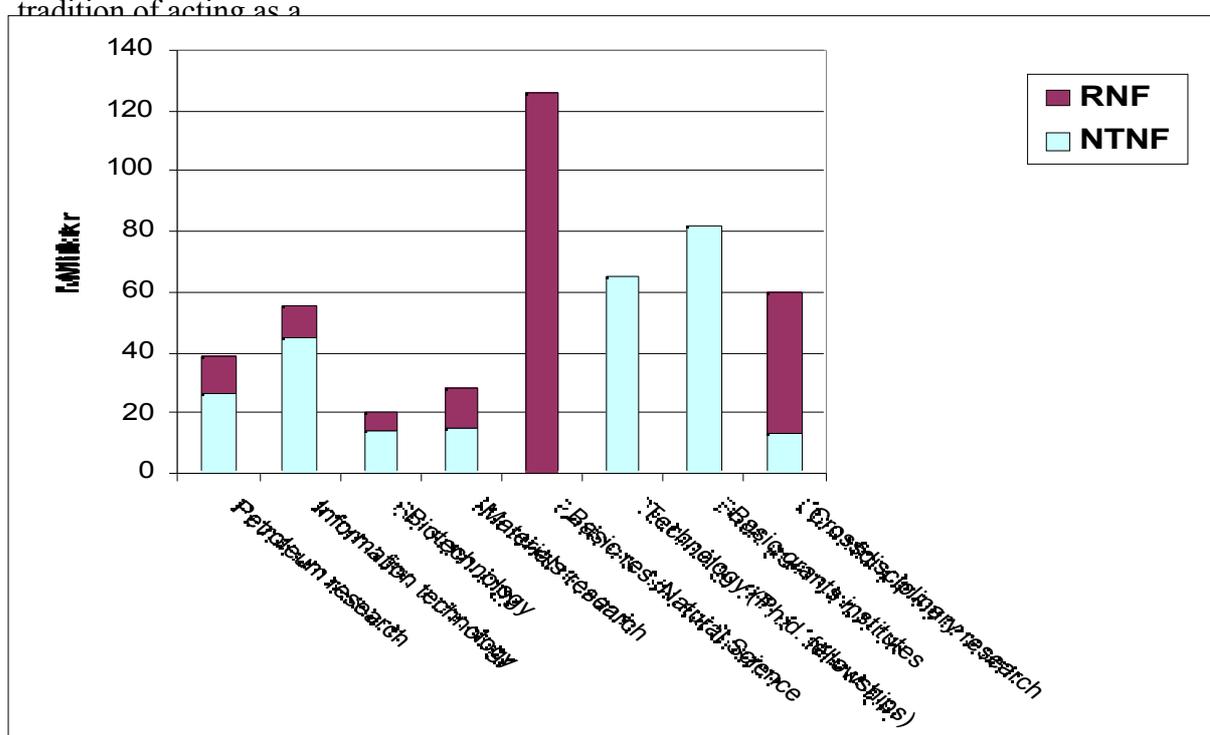
technology). As a result of the new and proactive strategy, the budget of RNF grew considerably, from 54 MNOK in 1984 to 231 MNOK in 1993.

After 1985, closer collaboration was also established with NTN¹ in the national areas of special concentration, and efforts were made to ensure a degree of overlapping of research personnel on the relevant programme boards.

Royal Norwegian Council for Scientific and Industrial Research

The principal objective of NTN was to promote technological research in order to encourage the competitiveness and growth of Norwegian industry. From the end of the 80s, NTN also laid increased emphasis on sustainable development and quality of life.

Its most important tools in this respect were user-controlled programmes, which were continued by the RCN's Division of Industry and Energy (IE), and basic grants and strategic technology programmes for the industrial oriented research institutes, plus an important programme of fellowships aimed at the universities. The fellowship systems consisted both of individual fellowships based on the candidates' qualifications and of a system of fellowship programmes known as block fellowships, which was the forerunner to the Strategic University Programme (SUP). Block fellowships were allocated to research groups on the basis of a combination of a high need for skilled researchers and the high quality of the research group itself. The development of highly qualified personnel was regarded as a high-priority task for society. NTN had a long tradition of acting as a



NTNF regarded research from an “instrumental applications perspective”, while RNF laid considerably more emphasis on the “cultural element” of research.

¹ RNF's coordinators for the national areas of special concentration were given office space at NTN in order to improve contact and cooperation between the two organisations.

Interactions between the research councils

Before the merger of the research councils, RNF and NTNF, in addition to their joint and competing interests, also had a certain degree of overlap with NLVF and NFFR, particularly with the biological sciences. One important point in this connection was that these research councils all depended on different ministries², for which reason there could be important differences in terms of temporal perspective, scientific focus and choice of central research groups for efforts within a particular subject. In some of the national priority areas, however, like biotechnology and aquaculture research, all the research councils were active co-ordinating efforts on an administrative level.

Furthermore, within NAVF there was also a certain degree of overlap with the Research Council for Medicine (RMF) (mainly in the biosciences, including the European Molecular Biology Laboratory (EMBL)) and National Committee for Environmental Research (NMF). NMF also had a considerable amount of activity in the biosciences and in practice acted in a very similar way to NAVF's other sub-councils. Most of its funding, however, came from Ministry of Environment and to a great extent this gave NMF a different "mission" from those of NAVF's other basic research-oriented sub-councils.

Where ordinary individual projects were concerned, boundary problems tended to be solved by means of a pragmatic division of responsibility based on the applicant's formal affiliation (e.g. the Norwegian Agricultural University (NLH) was looked after by NLVF, Institute of Marine Research (HI) by NFFR and the MN faculties by RNF), but in certain major research programmes overlapping interests resulted in joint financing of the research programme (e.g. the "Pro Mare" programme in marine research and the "Climate and Ozone" programme).

With respect to NTNF it proved to be difficult to arrive at joint integrated research programmes. In this area co-operation tended to acquire the character of separate programmes (though in practice, with a high degree of co-ordination), where RNF took the responsibility for university-oriented basic research in the natural sciences and NTNF prioritised industrially oriented research performed by the technological research institutes (e.g. in materials science, information technology, energy and petroleum research). Where technological research at the universities was concerned (in practice, applicants from Norwegian Institute of Technology³ (NTH), this was taken care of by NTNF, but as mentioned above NTNF financed basic research to only a limited extent.

1.2 Problems, challenges and goals for change of the division

While RNF and NTNF each addressed one ministry and a rather uniform group of researcher, NT has the challenge of facing to two different roles. NT receives funding from Ministry of education and research,(KUF) to support basic research at the

² Research councils and ministries that "belonged together" were NFFR-Ministry of Fisheries (FiD), NLVF-Ministry of Agriculture (LD), NTNF-Ministry of Industry (ID) (NHD) and RNF/NAVF – Ministry of Education, Research and Church Affairs (KUF).

³ In 1996, the Norwegian Institute of Technology (NTH) was merged into the new Norwegian University of Science and Technology.

universities and from three sector ministries Ministry of Trade and Industry (NHD), Ministry of Petroleum and Energy (OED) and Ministry of Transport and Communication (SD) to finance industrially oriented strategic research. In addition to the universities a large sector of industrially oriented research institutes are involved. A good interaction between the two roles is expected. To serve these widely different stakeholders is in itself a challenge.

It is important to note that the industrial structure in Norway is still not very R&D intensive. RCN is expected to meet the double challenge of stimulating existing companies to become more active users of R&D and to promote establishment of new knowledgebased enterprises. The society expects a more active involvement of university researchers in support of increased value creation in the business sector.

In the transition phase between the five old research councils and the Research Council of Norway the following problems and challenges were in focus.

Problems

The research institutions

- Limited degree of strategic thinking or scientific renewal in the universities.
- Poor co-ordination between basic research groups in natural sciences and research groups in technological and industrially oriented research.
- Excessive proportion of contracts with little research content in the technological research institutes
- Lack of funding for basic research in technology.

The Research Council

- Impression among many basic researches in the natural sciences that the RCN was most concerned with industry's need for know-how. Budgetary cuts in 1994 and 1995 resulted in severe reductions in allocations to new independent projects and were regarded as lowering the prioritisation of such projects.
- Unrealistic expectations from scientists working in basic research, especially at the universities, that the RCN would be able to reallocate the sector ministries' allocations for industrially oriented research to pure basic research.
- Problematic to profile the social and industrial benefits of research at the same time as the importance of free basic research.

Challenges

(Joint challenges for institutions and the RCN is not shown by parentheses)

Strengthen the role of the universities as basic research institutions

- Better division of work between the institutions (the Institutions).
- Encourage more eminent individual researchers.
- Develop several more powerful research groups.
- Develop good research management and strategic planning skills.
- Renewal of advanced research equipment (RCN).
- Give the best researchers proper working conditions through longer-term framework allocations (RCN).

- Strengthen communication with management at the institutions and with the sector's joint organs (RCN).

Further develop the industrial technology institute sector

- Better co-ordination between the institutes and the universities' basic research groups
- Better strategic planning with emphasis on industry's future demands for knowledge
- Attempt to obtain better basic funding and give these institutes framework conditions that are more similar to those enjoyed by the rest of the institute sector (RCN).

Recruitment to natural science and technology

- Raise the level of interest in science throughout the educational system
- Increase the availability of highly qualified personnel on the basis of the needs of research institutions and industry (RCN)
- Pay more attention to the quality of doctoral training.
- More conscious use of international research cooperation as a strategic measure.
- Strengthen scientific renewal and interaction across scientific boundaries.
- Prioritise efforts in areas in which it is important to build up national competence of importance for the development of industry and the exploitation of natural resources (RCN).

Change goals

On the basis of the challenges listed above, and NT's general goals, NT has chosen to emphasise the following change goals:

- Interact with management of institutions on strategic efforts
- Project support more sharply directed to long-term grants to the best researchers
- Promote and co-ordinate a national effort in the field of research equipment
- Perform systematic evaluations of research institutes and university research groups, and draw up national plans for individual disciplines on the basis of these evaluations
- Motivate researchers in natural science to develop stronger industrial network
- Promote improved funding for science and technology.
- Change negative trend in recruitment to studies in natural science and technology

Initially it was important to create a common organisational culture in the new research council. The employees in NT had their roots in either RNF or NTNF, and both management and the employees worked hard to develop the new culture. This took place both through the development of a new strategy, and in the practical work of developing rules and procedures for all the activities of the division (and the RCN).

1.3 The set-up of division boundaries and associated issues

The interface between NT and the other divisions of the RCN is illustrated in figure 2. With the exception of IE and NT, the other divisions are responsible for the whole spectrum of research within their own fields, from basic to applied research. NT, however, has a special relationship with IE, in that the two division are jointly responsible for the whole range of research in science and technology, from pure basic research to user-controlled applied R & D. NT has exclusive responsibility for basic

research and IE has no responsibility for basic research. In order to guarantee the implementation of this overall responsibility, formal case procedures and forms of co-operation have been established, ensuring a good co-ordination between NT and IE. The basic research supported by NT, however, may be of importance for several of the RCN's divisions, and the special division of responsibility with IE, as well as NT's joint interests with other divisions in basic research, are illustrated in figure 2.

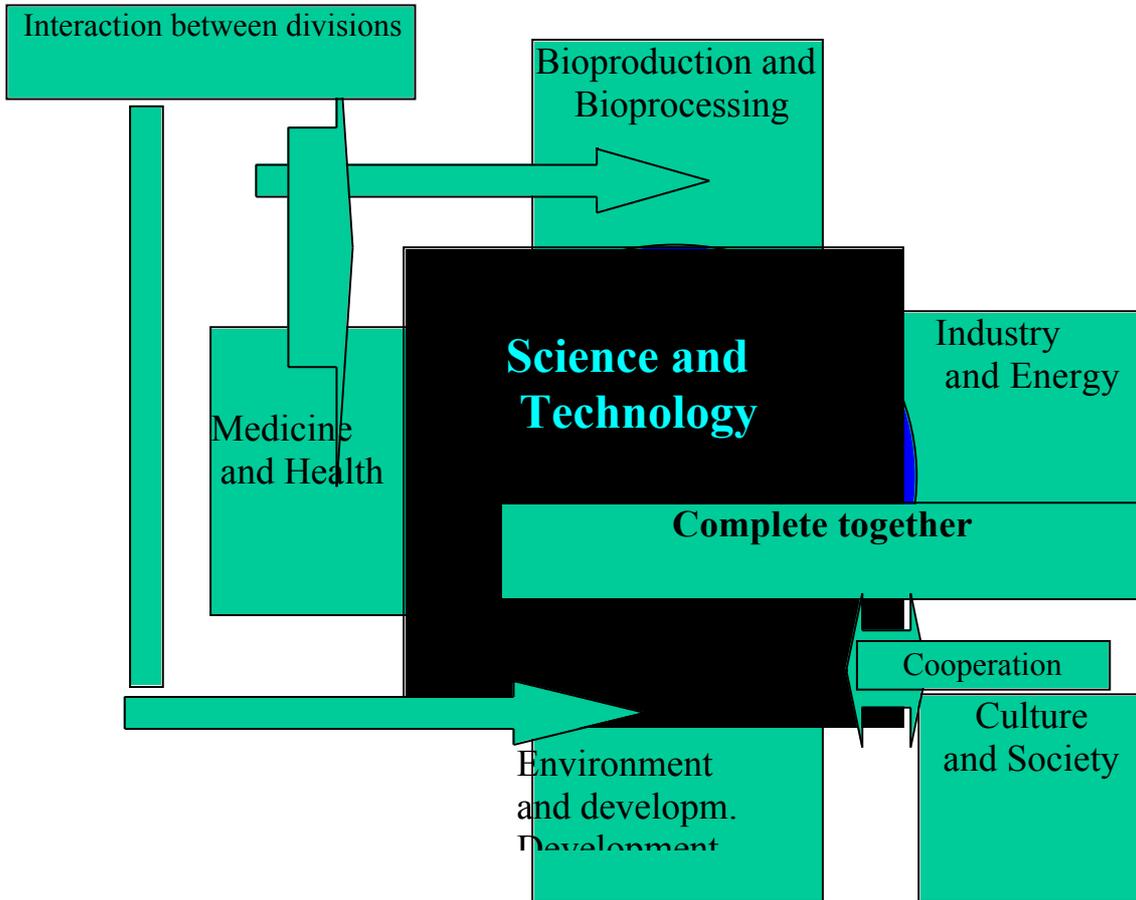


Fig 2: Co-operation with the other divisions of the RCN

Because basic research is of such central importance in NT, there are many inter-disciplinary and -subject interfaces with the other divisions. Scientific conflicts of interest may arise at the interface between an overarching responsibility for the development of basic scientific disciplines and the other divisions' needs for special efforts within specific topics or special aspects of their disciplines (sector interests). Where new research is important for the community as a whole and its relevance is great with respect to the RCN's other divisions, NT has a particular responsibility to consider basic scientific and technological research within an integrated perspective.

In particular, it is research related to the biosciences that has required most clarification, particularly with respect to the Division of Environment and Development (MU)⁴, Medicine and Health (MH)⁵, and Bioproduction and Processing (BF)⁶. In other parts of NT's disciplines, too, similar joint interests may be identified, all of which demand more concrete discussions between the divisions involved.

In a number of fields NT has given special priority to basic research of particular importance to sector-oriented programmes. Examples of initiatives taken by NT in this respect are taxonomy and systematics in relation to MU's work in biodiversity, the development of mathematical methods and models (the Bemata programme) for climate research (MU) and marine research (MU and BF), statistical methods and mathematical algorithms (independent projects) for various medical applications (basis of medical statistics and epidemiological research) and projects aimed directly at the development of technology or equipment for medical applications. (MH)

Basic research in the biosciences was also spread across several divisions by the RCN, and this initially led to the need to redefine the borders between a number of disciplines and institutions.⁷ In practice, the division of responsibility for bioscience among the divisions has largely followed the same pragmatic boundaries as existed before the merger of the research councils. However, it has become considerably simpler to co-ordinate the plans and strategies for the disciplines involved than it was before the merger. One good example is the joint evaluation of the biosciences as carried out by NT on behalf of BF, MH, MU and NT.

IE and NT co-operate closely in industrially oriented research. NT largely draws on scientific resource persons from IE in reviewing applications for strategic programmes in technological fields. The divisions have also co-operated closely in the development of a strategy for industrially oriented research and a new budgetary structure for NHD. The industrially oriented areas of expertise are a joint arena of co-operation for IE and NT, as will be discussed in section 2.2

⁴ For example, taxonomy and systematics, ecology, hydrogeology, climate and polar research.

⁵ For example, biochemistry, molecular biology, ICT and technology with potential medical applications.

⁶ For example, marine biology, oceanography and marine technology.

⁷ The report of the Groholt Commission initially proposed a separate council for "life sciences", but the round of hearings and later processing finally led to the organisation form that we know today.

2. Strategy

Technopolis request:

- A description of the **strategy** of the Division, how it addresses the change goals and how it has itself changed over the lifetime of the division
- An overview of the **achievements and impact** of the funding provided by the Division
- Future plans, visions, and the way Division strategy is expected to evolve in the future

2.1 Introduction

NT is responsible for basic research across the whole spectrum of disciplines in science and technology. Following up pure basic research is a special responsibility for NT, while where strategic or oriented basic research is concerned, responsibility is shared with other divisions in the RCN.

The NT-division's strategic work started in 1993 and the division board approved the first NT strategy in November 1993. A document establishing the framework for international research co-operation was completed in June 1995. The strategy was further developed during the next years, and a more complete strategy is presented in the document:

Strategy for the Division of Science and Technology 1996 - 2000 (July 1996)

Together with the IE-division as a leading division and other divisions, NT is strongly involved in industrially oriented scientific and industrial research. The RCN's industrially oriented strategy is presented in the document entitled:

Strategy for industrially oriented research and development (RCN, Febr. 1998)

Outline of strategies

NT's strategy for 1996 - 2000

The RCN has identified three main areas of concentration related to knowledge and infrastructure, viz. basic research, highly qualified personnel and international research co-operation. On the background of the RCN's main areas and the challenges that have been outlined in section 1.2, NT has formulated the following general strategy:

To create Norwegian research groups of high-quality scientific and technological endeavour, with

- diversity and the ability for renewal
- sufficient strength within areas of high priority
- oriented towards the needs of society.

Diversity and the ability for renewal will be stimulated by:

- Supporting research groups and individual researchers who are outstandingly creative
- Increase the exchanges of researchers with leading research groups abroad
- Finance doctoral studies and periods of stay for post-doc fellows at leading foreign universities.

Weight within areas of high priority will be achieved by:

- Putting long-term efforts into a limited number of areas in which Norway should be at the international forefront of research
- Encouraging development of a strategic profile for each of the research institutions
- Encouraging co-operation between universities and research institutes.

Research will be oriented to the needs of society by:

- Helping to create better insight into nature and the potential of new technology
- Developing new knowledge with the potential for value creation within the framework of sustainable development and improved management of natural resources
- Encourage interactions between the research community and users of research in the selection of topics for research.

One will observe that these goals are on a formulated on a rather general level and not very specific and result oriented, but the funding priorities were as far as possible made to realise these goals. In chapter 2.3 some specific results are outlined.

Basic research

The following aspects of basic research have been developed in more detail:

- Strengthen basic research, both on the disciplines' own premises (pure basic research) and in fields of importance to industry and society as a whole (strategic or oriented basic research)
- Promote the technology base in the technological institutes so that they are able to make a contribution research-based industrial innovation.
- Develop the interaction between the RCN and the universities, with emphasis on strategic basic research
- Follow up responsibility for pure and strategic basic research vis-à-vis the RCN's other divisions, particularly within generic technologies such as biotechnology, information technology and materials technology, in addition to petroleum research.

Highly qualified personnel

NT wishes to help strengthen recruitment to science and technology in general, and the recruitment of women in particular. A wide range of measures is required to this end, including measures aimed at the primary and secondary school systems. These are set out in terms of the following points:

- Actively contribute to the maintenance of the current level of doctoral training
- Increase added value and the transfer of knowledge via greater mobility of scientists between universities, research institutes and industry

- Monitor and stimulate interest in education and research in science and technology, with special emphasis on encouraging the recruitment of women.

Internationalisation

A serious involvement on the part of the R & D community must form the basis for participation in international research co-operation, which requires a heavy input of resources. Informal international co-operation is an element of many of the projects supported by NT. Such personal and informal collaboration is regarded as being of particular importance, but NT has not regarded it as an objective to control such activities. The following activities have been given priority:

- Formalised co-operative agreements made directly with research agencies in other countries within high-priority fields. In particular research that involves capital-intensive basic investments that would be too great for Norway to bear at national level.
- Offering young Norwegian researchers the opportunity to spend a period of time in recognised international research centres.
- Stimulating a greater degree of participation on the part of our universities and institutes in the EU's Framework Programme.

Following up the Research Council's thematic areas

The RCN strategy also deals with broad thematic areas that are given special priority:

- *Marine research*: NT's contribution is via its support for basic research in individual disciplines and areas of technology for the whole marine sector.
- *Environmentally oriented research*: Via its responsibility for basic research within the disciplines, NT's role is primarily related to the development of quality and a scientific basis for environmentally related research. NT will raise its level of effort in polar research, including EISCAT and the installations on Svalbard.
- *Industrially oriented research* is discussed more extensive in the following section

Strategy for industrially oriented R & D

NT interacts with the RCN's other divisions under the leadership of IE regarding the integrated implementation of Strategy for Industrially Oriented R & D, which was adopted by the RCN's Executive Board in 1998.

The following principal objective in this strategy is of particular significance for NT:

To develop a knowledge sector (universities, colleges and research institutes) that has competence, quality and capacity to satisfy current and future industrial requirements.

NT has a particular responsibility for an integrated follow-up of what has been designated the “*industrially oriented fields of competence*”, in collaboration with IE and other divisions that work in industrially oriented research. The industrially oriented fields of competence are fora for co-operation between the research community and industry. Via these fields of competence, all the RCN's divisions can work together to meet industry's future needs for knowledge. NT follows up the following industrially oriented fields of competence:

- *Information and communications technology (ICT)*
- *Biotechnology*
- *Materials technology*
- *Energy and petroleum*
- *Process technology*
- *Marine technology*
- *Construction and environmental technology.*

The industrially oriented fields of competence are described in a separate appendix. The descriptions form an important basis for advertising and allocating funds for industrially oriented strategic research.

2.3 Evaluations of disciplines and research institutes

The mandate of the RCN, paragraph 2, make it clear that the RCN will “perform and follow up evaluations of research and research institutions”. NT was the first division in RCN that took an initiative to follow up this task. Evaluations of basic research in scientific and technological disciplines and of research at the industrially oriented research institutes has been carried out.

An important step further was the initiative to develop *national strategic plans* for each discipline based on the evaluations.

Evaluations and strategic plans for disciplines in natural science

Since 1996, NT has performed evaluations of basic research in chemistry, geosciences, physics and biological sciences, and evaluations of ICT and mathematics have been launched, and evaluation of engineering science is planned. Independent panels of internationally recognised experts from foreign universities have carried out these evaluations of individual disciplines. Basic research in universities, colleges and relevant parts of the research institutes has formed part of the evaluations.

The general picture that has emerged from all four evaluations has been the same - too little of our research is up to international standard or is of significance at international level, but there also exist research groups at the international forefronts of their disciplines.

On the basis of all these evaluations, and particularly the recommendations made by the principal evaluation committee in the biological sciences, the challenges that face Norwegian research and all participants in this research - the researchers, research institutions (particularly the universities), the RCN and the ministries which finance basic research - can be summarised as follows:

- The financing of research must be improved. In particular, more funds must be provided for basic research initiated by the researchers themselves. Projects must be bigger and last longer.

- The scientific leadership at institute and faculty level must be improved. The system of democratically elected managers, who function for three-year periods without sufficient authority, is not satisfactory.
- The level of ambition of the research community must be raised. Scientific competence must be stimulated and groups that demonstrate high quality must be awarded.
- Institutes and faculties must develop scientific strategies that include scientific profiling and recruitment.
- The Norwegian research community is characterised by a large number of small, sub-critical groups, with poor interaction among groups. The number of research groups must be reduced and better co-operation, also at national level, must be developed. Individual researchers are largely concerned with defending their own academic freedom, often at the cost of joint scientific efforts and strategic planning at institute level.
- There must be more national and international mobility of researchers. Young researchers must travel more to international centres of research. More emphasis must be placed on periods of stay abroad as part of the research training process.

As a follow-up of these evaluations national committees have been appointed with mandates to draw up strategic plans for individual disciplines. Such plans have been completed for chemistry and the geosciences. The plan for physics is expected to be ready in autumn 2001, and similar process is being planned for the biological sciences. These scientific plans will provide advice regarding scientific strategies and follow-up measures for the institutions themselves, the RCN and the ministries. An overview of the evaluations that have been performed and strategic plans that are completed is provided in Appendix 1.

Even more important is that the evaluations have created a general awareness both at the universities, in the ministries and among politicians of the need to improve working conditions for basic research. This also includes actions to improve scientific at the universities.

Evaluations of the research institutes

The research institutes have three main roles: a) To perform contract research for industry and public organisations, b) Ensure a base of high quality research and competence in the longer term, say >4 years, c) General societal contributions, including the creation and commercial exploitation of R & D results.

The main objectives for institute evaluations are: a) to support the institutes in their strategic and operational efforts, b) to provide basic information for developing institute-related strategies and funding decisions, c) to improve the basis for communication between funding ministries and the institutes.

NT has performed evaluations of all the industrially oriented (technological) research institutes that receive basic funding from the Division. Independent committees of Norwegian and foreign experts from the research sector and industry have carried out these evaluations. In total, ten committees have evaluated 25 institutes/departments,

with separate, parallel clients' studies of each of them. In each evaluation the institutes or departments of institutes working in the same market segment has been evaluated together. The main conclusions have been that the research institutes are well organised and have good contact with their customers, but that a low level of basic grants offers them insufficient opportunity for scientific renewal.

Some general and aggregated main conclusions and recommendations from the evaluations are:

Management

- Management are generally professional, but management competence development should be given more emphasis
- Increase outside co-operation with universities, international, other institutes
- Increase commercialisation of R & D results, more company spin-offs.

Quality of R&D

- Generally high overall level of R & D competence among personnel
- Variable, sometimes very high, technical quality in R & D results
- Low rate of publication in internationally refereed journals
- Too little strategic and long-term research; R & D is too contract oriented/influenced.

Funding

- NT should increase its discretionary funding and funding for strategic research
- The institutes should provide more internal funds for strategic research.

Follow-up measures are being discussed with the institutes at our meetings with institute leaders. The institutes draw up their own scientific strategies on the basis of the evaluations. The evaluation of institutes are listed in Appendix 2.

2.3 Achievements and Impact

The achievements must be considered in the light of the budgetary situation. During the period under discussion NT has been forced to operate within falling or zero level budgets. Several of the goals which have been set, are based on an increased budget.

- The procedure for individual grants has been thoroughly reviewed. A system of international referees has been established for more objective evaluation of applications and more uniform evaluation across disciplinary borders.
- Greater support and longer-term funding for the best researchers has been emphasised in the strategy. In the first part of the period, minor sums of project funding were eliminated. The number of projects has been reduced by one third, (from 1313 in 1994 to 879 in 2000).
- For research programmes, during the latter part of the period, we have taken a further step in increasing the size of project grants. Number of projects receiving annual support over 1 MNOK tripled (10 projects in 1995 and 31 in 1999).
- Basic funding for research institutes has not been reduced if we do not consider inflation.

- Funds for SUP have been doubled (from MNOK 32 in 1994 to MNOK 62 in 1999). SUPs are funded on the basis of national competition, in dialogue with the institutions' management.
- International peer review of applications for the Centre of Excellence program demonstrates that many of the groups supported by NT in the past have reached a high scientific level
- Strategic plans for disciplines have been the basis for prioritising strategic programmes and for selecting topics for research programmes. Examples are a new basic research programme (Catalysis and synthetic organic chemistry) which was launched on the basis of recommendations in the strategic plan for chemistry, and in geoscience, a strategic university programme has been started as a follow-up of the strategic plan for the geosciences.
- Support for recruitment of researchers by NT has been held almost at the 1994 level even in a situation with reduced total funding. The number of doctoral fellowships has been reduced from 465 man-years in 1994 to 358 in 2000, while the number of post-doc fellowships has risen from 72 man-years in 1994 to 121 in 2000. Other things remaining equal, women have been given preference for fellowships.
- Mobility in the R & D system has been strengthened and more than 10% of the research staff at the industrially oriented institutes leave every year. This is partly due to a high demand for highly qualified personnel, but also to a policy in these institutes that encourages activities to be "hived off".
- NT has actively contributed to a national plan for the renewal of advanced scientific equipment that has received special funds from the national budget in addition to NT's own funds. NT has managed the RCN's total allocations for equipment.
- In co-operation with SINTEF, the University of Oslo and NTNU, NT has launched a strategic effort in micro technology, and
- NT has played a central role in establishing the Sars Centre for Marine Molecular Biology at the University of Bergen. This centre is considered to be an important contribution to reinforcing basic research in the marine sciences in Norway.

In 2000 an independent consultant carried out an inquiry of stakeholders' view of NT. Altogether 61 persons were interviewed. 20 from universities and 21 from research institutes. Employees from research departments in three ministries; KUF, NHD and OED were also interviewed.

The report from the interviews indicated that in general stakeholders are satisfied with NTs measures of funding research and our procedures. There was some criticism concerning processes for evaluation. NT has evaluated these comments and will take them into account in the evaluation process for ICT and mathematics.

One specific comment was that researchers missed feedback from NT on the final project report. This has now been changed. A letter will be sent within three months after the final report is received. Communication with researchers will be improved by means of a news page for independent projects on the RCN web site.

2.4 Strategic plans and visions for the future

For the past two years, NT has been engaged on the development of a new strategy. A change of management, a new Division Board in spring 2001 and co-ordination with the overarching strategy of the RCN have led us to aim at finalising this work in the course of 2001. There is already agreement, however, regarding certain important questions that will be emphasised in the new strategy. We wish to identify the following aspects in particular:

- NT will attempt to become more concrete in its new strategy than we were in the previous version.
- Subject and discipline priorities will be made clearer, although still at an overarching level.
- NT wishes to act as a locomotive for strategic efforts in collaboration with the scientific community.
- NT does not wish to go too far in controlling research groups in detail, but emphasises that its main task is to promote good research groups in science and technology.
- High-quality basic research, independent of areas identified for special effort, is essential.
- Recruitment will be followed up. Measures aimed at promising young researchers, particularly in cases which these can also bring about scientific renewal, will be emphasised.
- Internationalisation is regarded as an important means of improving quality and recruitment.

A future vision for NT discussed by the board is:

*To make research within science and technology recognised as
a basis for future prosperity*

3. Governance

Technopolis request:

- A summary of the **stakeholders** for the work of the Division and how their interests are served as users, clients and in the governance of the Division
- A description of the **governance** of the Division, especially explaining the role of the Division Board
- The (formal and informal) mechanisms that create links to other divisions of the RCN and how these contribute to co-ordination across RCN

3.1 Stakeholders

The research community

The research community within natural science and technology consists of faculties at four universities and also some colleges with an annual budget of NOK 2000 million and altogether 3000 man-years. The industrially oriented institute sector comprises 14 institutes with a turnover of NOK 2400 million, and human resources of 2900 man-years. The institutes are generally organised as independent limited companies or non-profit research foundations.

For a division such as NT, with its special responsibility for basic research, the research community plays an important role both as a customer group and as partners in co-operation. It has been of particular importance to develop a joint understanding of the importance of strategic research, in addition to creating greater awareness of the importance of good research management. With responsibility for research in both the natural sciences and technology in the university and college sector, as well as for a large industrial technology research institute sector, the disciplines and problems on which emphasis is placed will be different, even though interaction with these two sectors takes place according to the same model. Interaction at management level is organised in the form of regular dialogue meetings. The agendas for these meetings are agreed jointly, and they enable us to bring up both strategic and practical matters in wide-ranging discussions.

A system of regular “dialogue meetings” with the university and college sector has been established. This sector is represented by leaders of the faculties of mathematics and science and of technology (two meetings a year with each university). NT’s director (or his representative) also joins meetings of the national science faculty meeting (normally three meetings a year). NT also has observer status on the National Council for Technological Education (2 - 3 meetings a year).

Similar meeting-places have also been established vis-à-vis the industrially oriented institutes sector. Annual dialogue meetings are held at management level with each institute, in addition to two annual joint meetings with all institute leaders.

NT’s programme boards and members of our management team with responsibility for specific subjects also maintain regular contact, and relatively often have meetings, with

research groups of central importance to their programmes or for the activities of their disciplines in various connections (site visits, meetings of experts, etc.). These are meeting places that also involve individual researchers, at which scientific and technical questions related to specific research activities within programmes and disciplines can be brought up.

The ministries

The most important ministries for NT are KUF, NHD and OED. The documents submitted in connection with our annual budgetary proposals and allocations play a central role in our dialogues with the ministries. A number of meetings are likely to take place in connection with budgetary preparations, at which important strategic and discipline-related questions are discussed. On the RCN's side, much of the dialogue at management level is conducted by the director who "answers" to the ministry, but at the moment, NT does not have such responsibility vis-à-vis any ministry. With respect to the three ministries mentioned above, however, NT's management is always involved, due to our large project portfolio related to these ministries.

KUF, as the "owner" of the RCN, has an annual meeting with NT's management level, which provides an opportunity for wide-ranging mutual orientations and discussions of core research-policy topics.

NT has also set up annual meetings of NT's management, the Division Board and leading civil servants in KUF, NHD and OED. These meetings provide a useful and corrective counterweight to our other meetings with the ministries' leadership groups and case officers.

Users of research

The research programs have boards with members that are either prominent scientists or users the business sector and public administration with background in research. This constitutes an important linkage to the users together with the communication of results that all research activities are required to perform.

The general public

NT lays great emphasis on presenting the results of the research that the Division supports, and in general, contributes to providing the public with better insight into the importance of NT's research for modern society. Our most important tool in this respect is its Communication and Information Programme (see section 4.7), whose primary target group is the educational system (teachers and pupils).

Provision of information, both to the general public and to more specialised users, is also a compulsory part of the mandates of all research programmes.

3.2 The role of the Division Board

The Division Board has general responsibility for the activities of the Division. The Board adopts objectives, strategies, allocates budgets to various groups of activities and checks that the activities of the Division are in accordance with its decisions. Only in

exceptional cases does the Board assume responsibility for financial decisions at project level, and then only on the recommendation of a lower-level body.

The board has seven members. Four of the members represent various academic disciplines and the four universities, while the other three hold leading positions in various research institutes.

The activities of the Division are organised through a large number of sub-committees, to which the Board has delegated authority. All the programme boards have the authority to fund projects on the basis of a programme plan and a budget agreed by the Division Board.

The Division Board plays a key role when it comes to identifying and prioritising themes for larger research efforts. When new plans and programmes are being launched the Board appoints planning groups. These groups prepare the basic documentation of each case as a basis for subsequent decisions to be made at Board level.

The Board meets seven times a year (in 2000), in the course of which period it deals with about 100 items on its agenda (110 items in 2000). Many of these items, such as budgetary proposals, annual budget and formal approval of allocations at a general level (frameworks), occur according to a regular annual cycle. Other central items that occur every year include evaluations (of disciplines and institutes), and the development of new programmes (plans and priorities).

The Chairman of the Division Board and the Director of the Division are in regular contact between meetings, in order to discuss and prepare important cases and strategic choices before these are submitted to the Division Board. The Chairman of the Board also represents the Division at budget meetings of the General Board of the Research Council and together with the Director of the Division is the spokesperson of the Division vis-à-vis the General Board. The Chairman of the Division Board does not normally participate in NT's dialogue meetings with the university and college sector or the institute sector (see section 3.1).

The Division Board has established two subordinate bodies with a mandate to give advice on important strategic tasks:

The Advisory Committee for independent projects (SUNT)

NT has set up an advisory committee for dealing with applications for independent projects. SUNT advises NT in connection with the expert recommendations for independent projects. The work of the committee is intended to ensure quality and efficiency in the treatment of applications. Other important advisory duties for the committee are related to the division of work and cooperation among participants and applicants, the evaluation of proposals and measure to stimulate the recruitment and training of researchers, the follow-up of major individual projects and quality assurance of experts (peer review).

The Advisory committee for strategic programmes in NT (RUSP)

Advice from RUSP to NT's management team helps to quality assure the way in which applications for strategic programmes (SIPs and SUPs) are dealt with. This committee also provides NT with advice in matters that concern the follow-up of ongoing programmes and further development of these schemes. The activities of the committee are based on the rules applying to NT's strategic programmes, as well as the guidelines given by the ministries which finances them.

3.3 Mechanisms for forging links with other divisions

Contact with the other divisions takes place in the following ways:

- At top management level via the Director's participation in weekly director meetings
- Participate in specific RCN processes which are designed to include interaction with the other divisions
- Management-to-management meetings with the other divisions with the primary purpose of co-ordinating our activities
- Contact in specific co-ordinating bodies (i.e. the co-ordinating biotechnology group)
- Participation in joint research programmes
- Various informal and formal meetings, seminars and occasions, several of which are made possible by our sharing of office premises

During the phase of establishing the new structure there were some conflicts when the RCN was established, but now conflicts of this nature are rare. It is our experience that if a problem occurs, it is seldom that it is cannot be easily worked out in co-operation with the management of the other divisions. There are also several good examples of joint initiatives in which two or more divisions collaborate to achieve a common goal. Here we would mention several examples of initiatives for new programmes that have been taken in collaboration with one or more other divisions.

The following is a list of examples of joint activities and co-ordination with other divisions:

- Advanced scientific equipment (NT co-ordinator of the programme involving all scientific fields)
- Management group for business-related research (Directors of four divisions, chaired by IE, co-ordinate implementation of strategy and RCN funding of research)
- ICT-forum (NT in charge of forum that provides advice to RCN)
- Centre of excellence programme (All divisions take part in co-ordinating group chaired by division of Strategy)
- Medical technology (MH)
- Language technology (KS)
- Biotechnology (Co-ordinating group chaired by BF with members from five divisions)

4. Portfolio of Activities

Technopolis request:

- An explanation of how the strategy is reflected in the programme and project **portfolios**
- An explanation of the **structure of the Division** and the function of the different Departments
- A summary of the **content and structure of the research portfolio** per department. This will need to explain the use and allocation of resources and the portfolio breakdown between different funding modes (e.g. programmes, infrastructure support and disciplinary support). The summary for each part of the research portfolio needs to give a qualitative and quantitative description of the type of projects supported and the results
- A brief explanation of the programme and project **management processes**, especially project selection criteria and co-ordination processes with other Divisions and stakeholders

4.1 Main Portfolio

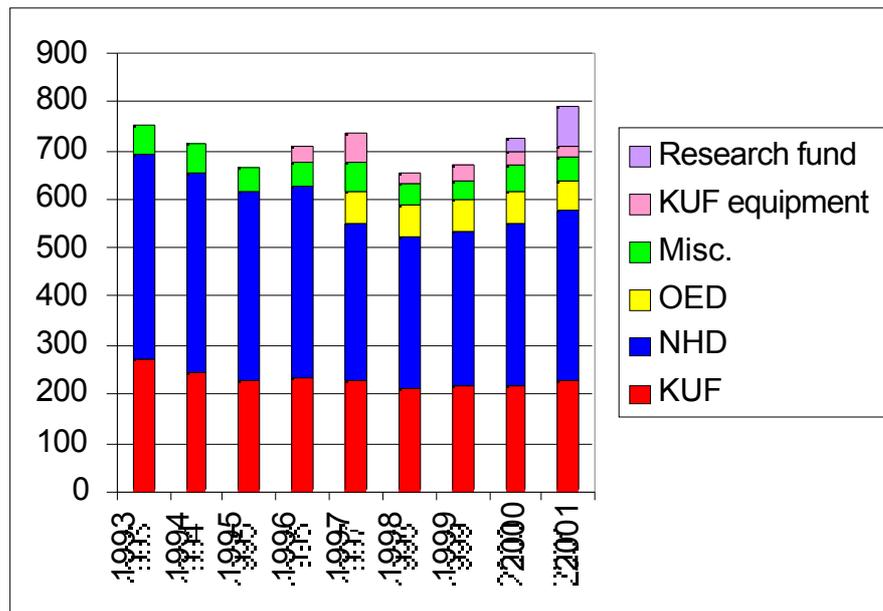


Fig 3 Budget for NT 1993-2001 by funding source adjusted for inflation (2001 MNOK)

In figure 3 shows the development of NT's budget and the funding from the different ministries. The Ministry of Education, Research and Church Affairs (MERC) is funding basic research. Industrially oriented strategic research mainly gets its funding from The Ministry of Trade and Industry (MTI) and the Ministry of Petroleum and Energy (MPE).

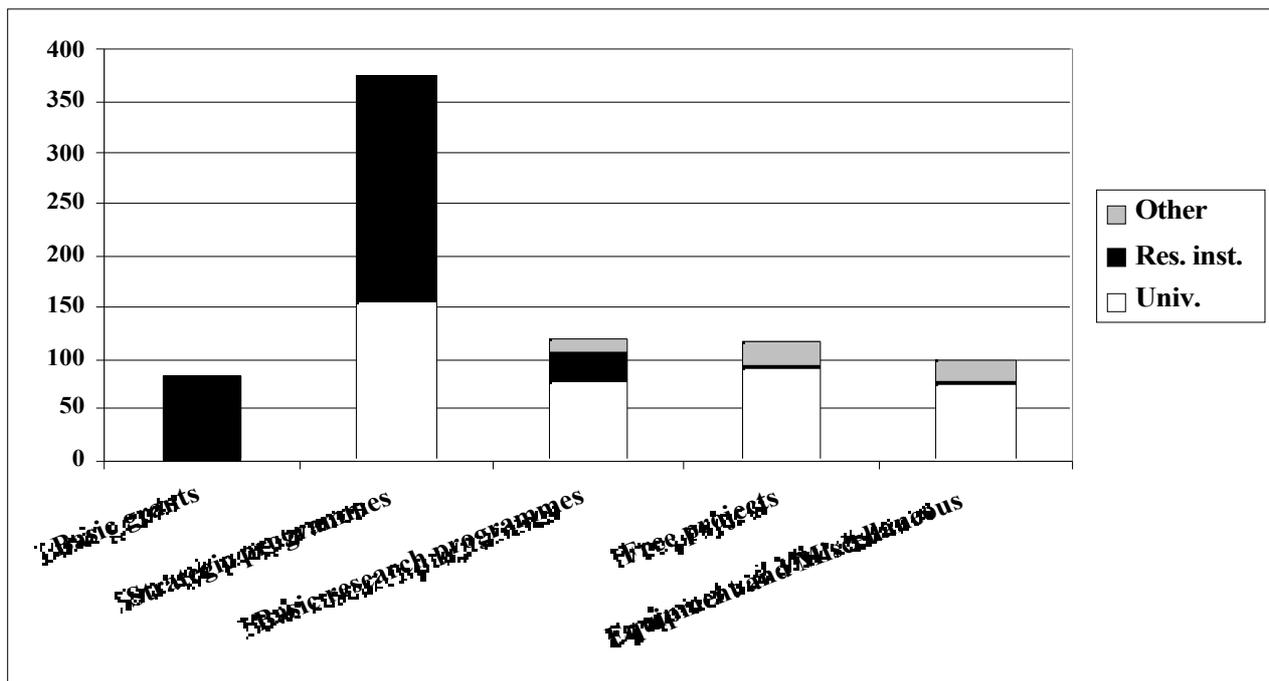
From 1997 there has been earmarked funding from MERC to expensive scientific equipment. The management of this programme has been taken care of by NT, and covers all fields of research within the Research Council. This program has been very important for natural science and medical research, which has taken about 80% of the total budget.

The general funding of basic research from MERC has shown a steady decline most of the years since the merger in 1993. From 2000, however, a new research fund was

introduced and turned the trend in the positive direction. The research fund came as a result of the last white paper on research to the Parliament.

The different funding modes have developed over time as shown in figure 4. Basic research, as funded by free projects, shows a steady decline, but has been compensated by an increase in strategic university programmes (SUP) and earmarked funding of expensive scientific equipment. Basic research programmes also have a positive trend. If we look at the funding of technical-industrial research institutes, however, both basic grants and the strategic institute programmes have declined.

Fig 4 NT Budget 1993-2001 by funding modes, adjusted for inflation (2001 MNOK)



financial resources that are made available to the institutions via their management. This include such means as basic grants, strategic programmes and advanced research equipment. The department is also responsible for the centres of excellence in research in science and technology. NT's communication and information activities, as well as programmes oriented towards the institution, also form part of the responsibilities of this department.

The infrastructure department also is responsible for operational tasks for the whole division such as budget and annual reporting.

Programme and Project department

The Programme and Project Department is intended to act as the researchers' arena, which is to say that it deals with the financial resources that are placed directly at the disposal of the scientific and technological community. These are typically independent projects and programmes. This department has divisional responsibility for international activities, scientific evaluations and the follow-up of scientific plans.

4.3 Responsive mode funding (independent basic research projects)

Our objective is to create versatile, high-quality research environments with the ability for self-renewal. Independent projects are the most important means of guaranteeing a scientific dynamic of this sort, on the basis of the personal priorities of individual scientists. This measure is aimed primarily at scientists in the university and college sector, and is based solely on open advertisements. Its results are measured in terms of scientific publications and doctorates submitted. This is intended to ensure access to highly qualified researchers in fields of applied research and to have an influence on the development of new disciplines.

Independent projects cover all disciplines in science and technology, with the exception of scientific subjects covered by the research programmes. The programmes' action plans are used as the basis for evaluations of relevance when applications are being distributed to programmes or independent projects. If an action plan is not available, the programme plan is used. For independent projects, therefore, individual researchers may apply for individual doctoral and post-doc fellowships, overseas fellowships, visiting researcher fellowships and for project and environment support. Universities and state and higher colleges may also apply for general support for periods abroad in connection with sabbaticals for tenured staff.

Scientific quality is the most important criterion in project evaluation. In addition to this comes a set of strategic priority criteria (DOKSY 5-5-6-8). Independent projects emphasise recruitment, and doctoral and post-doc fellowships make up an important part of the project portfolio. In 2000, almost 70% of the budget was directly related to recruitment activities. If we also include open fellowships under other project and environment support, the recruitment share of this budget rises to more than 80%.

Emphasis is placed on internationalisation by giving priority to periods abroad for fellows. For post-doc fellows, a period of at least six months abroad is a prioritisation criterion.

Administration of independent projects

Applications for independent projects are dealt with as follows:

NT has a panel of around 400 Norwegian and foreign referees. Universities, colleges and NT's own administration has proposed members of the referee panel. The list of referees has been approved by the advisory application committee (SUNT) before any member of the panel has been requested to act as referee for a five-year period.

Applicants are permitted to propose referees for their own applications. As long as the applicant has proposed referees whose legal competency are not in question, one of his/her proposed experts is usually used in addition to one or two from the panel of referees. The choice of referee requires that both the scientific topic of the application and any possible bias of the referee with regard to the applicant is taken into account. The evaluation is made in according to a standard evaluation form. The guidelines for referees are enclosed (Appendix 3). The same guidelines are used for programme project applications and for Strategic Institute Programmes (SIP)/SUP. Two or three experts are involved in evaluating each application, with the exception of applications for

fellowships for periods abroad and applications for support for conferences, which are dealt with by the administration.

The administration ranks and recommends the applications on the basis of the experts' evaluations and the given prioritisation criteria (DOKSY 5-5-6-8).

An advisory application committee, SUNT, examines the administration's recommendation, and may propose changes in the recommendations. The applications are made available to SUNT in advance of the meeting and while they are being dealt with at the meeting.

The Division Board makes the final decision regarding allocations. Applicants are informed of the results of the processing of their applications. Anonymous copies of the experts' evaluations are enclosed

In 1998/99, NT carried out a development project whose objective was to go through the regulations and practices of the referee system in order to improve routines and raise the quality of processing applications. A questionnaire was sent to applicants, which revealed that applicants generally regarded the application procedures for independent projects as functioning well.

The administration has launched a self-evaluation procedure among its scientific advisers and members of SUNT. The aim of this procedure is to evaluate the functioning of SUNT and its ability to quality-assure the processing of applications.

4.4 Basic research and network programmes

In NT, the RCN's current policy for research programmes - DOKSY 2-5-1 - forms the basis for working with and in research programmes. NT has also adopted the relevant DOKSY procedures (DOKSY 3-2-1-1, 3-2-1-2 and 3-2-1-3) for the mandates for programme boards, instructions for programme co-ordinators and instructions for the RCN's contact persons in programmes with external co-ordinators. A programme plan adopted by the Division Board, which defines scientific and strategic goals and central problems, has been adopted for work on programmes. NT's portfolio of programmes is shown in the table and described in Appendix 4.

(1 000 kroner)				General funds				Spec. funds	Total
	Start		End	KUF	NHD	OED	FOND		
<i>Basic research programmes</i>									
Marine resources, environment and management	2000	-	2004	5 000					5 000
Energy for the future	2000	-	2006			8 600	3 000		11 600
Basic petroleum research	1998	-	2003			12 000			12 000
Drinking water research 2000	1995	-	2004					3 000	3 000
Basic biotechnology	1997	-	2001		5 000				5 000
Basic industrially oriented biotechnology	2001	-	2008		4 500				4 500
Basic ICT research (IKT-2010)	2000	-	2007		8 000			4 000	12 000

Basic telecommunication research	1997	-	2001					11 000	11 000
Monitoring marine and terrestrial systems	2000	-	2004				7 500		7 500
Computational mathematics in applications	1999	-	2006	8 000	2 000				10 000
Catalysis and organic synthetic chemistry	1999	-	2006	6 900		5 600			12 500
Romforsk II	2000	-	2001	10 000					10 000
Nuclear and particle physics	1995	-	2005	11 250					11 250
ESRF-related tasks				3 000					3 000
Total				44 150	19 500	26 200	10 500	18 000	118 350

A research programme in NT is a strategic, goal-oriented, co-ordinated and time-limited research effort that aims to generate new knowledge and competence within a defined field, in which responsibility for its implementation, within defined financial and scientific frameworks, has been delegated to a programme board nominated by the Division Board. NT's research programmes are *basic research programmes*.

Research is carried out through a number of individual projects, all of which contribute to the realisation of the aims of the programme. The project portfolio is put together on the basis of applications received or initiatives taken by the programme board. Project proposals (i.e. applications) are evaluated with respect to their scientific quality and their relevance to the goals adopted for the programme. A programme plan adopted by the Division Board, defining scientific and strategic goals and central problems, is adopted for work on programmes.

NT's research programmes contribute to coordination and cooperation within priority areas and to our ability to consider the results of individual projects in a wider context. The objective is to promote new knowledge and competence within specific areas of particular importance for Norway and Norwegian industry in the short and long term, to help solve important management problems, and to profile Norwegian research in the international arena. The programmes encourage cooperation among research groups from universities and research institutes. Cooperation between researchers and future users of the results that they obtain (industry and the authorities) is a central element of many programmes.

The research programmes cover research that has national priority, takes up new scientific challenges, and requires the participation of several research institutes. Current research programmes are related to natural resources, generic technologies and international research co-operation. The national research support programmes related to our participation in large expensive international research programmes and various programmes take care of laboratories.

Implementation of a research programme

The work of a research programme can be divided into three phases.

Initiation and planning phases:

The Division Board decides which new research programmes are to be planned and appoints a planning group that is given a mandate to draw up a programme plan. A

central aspect of this task is the description of challenges, objectives and current problems for the new programme. The planning group consists of researchers and users in the relevant area. Their work takes the RCN's administration as its point of reference. The planning group draws up a programme plan that is sent out for expressions of opinion to relevant research groups and users before the Division Board discusses it. The Division Board retains overall strategic and scientific responsibility for the research programmes, and it decides both the overarching objectives and the scientific and financial framework of each programme.

Implementation phase:

In NT the programme board is responsible for the implementation of a research programme vis-à-vis the scientific and financial framework determined by the Division Board, and described in DOKSY 2-5-1. The Division Board appoints the programme board. The programme board is qualified to take decisions and make allocations to individual projects (activities) in the programme within the limits determined by the Division Board. The programme board reports to the Division Board through the Division Director. NT's administration cannot formally issue instructions regarding the work of the programme board.

A programme co-ordinator, who may either be an external scientific expert or an adviser/special adviser employed by the administration of the RCN, is appointed to assist the programme board. The programme co-ordinator is not authorised to distribute funds. A programme co-ordinator requires office support. External programme co-ordinators have a programme secretariat set up at their own institution to provide administrative office support. A consultant in NT's administration performs certain additional tasks, primarily project-related administrative tasks,, and an adviser/special adviser in NT's administration is appointed to be the programme's contact person.

4.5 Core grants research institutes

The basis grants are intended to ensure that the research institutes develop the scientific competence that will enable them to meet the future requirements of industry and the authorities. The basic grants are transferred to the institutes in the form of a round sum. It may be used for their internally initiated research and strategic efforts, for example in order to reinforce the financing of strategic institute programmes, participation in international co-operative programmes, positioning costs vis-à-vis The European Union's (EU) research and competence development of institute personnel. The institutes themselves control how the basic grants are used, and subsequently report on their use of this type of funding and on the results achieved.

4.6 Strategic university and institute programs

The objective of the strategic programmes is to support the universities' (mathematics and science faculties) and technological institutes' R & D strategies. Strategic programmes last from three to six years. The RCN and a university faculty or institute, or a technological research institute signs a contract. The research topics are concerned

with areas that are regarded as being of future importance for society and industry. Proposed programmes must be of high quality and competent research teams must do the research with a well-qualified leader.

The programmes are of two types:

- Strategic Institute Programmes (SIP), which make up the institutes' core allocations in conjunction with their basic grants
- Strategic University Programmes (SUP), which are intended to build up research groups around competent research leaders. This in order to strengthen the competence of highly qualified university researchers who are operating at the international forefront of research, or to concentrate of the development of disciplines that are new to the universities and which are required by industry or the authorities.

Process for establishing strategic programmes

Starting in the 2001 budgetary year, NT's process for establishing strategic programmes will be based on the following points (reference: DOKSY 5-5-4-2 NT):

1. The Division Board of NT approves the following year's budget proposal with a tentative framework budget for new SIP/SUPs.
2. Universities, higher colleges and technological research institutes are invited to apply, and the invitation to submit applications is followed up by dialogues with the institutions concerned.
3. Applications received are sent to international experts for evaluation of their scientific quality.
4. RCN staff with responsibility for a particular discipline evaluates the relevance of each application.
5. NT's administration draws up a set of recommendations. These are submitted to NT's Advisory Committee for Strategic Programmes (RUSP), whose comments are incorporated in the final recommendation, which is submitted to the Division Board for budgetary approval.

Initiation of strategic programmes: The institutions' own management are responsible for initiating proposals for new strategic programmes via their internal processes, and they prioritise the various proposals which have been initiated and submit application based on them. Each application must be accompanied by proposals for at least three external expert referees.

External evaluation by experts: As a general rule all applications must be evaluated by between three and five external referees. The administration's case officer together with the person selects these experts with responsibility for a particular discipline.

Each expert signs a declaration of in which he or she disclaims bias with respect to the applicant. The expert referees must provide a written statement for each application they have received for evaluation. Experts who are given more than one application for evaluation are requested to rank them.

Internal evaluation by RCN staff with responsibility for a given discipline: In order to evaluate applications within a given area, working groups consisting of RCN staff with

responsibility for a given discipline are utilised. Each working group draws up a written recommendation on the basis of the application's scientific quality and its relevance to the subject area concerned. The recommendations of the working group are sent to the case officer responsible for strategic programmes in NT, as a basis for drawing up the main recommendations for SIPs and SUPs.

Submission to NT's application committee for strategic programmes: once the internal working groups have finalised their recommendations and a draft overall recommendation is available, this is submitted to NT's application committee for strategic programmes.

Budgetary approval by NT's Division Board and follow-up: NT's Division Board normally deals with the budget recommendations for strategic programmes at its December meeting. On the basis of the Division Board's budgetary approval the administration sends letters of rejection or approval of programmes to the applicants.

The administrative follow-up is the responsibility of the Infrastructure Department, which appoints a member of staff to be responsible for each programme, normally from NT or IE. At the end of the programme the contract partners are expected to organise a scientific seminar at which the programme's research and the results it has obtained will be discussed.

A series of hearings about strategic programmes are organised, so that at least one university and one technological research institute will provide orientations about a clutch of programmes every year.

In 2000, NT financed a total of 77 strategic programmes, including 32 at universities and colleges and 45 at technological research institutes. In the same year, the strategic programmes financed a total of 143 doctoral fellows. A list of SIPs and SUPs is shown in Appendix 5.

4.7 Special projects

In this section we will present the activity related to advanced scientific equipment and listed some other larger initiatives which do not fall directly within the regular funding modes. NT considers it important to be able to handle this kind of tasks.

Further details for some of these projects are presented in Appendix 6

Advanced research equipment

An Equipment Committee has been appointed to encourage co-operation and co-ordination among institutions with identical or closely related needs for equipment. The committee will also strengthen purchasing expertise within the institutions, e.g. by offering training in the subjects of EEZ (European Economic Zone) regulations and negotiating techniques.

The total amount set aside for advanced scientific equipment in 2000 was MNOK 35. The Main Board also decided to set aside a further MNOK 10 from the yield of the

Research Fund for advanced equipment. In 2000, funds were provided for a total of 25 new projects, of which eight were financed by the Research Fund. In 2001 the equipment allocation from the Research Fund was raised to MNOK 85.

Other special projects supported by NT

- Infrastructure programme “Supercomputing II”
- Microtechnology research
- The communication and information programme
- Sars centre for Marine Molecular Biology
- COST activities (Cooperation européenne dans le domaine de la recherche scientifique et technologique
- French-Norwegian Foundation
- The Mobility Programme
- The Halden Project and other nuclear activities
- Combined store and depository for low- and medium-level nuclear waste in Himdalen
- Simula Research Laboratory (ICT research centre at Fornebu).

Appendix 1

Evaluations and national strategic plans for individual scientific disciplines

Title	Volume/Panel	Year	ISBN
Chemistry research at Norwegian universities and colleges: A review		1997	ISBN 82-12-01000-7
Earth sciences research at Norwegian universities and colleges: A review	Volume 1: Assessments, recommendations and conclusions	1998	ISBN 82-12-01131-3
Earth sciences research at Norwegian universities and colleges: A review	Volume 2: Statistics, publication & citation, research at the institutes, departments and museums	1998	ISBN 82-12-01131-3
Physics research at Norwegian universities, colleges and research institutes: A review	Volume 1	2000	ISBN 82-12-01454-1
Physics research at Norwegian universities, colleges and research institutes: A review	Volume 2: Statistics, bibliometry and description of institutes	2000	ISBN 82-12-01461-4
Research in biology and relevant areas of biochemistry in Norwegian universities, colleges and research institutes: A review	Panel 1: Zoology, botany, ecology, plant physiology, marine zoology, marine botany and limnology	2000	ISBN 82-12-01467-3
Research in biology and relevant areas of biochemistry in Norwegian universities, colleges and research institutes: A review	Panel 2: Physiology, neurophysiology, neurochemistry, anatomy, toxicology and pharmacology	2000	ISBN 82-12-01479-7
Research in biology and relevant areas of biochemistry in Norwegian universities, colleges and research institutes: A review	Panel 3: Microbiology, molecular biology, genetics, biochemistry, immunology and biotechnology	2000	ISBN 82-12-01475-4
Research in biology and relevant areas of biochemistry in Norwegian universities, colleges and research institutes: A review	Factual information	2000	ISBN 82-12-01462-2
Research in biology and relevant areas of biochemistry in Norwegian universities, colleges and research institutes	Report of the principal evaluation committee	2000	ISBN 82-12-01510-6
A strategy for chemistry research: Recommendations		1998	ISBN 82-12-01206-9
Strategic plan for the geological sciences. (Plan for research and teaching in the geological sciences in the university and college sector)		1999	ISBN 82-12-01336-7

Appendix 2

Evaluations of Industrially Oriented Research Institutes

In a period of six years, 1995-2000, a total of nine sub-sectors of industrially oriented research institutes have been evaluated by ten different committees and covering 26 Research Institutes/departments.

Sub-sector evaluated	Research Institute/department (Name of Institution in Norwegian)	Year
Norwegian Building and Construction Institutes	NBI	1996
	NGI	
	NORUT	
	SINTEF Bygg&Miljø	
Information Technology within the Industrially Oriented Research Institutes in Norway	NR	1995-96
	NORUT	
	SINTEF Delab	
	SINTEF Industriell matematikk	
	SINTEF Informatikk	
	SINTEF Instrumentering	
	SINTEF Reguleringssteknikk	
Norwegian Petroleum Research Institutes	NORSAR	1997
	CMR	
	IKU AS	
	RF	
(IFE petroleum technology: separate study)	IFE petroleum	1999
Norwegian Energy Research Institutes	IFE	
	SINTEF Energiforskning	
Norwegian Materials and Chemistry Research Institutes	IFE	1998-99
	SINTEF anvendt Kjemi	
	SINTEF materialteknologi	
	TelTek	
Marine- and Offshore Technology	MARINTEK	1999-2000
Technology management	SINTEF teknologiledelse	1999-2000
Medical Technology Research	SINTEF Unimed	2000

The OECD Halden Reactor Project and the Institute for Energy Technology Halden activities	IFE/Haldenprosjektet	2000
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Appendix 3

GUIDELINES FOR REFEREES

From the Research Council of Norway

Please provide a fairly detailed appraisal of the following items and comment on strong and weak points of the proposal. The referee's report should not exceed two typed pages, or four pages for strategic programmes.

- 1.a) **Project manager:** What has been the contribution of the project manager to his or her area of research in the course of the past few years? Does the project manager have sufficient knowledge, experience and drive to contribute significantly to this field? Has the group where the project manager works the necessary resources to carry the project through? The ability and resources of the project manager may be compared to other recognised research groups in the field. For applications for doctoral grants, the competence of the project manager as a thesis adviser should also be mentioned.
- 1.b) **Should only be filled out if there are named candidates for fellowships.**
Candidates for fellowships: Please comment on the strong and weak points of the candidate. For fellowship applicants, their previous academic career, grades and research experience may be relevant. For guest scientists, their know-how in fields relevant to the project should be appraised.
- 2 **Scientific quality and importance:** Does the application state well-defined goals; is it clear on the methods and theory to be used; does it have some originality and can the project be completed in the time proposed? Is it likely that the project will lead to new knowledge or significant progress in the field? Is research in this area important for the development of the field (the area of research in question may no longer be of importance or, at the other end of the scale, be new and rapidly expanding)?
3. **Usefulness and contribution to research:** Will the project recruit researchers; i.e. Ph.D.students, postdoctoral fellows or in other ways strengthen research in Norway?

Can the project have a bearing outside its field on the development of new technology or in the solution of problems of national (Norwegian) importance? If the project succeeds, could it be of importance to industrial requirements in due course?

What is the minimum support necessary to start the project or part of the project? Indicate which parts of the project you would support if it were given a reduced grant? Please summarise your impression by filling out the following table on the enclosed form: Conclusion of the evaluation.

<i>Conclusions regarding</i>	<i>Excellent</i>	<i>Very good</i>	<i>Good</i>	<i>Fair</i>	<i>Poor</i>
1a) Project manager					
1b) Candidates for fellowships					
2 Scientific quality and importance					
3) Usefulness and contribution to research					
Total appraisal					

The scale is as follows:

1. *Excellent:* Within the best 10% in the area of research internationally. Should only be used for really exceptional applications.
2. *Very good:* Within the best 1/3 of research in the area. Undoubtedly deserves support.
3. *Good:* In the middle 1/3 of research in the area. Could be worth supporting.
4. *Fair:* In the lowest 1/3 of research in the area.
5. *Poor:* The application has serious weaknesses and should not be supported.

Appendix 4

NT's portfolio of research programmes

Completed programmes

Distributed IT systems (DITS) (1996 - 2000)

Drinking water research towards 2000 (1995 - 1999)

Final report: ISBN 82-12-01354-5

[http://program.forskningsradet.no/drikkevannsforskning/uploaded/nedlasting/sluttrappor
t.pdf](http://program.forskningsradet.no/drikkevannsforskning/uploaded/nedlasting/sluttrappor
t.pdf)

Basic petroleum research (Propetro) (1991 - 1998)

Basic energy research (1996 - 2000)

Marine resources and environment (1995 - 1999)

Materials science (1995 - 2000)

Final report: ISBN 82-12-01363-4

<http://www.forskningsradet.no/fag/nt/nedlast/materialforskning.pdf>

Chemical conversion of natural gas (1994 - 1999)

Final report: ISBN 82-12-01449-5

<http://www.forskningsradet.no/fag/nt/nedlast/gass%20sluttrappor.pdf>

Space research I (1995 - 1999)

Final report: Not given ISBN

Supercomputing I (1995 - 1998)

Final report: ISBN 82-12-01316-2

<http://metacenter.uio.no/nfr/publikasjoner/Sluttrappor.pdf>

Ongoing programmes

Computational mathematics in applications (BeMatA)

Programme period: 2000 - 2006

Funding ministries: KUD and NHD

Budget (2001): MNOK 10.0

- “Computational mathematics” refers to the development and analysis of mathematical models, numerical techniques methodological software for solving problems in science and technology by using computers. Computational mathematics is thus a synthesis of mathematical disciplines and informatics. The use of mathematical technology of this sort is undergoing rapid growth throughout the industrialised world. This is not merely a matter of applications in the natural sciences and technology, but such areas as biology, medicine and the social sciences are now also utilising mathematics much more than they used to. Developments in computing have increased rather than decreased the need for research in mathematics, and have oriented aspects of such research in the direction of methods that are capable of exploiting modern computational technologies. The programme focuses on basic methodological development. At

the same time, it is important to obtain synergy effects between methodological development and application-oriented problems. The primary aim of the program BeMatA is the development of new mathematical methods for studying the properties of classes of models. Top priority will be given both to the development of methods focused on bottlenecks of important applications and to more basic methodological research with future applications. Furthermore, the program will develop a “toolkit” of mathematical and numerical techniques for use in other sciences. The use of well-known methods on various problems, as well as the development of user interface, will not be part of this research program.

Drinking water research 2000

Programme period: 2000 - 2004

Funding ministry: SHD special funds

Budget (2001): MNOK 3.0

As a result of the European Economic Area Agreement Norway is required to implement the EU's directives in national legislation and regulations. As far as water supplies are concerned this means that the Drinking Water Regulations of 1995 will have to be revised in order to meet the requirement of the EU's revised Drinking Water Directive. The Directive focuses on the relationship between water quality and risk to health, and the EU lays particular emphasis on microbiological quality, the by-products of disinfection and the formation of substances injurious to health caused by materials that come into contact with drinking water. The “Drinking Water Research 2000” research programme is a continuation of the “Drinking Water Research towards 2000” programme that began in 1995. This research programme forms part of the “Water Supply Programme”, which represents the efforts of the Government to upgrade Norwegian water supplies to satisfy national objectives and international requirements. The supply of water in adequate quantity and quality for drinking, other industrial purposes and sanitary uses will be assured. Prioritised areas of research include tasks related to water quality and health, and how these challenges can be dealt with via water treatment technology.

Energy for the future

Programme period: 2000 - 2006

Funding ministry: OED and research funds

Budget (2001): MNOK 11.6

Norway's energy resources are a decisive factor in the Norwegian economy, and will most likely continue to be so for many years to come. There is currently a dawning realisation in Norway that we are in the process of moving to an energy system that will be different from what it has been - not only in terms of technology but also purely conceptually. Instead of the traditional central generation of energy which is then transported to the consumer in the form of electricity and petroleum products, in the future we will see a more diverse energy system consisting of both central and local energy production - in the form of heat, refrigeration and electricity. In such a system hydropower will continue to play an important role, but the resource base will gradually

span a wider range of options, and many types of technology will be involved. The interactions in such a system, in which hydropower will be one of the corner-stones, will be of decisive importance. This will make completely new demands of our system competence in a number of technologies. The programme has the following main objectives: to develop the competence needed for education, research and industrial development that will be capable of encouraging the development of a sustainable energy system, characterised for example by energy flexibility, diversity, efficiency and the right quality for the right purposes. Interactions among various sources of energy are important, where renewable energy sources and natural gas are central aspects.

ESRF-related tasks

Programme period: 2000 - 2002

Funding ministry: KUF

Budget (2001): MNOK 3.0

The RCN is responsible for funding activities related to Norwegian membership of the European Synchrotron Radiation Facility (ESRF). Norway is a member of ESRF by virtue of its membership of the Nordic NORDSYNC consortium. The ESRF membership fee is paid directly by KUF, while the Research Council has been given responsibility for “follow-up” research. Together with Switzerland, Norway also runs its own beamline at ESRF; the Swiss-Norwegian Beamline (SNBL). The costs of SNBL cooperation are covered by the RCN, the University of Oslo, NTNU, the University of Tromsø and Stavanger College via Norwegian Synchrotron Research AS. The funds allocated to this purpose are largely employed on ESRF-related tasks, which have mainly consisted of travel funding for Norwegian scientists’ use of the facilities at ESRF and SNBL, the Research Council’s share of the SNBL membership subscription and the management of Norwegian Synchrotron Research AS, in addition to Norwegian participation in ESRF’s management bodies.

Basic biotechnology

Programme period: 1997 - 2001

Funding ministry: NHD

Budget (2001): MNOK 5.0

In White Paper no. 60 (1984 - 85) biotechnology was identified as a national area of concentration within the framework of our long term research priorities. In “Research for the Community” (White Paper no. 36 (1992 - 1993), the Government resolved to maintain this as a priority. The principal objective of this programme is to develop scientific competence of importance for biotechnological research, education and industry, via support for research projects of high scientific quality. The aim of the research is to develop basic knowledge that will offer us the possibility of developing future biotechnological products and services.

Basic industrially oriented biotechnology

Programme period: 2001 - 2008

Funding ministry: NHD

Budget (2001): MNOK 4.5

A series of national and international studies emphasises the enormous potential of biotechnology for social development all over the world in the near future. To date, major Norwegian companies have been willing to put only limited efforts into modern biotechnology. Major changes are under way, however, in that a number of new companies are being set up, and that financial institutions are displaying a great deal of interest in investing in this sector. The further development of good research groups of high international standard is the most important precondition for the growth of a powerful biotechnological industry in Norway. The aim of the programme is to develop basic scientific competence of importance for biotechnological research, education and industry, via support for research projects of high scientific quality in the field of genome research. The programme will support projects in which the overreaching aim of the research is to develop basic knowledge that will offer the possibility of developing future biotechnological products and services.

Basic ICT research (IKT-2010)

Programme period: 2000 - 2007

Funding ministry: NHD and SD special funds

Budget (2001): MNOK 12.0

In many ways, competence is the key to grasping the potential for growth and meeting the challenges that face us in ICT, both with regard to industrial development and at the levels of the individual and society as a whole. This will require a powerful increase in capacity and a rise in the quality of national ICT competence. If we are to be able to satisfy future needs for special expertise, it will be particularly important to ensure a high level of quality in basic disciplines and to strengthen basic research in areas of technology of particular importance for industry and the community. This all-encompassing use of ICT will require a solid grounding in basic research if Norway is to find itself in a position to meet the challenges of the future in this area. The aim of this programme is to develop and make available new knowledge within vital aspects of ICT, in order to build up basic competence for future industrial and social development. The programme will prioritise research in the areas of distributed systems, communications technologies, and large information and programming systems.

Basic petroleum research (PetroForsk)

Programme period: (1998 - 2004)

Funding ministry: OED

Budget (2001): MNOK 12.0

The PetroForsk research programme forms part of the RCN's long-term efforts to exploit Norwegian oil and gas resources in an optimal way. The programme focuses on the value-adding aspects of research. This means that emphasis will be placed on the benefits of research to society as a whole as well as on its scientific and innovative qualities. At the same time, the long-term perspective and willingness of research to take risks will be maintained. The programme will primarily focus on the development of relevant knowledge and competence in the basic disciplines. The main aims of the programme are:

1. Development of methods for measurement and interpretation to improve quantification of geological and reservoir technical parameters.
2. Development of modelling tools that can result in new drillable prospects on the Norwegian shelf, and to better understanding of fundamental processes.
3. Improvement fundamental understanding and development of methodologies for improved prediction and monitoring of recovery processes.
4. Binding co-operation by all parties involved (universities, research institutes, industry) by contributing active participation and resources within the framework of the projects.

Basic telecommunication research

Programme period: 1997 - 2001

Funding ministry: SD

Budget (2001): MNOK 11.0

Rapid technological developments in the telecoms sector are producing major social and economic effects in Norwegian society and industry. This is due in particular to the ever closer integration of communications and information technologies. The old telecommunications monopolies are in the process of dissolving, both in Norway and throughout Europe. As a result, a major market is developing. Norwegian research groups are currently a powerful international presence in several niche areas. Growth in research efforts is essential in order to ensure that their expertise is maintained and in order to create the foundations of new activities in the telecoms field. The "Basic telecoms research" programme supports basic research in the following four main areas: mobile systems, broad-band systems, transport networks and end systems with focus on multi-media applications, in addition to telecoms systems for groups with special needs. The programme will build up basic competence in universities and research institutions for future industrial and social development related to this area.

Catalysis and organic synthetic chemistry

Programme period: 2000 - 2006

Funding ministry: KUF and OED

Budget (2001): MNOK 12.5

Norway is one of the world's leading oil- and gas-producing nations. Catalysis is a key technology for processing our gas resources into petrochemical products and fuels. Fine chemicals and medicines are products with extremely high processed value. Norwegian industry is making rapid progress in these areas, but their scope is not particularly wide and there is still potential for considerable expansion. The main objective of this programme is to increase added value in the Norwegian chemical industry. In order to achieve this the programme has defined a number of strategic aims (short version):

- Increase the added value of Norwegian petroleum resources.
- Establish powerful research groups at top international level in universities and research institutes.

- Increase the number of graduates in catalysis and organic synthesis in order to lay the foundations of future expansion and create new companies in the chemical industry.
- Encourage co-operation among Norwegian research groups and greater collaboration with international research centres in catalysis and organic synthesis.

Nuclear and particle physics

Programme period: 1995 - 2005

Funding ministry: KUF

Budget (2001): MNOK 11.25

The programme covers follow-up research under the terms of co-operation with the European Organisation for Nuclear Research (CERN). The programme portfolio consists of four major projects, including Norway's obligations in the LHC experiments ATLAS and ALICE.

Monitoring marine and terrestrial systems

Co-financed with BF. NT is responsible for co-ordination.

Programme period: 2000 - 2004

Funding ministry: research fund

Budget (2001): MNOK 7.5 (NT's share)

Our renewable natural resources are of fundamental importance for Norwegian wellbeing and patterns of human settlement. More intense exploitation and harvesting of natural resources can have long-term negative effects on the environment, in addition to reducing future harvesting potential. For this reason it is ever more important to maintain reliable monitoring of conditions and phenomena on land, in the atmosphere and in the oceans. For Norway, with its exploitation rights and interests in large areas, particularly in marine and polar regions, it is important to be at the forefront in this field. The programme will develop knowledge and techniques of great importance for future resources and environmental monitoring systems. It will deal with renewable oceanic and land-based resources of economic importance for Norway.

Space research (ROMFORSK II)

Programme period: 2000 - 2001

Funding ministry: KUF

Budget (2001): MNOK 10.0

The ROMFORSK II research programme is intended to provide important basic knowledge about space by improving our understanding of important processes and the development of the necessary technology. The programme description points out that this is a pure research support programme aimed at Norwegian participation in ESA, EISCAT and NOT. Norwegian involvement in major projects, such as satellites, rockets and ground-based telescopes based on international collaboration, have formed important elements of the programme's portfolio. The programme is primarily a two-year prolongation of the RCN's previous ROMFORSK programme (which came to an end in 1999). The short time-frame was chosen on the basis of the recommendations

that are expected to be made by the international evaluation of Norwegian physics (completed in June 2000); and the Scientific Plan for Norwegian Physics, which is currently in preparation (expected September 2001).

Marine resources, Environment and Management

Cofinanced with BF and MU. BF is responsible for coordination

Programme period: 2000 - 2004

Funding ministry: KUF

Budget (2001): MNOK 5 (NT's share)

In a long-term perspective, with falling revenues from the petroleum sector, what is already the central importance of the sea for Norway will be reinforced, both as a source of national and international consumption of seafood and as a basis of industrial activities of various types. Our relationship with, and dependence on, the sea make it natural for us to maintain strong, broadly-based scientific groups that focus on marine ecosystems. A solid knowledge base will improve our ability to accurately predict cycles in biological production in the ocean and the effects of human activities.

Responsible exploitation and development of the marine environment and marine resources demands a broad knowledge base. The aims of the programme are:

- To produce new knowledge of the structure, processes, production, temporal and spatial variability, and effects of human activities on marine ecosystems.
- To develop a knowledge base and methodological basis for commercial harvesting of marine resources within sustainable development.
- To develop bioeconomic models for long term management strategies.
- To develop calibrated measurement systems and models that will provide us with basic insight into our marine ecosystems and make marine resources and environmental monitoring more efficient.

Appendix 5

NT's portfolio of SIP/SUP in 2001

Prosjekt	Dicipline	Prosjekttittel	Institu tion	Minist ry	Start (year)	Grant 2 000
Serial nr.	Subject					
Et verdiskapende IKT- og tjenestesamfunn						
133761/ 420	Informasjon stekn.	Experimental Operation Centre	IFE Halden	NHD	2000	3 000
127586/ 420	Informasjon stekn	Geographic Information Networks (GIN)	NORU T	NHD	1999	3 000
121144/ 420	Matematikk	Knowledge, Data and Decisions	NR	NHD	1998	3 600
133661/ 420	Informasjon stekn.	Service architecture	NR	NHD	2000	1 000
127487/ 420	Informasjon stekn.	Living Knowledge	SINTE F	NHD	1999	6 100
110691/ 420	Informasjon stekn	TELECOM 2005 - dr.ing.progr. Mobil kommunikasjon	NTNU	NHD	1996	1 600
121455/ 429	Informasjon stekn	Computational Science and Engineering	NTNU	NHD	1998	2 300

Microtechnology						
113715/420	Elektrofag	MIKRONY - Program for micro- and optoelectronics	SINTE F	NHD	1997	6 000
127631/420	Elektrofag	Fiberoptic components	NTNU	NHD	1999	2 300
133952/420	Informasjonstekn.	Design of ASICs	NTNU	NHD	2000	2 700
129537/420	Materialteknologi	FIN Films, Interfaces and Nanomaterials	UiO	NHD	1999	4 600
133675/420	Informasjonstekn.	Microsystems	UiO	NHD	2000	1 500
Equipment microtechnology				NHD	1999	24 600
Network programme	Distributed Information Technology Systems (DITS)			NHD	1996	8 000
Network programme	Basic Information and Communication Technology					1 000
Network programme	IT Fornebu					5 000
Sustainable value creation from energy- and natural resources						
110675/420	Kjemi	Homogeneous Single-site Catalysts for Polymerization of Olefins	SINTE F	NHD	1996	3 000
113334/420	Kjemi	Homogeneous single-site catalysts for polymerization of olefins	UiO	NHD	1997	1 700
Biological resources and food processing						
110682/420	Kjemi	Technology for competitive food processing	SINTE F	NHD	1996	4 070
133724/420	Biofag	Hormone disruption in marine invertebrates	RF	NHD	2000	2 000
133721/420	Biofag	Fish neurobiology	UiO	NHD	2000	1 500
115197/420	Maskintekn.fag	Food processing and logistics	NTNU	NHD	1997	200
Network programme Biotechnologu programme				NHD		9 000
Marine offshore activities						
113910/420	Marintekn.fag	SKIPRO 2001, Motstand - Propulsjon	MARI NTEK	NHD	1997	5 000
121143/420	Petroleum	Characerization of corrosion inhibitor performance by radioactive tracer techniques	IFE	NHD	1998	1 550
127512/420	Petroleum	3D Tectonic modelling	RF	NHD/O ED*	1999	3 700
113354/420	Petroelum	Fluid-rock interaction	UiO	NHD	1997	2 600
115185/420	Petroleum	Petroleumsrelatert formasjonsfysikk	NTNU	NHD/O ED*	1997	2 000
Value creation from other land-based industries						
113555/420	Materialteknologi	Mathematical modelling of spaceframe welding	IFE	NHD	1997	1 550
127507/420	Miljøtekn.(Petro)	Utilization of isotopes in environmental technology	IFE	NHD	1999	1 800
133692/420	Bygningstekn.	Environmental Favourable Energy Use in Buildings	NBI	NHD	2000	2 000
110681/420	Bygningstekn.	Optimal fundamentering på land	NGI	NHD	1996	2 000
113762/420	Bygningstekn.	Fractured rock behaviour	NGI	NHD	1997	2 500
117939/320	Geofag	Snøskredforskning	NGI	NHD	1997	2 500
127291/420	Bygningstekn.	Permafrost response to environmental and industrial loads	NGI	NHD	1999	1 500
121363/420	Bygningstekn.	Structural consequences of deterioration and repair of concrete members	NORU T	NHD	1998	2 100
110668/420	Materialteknologi	Materialteknologi, Prosessmodellering og produkttegenskaper	SINTE F	NHD	1996	510
110684/420	Fellesfag NT	Laboratorium - Personlig verneutstyr	SINTE F	NHD	1996	300
121126/	Bygningstekn.	CMC-Computation mechanics in civil engineering	SINTE	NHD	1998	6 350

420	kn.		F				
133696/	Materialtek	Surface Engineering	SINTE	NHD	2000	3 000	
420	nologi		F				
133726/	Maskin	Particle Technology	SINTE	NHD	2000	3 000	
420			F E				
113490/	Kjemi	Experimental studies and computer simulations og	TEL-	NHD	1997	1 250	
420		particle/fluid systems	TEK				
110685/	Materialtek	Polymervitenskap	NTNU	NHD	1996	2 000	
420	nologi						
Network programme Material research programme				NHD		2 000	
Technologies of the future							
133667/	Informasjon	VR laboratory	CMR	NHD	2000	1 200	
420	stekn.						
131341/	Geofag	NORSAR ("transition grant")	NORS	NHD	1999	2 500	
420			AR				
138026/	Geofag	NORSAR ("allocation")	NORS	NHD	2001		
420			AR				
136773/	Fellesfag	MR Technology	SINTE	NHD	2000	3 000	
420	NT		F				
133739/	Elektrofag	Power electronics	SINTE	NHD	2000	2 000	
420			F E				
121138/	Fysikk	Miniaturized rocket payloads	UiTø	NHD	1998	1 500	
420							
121443/	Materialtek	Ceramics and Heterogeneous Materials	NTNU	NHD	1998	2 000	
420	nologi						
129104/	Tverrfaglig	Medisinsk teknologi (Medfinans. fra MH + 1 MNOK	NTNU	NHD	1999	4 000	
420		pr. år)					
133958/	Biofag	Neural mechanisms of sensory functions and	NTNU	NHD	2000	1 700	
420		memory					
Network programme Computational mathematics in applications (BeMaTa)				NHD	1999	0	
Basic funding and other infrastructure measures							
107631/	Fysikk	IFE Kjeller (Nuclear activities)	IFE	NHD	1995	37 000	
107630/	Fysikk	IFE Halden-project	IFE	NHD	1995	25 000	
		French-Norwegian Foundation		NHD			
133943/	Biofag	NORPEC (Norwegian climate)	UiB	OED	2000	2 500	
420							
113921/	Elektrofag	Next generation insulation system for high voltage	SINTE	OED	1997	1 400	
420		power transmission cables	F-E				
121229/	Elektrofag	Integration of hydro power production, scheduling	SINTE	OED	1998	2 100	
420		and economic risk analysis	F-E				
133716/	Maskin/Ene	Renewable energy resources	IFE	OED	2000	3 600	
420	rgi						
						9 600	
Nettverksprogram		Energy for the future		OED		7 100	
Nettverksprogram		Catalysis and organic synthetic chemistry		OED		4 200	
Nettverksprogram		Energy research programme		OED		7 000	
113596/	Petroleum	Formation Evaluation	SINTE	OED	1997	2 450	
420			P-P				
113597/	Petroleum	3D seismisk hybrid-modelling of oil/gas reservoirs	NORS	OED	1997	1 000	
420			AR				
113720/	Petroleum	Accelerated computation of multiphase and reactive	SINTE	OED	1997	5 500	
420		flow	P-P				
113928/	Petroleum	Gas technology	CMR	OED	1997	2 000	
420							
121225/	Petroleum	Complex wells	RF	OED	1998	3 000	
420							
127504/	Petroleum	Intelligent wells	SINTE	OED	1999	6 500	
420			F				
129112/	Petroleum	Prediction of hydrocarbon phases in reservoirs by	SINTE	OED	1999	3 100	
420		use of selected hydrocarbon components	P-P				
133713/	Petroleum	Optimal operation of petroleum production	IFE	OED	2000	1 750	
420							

133714/ 420	Petroleum	Norway from oil to gas	IFE	OED	2000	4 000
133715/ 420	Petroleum	Characterisation and modelling of oil	IFE	OED	2000	1 550
Network programme		Basic petroleum technology		OED		9 000
107622/	Biofag	Mikro- og makroorganismer	UiO	KUF	1995	
107626/	Biofag	Protein Crystallography	UiTø	KUF	1995	
108260/	Biofag	Kompetanse i genteknologi	UiO	KUF	1995	
110686/ 420	Kjemi	Basal forurensningsforskning	NTNU	KUF	1996	500
110687/ 429	Geofag	Høyoppløselig stratigrafi: Prosesser og anvendelse	UiB	KUF	1996	
110688/ 420	Biofag	Molekylære og epidemiologiske studier av antibiotika resistens og utvikling av nye petidantibiotika	UiTø	KUF	1996	
110689/ 420	Biofag	Sanseorgan og immunsystem hos fisk	UiB	KUF	1996	
110690/ 420	Biofag	Dyn. Of Animal Populations in Space and Time	UiO	KUF	1996	
110751/ 420	Matematikk	Numerisk simulering i strømningsmekanikk	UiB	KUF	1996	132
113492/ 420	Informasjonsteknologi	Parallell algorithms for scientific computing	UiB	KUF	1997	1 800
113593/ 420	Geofag	Sedimentary processes and paleoenvironment in northern fiords	UiTø	KUF	1997	2 000
115846/ 420	Geofag	Containment behaviour and spreading in soil and ground water	UiO	KUF	1997	2 400
121076/ 420	Fysikk	Modelling of Astrophysical Plasmas	UiO	KUF	1998	2 800
121078/ 420	Fysikk	General analysis of realistic ocean waves	UiO	KUF/OED	1998	3 200
121425/ 420	Biofag	Marine Algal Viruses	UiB	KUF	1998	1 900
128256/ 420	Biofag	Drug transport and drug delivery	UiTø	KUF	1999	3 000
128388/ 420	Biofag	Application of molecular techniques in systematic biology	UiB	KUF	1999	3 000
128418/ 420	Geofag	Subsurface biosphere, hydrothermal activity and magmatism along the Arctic ridges	UiB	KUF	1999	2 500
128726/ 420	Biofag	MODTEQ Model based development of advanced marine equipment	NTNU	KUF	1999	2 400
129525/ 420	Biofag	From DNA sequence to gene function using Arabidopsis	UiO	KUF	1999	2 400
133335/ 420	Biofag	Sars International Center - NTs andel	UiB	KUF	1995	2 500
133810/ 420	Geofag	Oil recovery from fractured reservoirs	UiB	KUF	2000	2 100
Nettverksprogram		Computational mathematics in applications (BeMaTa)		KUF	1999	8 000
Nettverksprogram		Space research II		KUF	2000	9 000
108261/	Biofag Biofag	Sars International Center (contribution from NT) Sars International Center (extra grant from NT)	UiB UiB	KUF KUF	1995	

Appendix 6

Outline of some Special Projects supported by NT

Infrastructure programme “Supercomputing II”

At present, Norway has national supercomputing resources for technological and scientific research and operational weather forecasting financed by special allocations from KUF’s budget. Supercomputing is of vital importance for the development of weather forecasts as well as for nationally important research in the fields of climate change, ocean currents, multi-species modelling, oil reservoir modelling, etc.

RNF and NTNF supported the purchase of NTH’s and SINTEF’s Cray XMP supercomputer in 1986. Since 1992 the RCN has had a supercomputer investment programme. This programme has made it possible to coordinate requirements for performing calculations on supercomputers for weather forecasts at the Norwegian Meteorological Institute (DNMI) with those of technological and scientific research at universities and colleges. National coordination of investment in supercomputers has led to better utilisation of the investments that have been made in this type of equipment, than would have been possible if each institution had met its own requirements.

Supercomputing has been financed by KUF via the RCN, by industry and by the universities themselves. The annual budget for supercomputing (2001) is MNOK 22.0.

The objectives of the programme are as follows:

- to offer cost-efficient supercomputing resources to scientific research groups and Norwegian universities and colleges
- to meet DNMI’s requirements for supercomputing resources for its operational activities and research
- to enable other financial participants in the programme to perform their calculations.

Microtechnology research

Microtechnology has a great deal of potential for Norwegian industry. The development of this technology offers major research challenges and demands a high level of basic research activity in Norwegian universities and research institutes. A proposal for a national effort in microtechnology was submitted in 1997 by the Foundation for Scientific and Industrial Research at the Norwegian Institute of Technology (SINTEF), University of Oslo (UiO), NTNU and SensoNor Ltd. Microtechnology is specifically mentioned in the Government’s planning document “Norway - marginal nation at the leading edge - industrially oriented IT plan” as a strategic technology area for Norwegian industry.

On the basis of these inputs the RCN launched a research effort on microtechnology for microsystems. This research is being financed via special funds provided by NHD, and between 1999 and 2003 it will focus on building up laboratories at SINTEF, NTNU and

UiO, in addition to building a dedicated laboratory building for microtechnology in Gaustadbekkdalen in Oslo. This building, which is being co-financed by the RCN and SINTEF, is due to be ready for occupation in 2001. The RCN will invest a total of MNOK 205 in 1995 - 2003 on new equipment, building support and strategic programmes. In addition to these funds, the IE Division will support a portfolio of user-controlled projects in microtechnology, run by Norwegian industrial companies.

The RCN plans to evaluate this effort in 2003. If the results are positive, they will be followed up with funds for strategic research in a new five-year period, with the aim of enabling research groups to utilise the new facilities.

The communication and information programme

The communication of research results and provision of information regarding the importance of research for a modern society are essential aspects of NT's recruitment action plan. The long-term aim of this effort is to increase interest in and recruitment to mathematics, the sciences and technology.

The communication and information programme comprises a wide range of measures, but has prioritised those aimed at children and young people, teachers and the educational system. It is also desirable to reinforce networks and cooperation with other key players in society who are also attempting to improve recruitment to mathematics, the sciences and technology.

Appendix 7

List of Abbreviations

BF	Division of Bioproduction and Processing
DNMI	Norwegian Meteorological Institute
DOKSY	System of governing documents
EMBL	European Molecular Biology Laboratory
ESRF	European Synchrotron Radiation Facility
FiD	Ministry of Fisheries
HI	Institute of Marine Research
ICT	Information and Communications Technology
ID	Ministry of Industry
IE	Division of Industry and Energy
KS	Division of Culture and Society
KUF	Ministry of Education, Research and Church Affairs
LD	Ministry of Agriculture
MD	Ministry of Environment
MH	Division of Medicine and Health
MU	Division of Environment and Development
NAVF	Norwegian Research Council for Science and the Humanities
NFFR	Norwegian Fisheries Research Council
NHD	Ministry of Trade and Industry
NLH	Norwegian Agricultural University
NLVF	Norwegian Agricultural Research Council
NMF	National Committee for Environmental Research
NT	Division of Natural Science and Technology
NTH	Norwegian Technical University
NTNF	Royal Norwegian Council for Scientific and Industrial Research
NTNU	Norwegian University of Science and Technology
OED	Ministry of Petroleum and Energy
RCN	Research Council of Norway
RMF	Council for Research in Medicine
RNF	Council for Research in the Natural Sciences
RUSP	Advisory Committee for Strategic Programmes
SD	Ministry of Transport and Communications
SINTEF	Foundation for Scientific and Industrial Research at the Norwegian Institute of Technology
SIP	Strategic Institute Programmes
SNBL	Swiss-Norwegian Beamline
SUNT	Advisory Committee for Independent Projects
SUP	Strategic University Programmes

Bioproduction and Processing Division
Briefing material for Divisional Review

Evaluation of the Research Council of Norway

The Bioproduction and Processing Division

- History, Scope and Changes of the Division
- Strategy
- Governance
- Portfolio of Activities

2001 August

The Bioproduction and Processing Division (BF) of the Research Council of Norway

Responsibilities and scope of work of the Division

The Division is responsible for research in the primary industries, e.g. farming, forestry, hunting, freshwater fishing, as well as research related to fish and animal health, fisheries and aquaculture, and research in the food, beverage, animal feed, biochemical and wood processing industries.

In the following some subjects are dealt with in more than one section, however in varying degree of detail. We feel this simplifies the explanation and the understanding of a rather complicated system in which numerous considerations have to be taken.

1. History, Scope and Changes in the Division

1.1 Historical outline

A historical description of the situation before the Bioproduction and Processing Division and the Research Council of Norway were set up – focusing on the strengths and weaknesses of the different systems

In 1993 the Bioproduction and Processing (*Bioproduksjon og Foredling, BF*) Division was formed by merging the responsibilities of the former Agricultural Research Council (NLVF), the Fisheries Research Council (NFFR), and the aquaculture activities of the Royal Norwegian Council for Scientific and Industrial Research (NTNF). The division was given responsibilities for strategic research, action programmes and user directed research¹, the only division with such a broad responsibility. Later the division was given co-ordinating responsibility for two main strategic research areas in the Research Council of Norway (“the Research Council” in the following), marine research and biotechnology.

A Parliamentary White Paper from 1991-92 dealing with changes in the Research Council structure states that BF will be responsible for research activities with a basis in biological production mainly associated with food production. This implied that BF should cover research in the areas agriculture, forestry, veterinary medicine, fisheries, aquaculture and the food processing industry.

The White Paper emphasised that these sectors had many common denominators with regard to basic knowledge. Both the agricultural and the marine sectors were actively engaged in

¹ *The terms used in this document are the same as those used in the NIFU report prepared for the evaluation of the research Council in 2001; "The Budgets for Research and Development of the Research Council of Norway, 1993 – 2000".*

aquaculture and food processing research, and they were important with regard to rural settling and development.

Considering these two sectors in Norway, it is important to notice that the fisheries and aquaculture sector is of considerably greater importance than the agricultural sector, and very much so in comparison with other European countries. The relationship between the sectors has traditionally rather been one of competition and conflict of interests than of co-operation.

Fisheries and agricultural research has been carried out for a long time. This applies particularly to agricultural research, which received its own research council in 1949. The fisheries research council was established in 1972. Fisheries and aquaculture research was gradually, but considerably strengthened in the period up to 1993. At that time both sectors had a well-established research system, both institutionally and financially. This was in accordance with the sector principle by which Norwegian research is organised. The two sector research councils (NLVF and NFFR) were an integrated part of this apparatus, and covered both basic and applied research within their respective sectors.

The sector principle implies a considerable need for co-operation and this was a main reason for establishing the Research Council. The need for co-operation was especially evident in the areas of aquaculture and food processing research. NFFR and NLVF had supported aquaculture research from the early seventies, but from early 1980 NTNF became an important actor. NFFR and NLVF managed to co-ordinate most of its activities in common programmes, but NTNF maintained its own programmes. In order to improve the dialog and co-operation a national committee for aquaculture research was established. The committee had limited responsibility and mandate, and conflict of interest was quite evident between the actors until BF was established. In the food processing area the situation was almost the opposite. While NFFR took responsibility for, and had considerable activity directed towards the fish processing industry, NLVF and NTNF maintained a rather low level of activity in this area. As late as in 1992, the three councils joined in a common user-directed research program for food processing. Its main goal was to strengthen the competitive edge of the Norwegian food processing industry.

1.2 The problems and challenges, as well as the change goals of the Division

The establishment of the BF Division faced some extraordinary challenges from the start.

Since the new Research Council was located in Oslo, one of the challenges was that the Fisheries Research Council (NFFR) was situated in Trondheim, 500 km north of Oslo. This resulted in that only a few employees decided to move to Oslo. In the following couple of years after the establishment of the Research Council, additional Trondheim employees quit their jobs at BF. The overall result was a considerable depletion of competence and experience. Both the Ministry of Fisheries and the Ministry of Agriculture had "lost" their "own" respective research council. That in itself caused some apprehension on their part. They also had to adjust their way of interacting with the Research Council. Furthermore, the new Bioproduction and Processing Division was staffed with a number of new employees, unfamiliar to them. This also caused considerable unrest in the research and business communities. The new system implied less programmes, less programme boards, in short less opportunities of insight and influence. A lot of personal bonds and acquaintances had been severed. The all-important personal networks had been severely impaired. The Bioproduction

and Processing Division soon realised that it was a major task to build new relations and new confidence in the system. In 1995 a consulting company was engaged to map the situation, both externally and internally in the administration. The same consultants conducted a similar survey in 1999. It was very satisfying to register that the problems had meanwhile been solved to a large extent.

Financially, the Division got a difficult start due to budget cuts in 1994. This particularly affected aquaculture research, but also agricultural research. To compensate for the effects of this, the Division prioritised established commitments rather than entering into new commitments which could have profiled the new Division better and given room for introducing a more co-ordinated use of financial instruments from the beginning. However, the situation provided the organisation with a little more time to develop strategies, new programmes and financial instruments.

It was decided that research funds were to be distributed along two main channels, namely research programmes and infrastructure activities. Financing of doctoral fellowships should be done through these financial instruments, and not as individual projects as had been the practice of the previous councils. Strategic programmes and user-directed programmes were introduced as new instruments. According to this strategy, 15 programmes were initiated in 1995-96 for a duration of 4-5 years, all ending in 1999. Except for the Biotechnology programme, all were thematic programmes. Biotechnology was considered to be an important key technology, which justified a common programme. Great emphasis was put on achieving synergetic effects. Consequently, 5 programmes were cross sectorial, combining marine and agriculture research. Support to innovation and new products and services was concentrated into one programme. However, the other programmes also reserved funds for user-directed projects. All programmes were given responsibility for both basic and applied research within their area.

A new division board was appointed in 1997. The main challenge for the new board was to decide on how to use the financial instruments and to design a new programme structure to be introduced from 2000. A very thorough procedure was decided upon. This implied collecting experiences from the present system, both internally and externally, as well as extensive contact with our stakeholders. When the old system was phased out in 1999, the new system was ready to take over with no interruption in the allocation of grants at all. This was a considerable achievement as it is common to experience a slow-down before a new programme is set on the tracks. The main changes compared to the previous system were:

- A larger share of the funds was allocated to infrastructure, from 40 % to 50 %.
- A simplified programme structure, 8 programmes instead of 15, all with a five year duration.
- All were value-chain programmes, going from primary production to end-products, and from strategic basic research to applied and user-directed R&D.
- Programme co-ordinators selected from BF staff, previously mainly hired from research institutions.

THIS DESCRIBES THE BF AS A MISSION DRIVEN RESEARCH COUNCIL (SEE BRAUN ET AL).

A main development in the BF Division is substantially more emphasis on institute policy. A main reason for this is that the Ministry of Agriculture from 1997 decided to channel all basic funding to the agricultural institutes through BF. In order to enable BF to manage this new

responsibility in an efficient and professional manner, BF has used considerable resources in building up competence with regard to the research institutions and the research system supporting the two sectors. Instruments in this respect have been evaluations and an internal BF competence-building project. (*Please also refer to chapter 2 and 4 for strategic implications from the use of financial instruments, new programme structure and the competence-building project.*)

1.3 Present status

An explanation of the current division boundaries and why these were set as they are, including a comment on issues associated with these boundaries

The boundaries between the Bioproduction and Processing and the other Divisions were largely described in the White Paper prior to establishing the Research Council in 1993. The responsibilities of the two previous councils were to a large extent transferred to Bioproduction and Processing Division. Aquaculture and food processing research was consequently placed in one unit, solving previous co-operation problems.

The establishment of the Environment and Development Division (*Miljø og Utvikling, MU*) was the most significant change compared to the old system. Both the Agricultural Research Council and the Fisheries Research Council had responsibility for co-financed programmes with funds from the National Committee for Environmental Research and the Ministry of Environment.

When establishing the Research Council, the programmes were considered and responsibility for the activities was divided between the Environment and Development Division and BF. These programmes covered issues where both the Ministry of Environment and the sector ministries had a financial responsibility. On this background it was difficult to define stringent criteria for where to place the programmes. A pragmatic approach was chosen and most of the co-financed programmes were placed in the Environment and Development Division. The main principle, however, is that the Bioproduction and Processing Division takes responsibility for environmental research directly related to the sector. The Environment and Development Division is responsible for the more general environmental research topics. Marine resource and environmental research is, however, organised in one programme in BF with financial contributions from the Environment and Development Division and the Science and Technology Division (*Naturvitenskap og Teknologi, NT*).

Furthermore, BF has continued, in agreement with the Culture and Society Division (*Kultur og Samfunn, KS*) a rather substantial activity within economical and social research related to business development and policy creation in the fisheries and agricultural sectors. The Culture and Society Division is responsible for the more general research related to the two sectors. With regard to the responsibility for wood processing (pulp) and the equipment sector for the food processing industry, it is shared in the way that the Industry and Energy Division (*Industri og Energi, IE*) is mainly responsible for this, however, where practicable in co-operation with BF. A co-operation with the Medicine and Health Division (*Medisin og Helse, MH*) on food/health research has been established.

A special coordinating committee for biotechnological research, with representatives from all divisions in the Research Council, was established in 1993. In 2001, a joint ethics programme for biotechnology (Ethics, Society and Biotechnology) was established. The programme is coordinated by KS, but co-funded by all divisions. In 2000, income from the Research Fund was distributed for the first time. In this connection, the Bioproduction & Processing and the

Nature & Technology Divisions established cooperation within research on the monitoring of marine and terrestrial resources as well as bioinformatics focusing on the mapping of the salmon genom.

2. Strategy

This chapter is based on the BF Division's structure and its use of policy instruments, as described in chapter 4.

Since 1993 the strategies of BF have changed considerably with regard to number of research programmes, use of individual scholarships, basic grants and strategic programmes, both in general direction as well as in budgetary terms. The general aim has been to clarify the research goals, identify synergies between agriculture and fisheries research, reduce the number of grey zones, and simplify the administrative work connected with the various funding instruments. In the following we will describe the process the Division has been through, however, the main emphasis will be to describe the present strategy and thoughts on future challenges and strategies.

2.1 Description of strategy

The Research Council of Norway ("Research Council" in the following) has the following tasks:

- Develop strategies for Norwegian research and development activities
- Provide advice on R&D policy matters, mainly to the Government and politicians
- Serve as a funding agency
- To act as a networking body, forging links between science, business and policy-makers,.

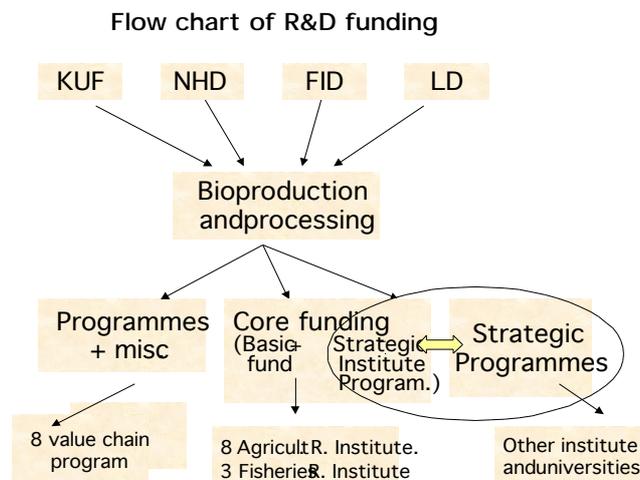
The BF Division contributes to these tasks in the following manner:

2.1.1 Use of policy instruments

(See NIFU document for detailed information)

The Division uses the following policy instruments:

- Basic funding (Norweg.: *grunnbudsjett*) to a number of institutions
- 3-5 year strategic programmes to institutes and universities
- Value-chain programmes (including action-oriented and user-directed projects)



Basic funding and Strategic (Institutional) Programmes (SIPs) together constitute the core funding of institutes for which the Bioproduction and Processing Division has core funding responsibility. The total amount, as well as the relative proportion between basic funding and strategic programmes, varies considerably from institute to institute, mainly depending on which ministry is responsible for the institute. Up to 1997, BF was responsible for the basic funding of only two institutes, the Institute of Aquaculture Research financed by the Ministry of Agriculture, and the Norwegian Institute of Fisheries and Aquaculture financed by the Ministry of Fisheries. As a consequence of new guidelines for public financing of research institutes set down by the Government in 1995 and the reorganisation of agricultural research in 1997, the Ministry of Agriculture transferred the responsibility for core funding of seven agricultural research institutions to the Research Council from 1997. As a result, the entire public budget to these institutions was defined as basic funding. However, the Ministry of Agriculture and the Research Council agreed to reduce the basic funding of these institutes in the years that followed in favour of more emphasis on strategic programmes. The institutions were given a political guarantee that the total amount of core funding should remain at a predictable level in a four-year period. The relative proportion between basic funding and strategic programmes should be 2:1.

From 2001, the Ministry of Fisheries transferred the responsibility for core funding of two of the fisheries research institutes (Norconserv and SINTEF Fisheries and Aquaculture) to the Research Council. Thus, at present, the Bioproduction and Processing Division is responsible for the basic funding of 11 institutes. With regard to their tasks, customers, ownership, organisation and economic structure the picture of the institutes is quite complicated. (BF is now working on developing a common base for institute funding as part of the competence-building project, see p. 8.)

The previous Division Board felt it had little influence on the strategic use of basic institute funding, as these funds are basically granted to the institutes at their own disposal with few strings attached except the governmental general guidelines for financing research institutes and the signals in the ministries' allotment letters. The Division Board therefore adopted a general policy to reduce the basic institute funding (especially for the agricultural research institutes) and to instead utilize these funds to accordingly increase the volume of strategic institutional programmes (SIPs). The aim was to obtain better control with the use of competence building funds.

Parallel to shifting emphasis from basic institute funding to SIPs, the board also decided to transfer funds from the programme budgets to the Strategic Programmes budget. This was decided on the grounds that the basic, strategic research part of BF's total budget was considered too small. This transfer of funds was made according to a plan over a period of several years from 1997 and is now nearly completed.

The institutes for which the Bioproduction and Processing Division has a basic funding responsibility do not cover the complete spectre of competence needed to develop the marine and agricultural sector. To a large extent, BF accordingly supports competence-building in research institutions (institutes and universities), for which BF has no basic funding responsibility. For this purpose only strategic programmes are used.

Evaluation of research institutions is another important policy instrument for BF. Such evaluations are carried out on a regular basis (approx. 7 years interval) and serve many purposes. The evaluation is used by the institute itself as an instrument to improve its

strategies, the quality of research and the administration of the institute. BF uses the evaluations to map strengths and weaknesses of the institutions, to develop strategies for the allocation of funds (infrastructure, basic and applied research), and as a mean to stimulate a research system which is well co-ordinated and has an optimal scientific competence profile. The ministries use the evaluations for their own information and planning purposes.

In 1993, the Division inherited a large number of individual scholarships from the former councils. These constituted a very heavy workload for the administration and the Board decided to end this practice. Instead it was decided to include all scholarship into either SIPs or as part of projects in the programmes. This change added considerably to the strategic ability of the Division, as well as to reduce the workload. Running scholarships were allowed to terminate according to their original set-up.

2.1.2 Research programmes

(See details of programme portfolio)

The programme policy has changed considerably as well. In 1993, the combined programme portfolio of the former councils were adopted. From 1995 the first Division Board introduced a new portfolio of 15 programmes. They were divided into action-oriented and user-controlled programmes. However, many of them contained both types of projects. This was due to the fact that BF, as previously mentioned, was the only Division given responsibility for both basic *and* applied research. The budget headings of the Research Council did not have the category "value-chain programmes".

The first portfolio of programmes was given a five-year life, ending in 1999. A new Division Board was constituted in 1997 and started planning the programme portfolio starting from the year 2000. A very thorough planning and initiating period was launched, lasting two years. This involved several rounds of discussions with stakeholders; ministries, public authorities, research institutions and business organisations. This procedure proved very successful, in contrast to the previous one, which was carried out in a hurry due to limited time. The new procedure established close relationships and a high degree of acceptance with the stakeholders as they got a chance to voice opinions at various stages in the procedure. The goal of the Board was to reduce the number of programmes and to make them "wall-to-wall" within their specific area. The philosophy was that the portfolio should cover all the responsibilities of the Division and reduce grey zones and eliminate voids between the programmes. They should also combine agricultural and fisheries research where advantageous and practicable. Together they should also cover the whole range from "sea /field to table".

Programme documents for each of the eight programmes were prepared. It was realised that the budgets made available to the programmes would not be adequate to satisfactorily cover the research needs described in the programme documents. Accordingly, each programme board was asked to produce an action plan for the programme, in which the prioritised research topics are linked to the given budget. The action plans are revised each April and serve as basis and guidance for applications for research funds the following year. All eight programmes are value chain programmes, containing both action-oriented and user directed projects. They all start and finish simultaneously. This provides ample opportunities to adjust the portfolio as a whole, and not programme by programme as would be the case with different start and finish dates. We consider this to be an advantage.

2.1.3 Use of staff

The previous programme portfolio was managed mainly by external programme co-ordinators, who often were researchers at research institutions, while the Research Council's own employees were contact persons between the programme co-ordinators and the administration. The tasks of the programme co-ordinators are among other things to prepare applications for programme board judgement and to maintain daily contact with the different stakeholders. The experience from that practice was unsatisfactory. Our own employees gradually lost contact with the applicants and users of research, and lost hands-on contact with our own system.

For the new portfolio starting in 2000, it was decided to use the Research Council's own employees as programme co-ordinators. This was deemed necessary for several reasons; daily management responsibilities is the main source of individual competence building, and the start of the competence-building project (see separate box) called for an active engagement of our own staff. The overall aim was to build better strategic decisions into our new programmes. Necessary additional working capacity to support the programme co-ordinator is now hired from research institutions according to the needs of each individual programme. The challenge is to find a good balance between strategic and advisory functions on one side and administration of financing instruments on the other. We feel we are on the right track in finding this balance.

BF's competence-building project

To support the main tasks of the Research Council the Division is gradually putting increased emphasis on strategic and advisory functions.

In order to improve the BF staff's competence with regard to institute policy and advisory matters, the BF administration has initiated a competence-building project aimed at increasing the staff's knowledge about the research units and research system with regard to strengths, weaknesses, funding situation, relation to other stakeholders, etc. This work has resulted in a first edition of the report "The Competence Profile of the Bioproduction and Processing R&D Institutions". This report contains all relevant information we have on each research institute, partly supplied from the institutes themselves, partly extracted from systematic international evaluations and based on the knowledge of the BF-staff.

The competence project will be "never-ending" and continuously maintained due to constant changes and needs.

The increased knowledge will be used to improve the development of the R&D system in accordance with future needs. The responsibility for one or more of the research institutions has been assigned to the BF staff and departments according to what is natural based on their areas of responsibility.

The Bioproduction and Processing Division is privileged in having responsibility for strategic, basic research, action-oriented research and user-oriented research within the Division. This provides the possibility of dealing with the knowledge value-chain from a birds-eye view. In addition, and simultaneously, we have close relations with business, public authorities and the Government as users of research results, and with the research community as providers of research results. It is becoming increasingly necessary to couple research and innovation together at an early stage, as well as research and the needs of public authorities. Compared with the old systems with numerous councils, with a corresponding number of grey zones, the Bioproduction and Processing Division administration consider the present arrangement with one council is a great improvement.

2.2 Achievements and impact

2.2.1 Marine research - achievements and impact

Aquaculture

The Norwegian aquaculture industry has had an outstanding and rapid development. It is entirely research based. It started about 30 years ago with salmon. After 20 years, in 1988, the production reached 100,000 tons. In 2000 the production of salmon was 420,000 tons. Combined exports of salmon and trout in 2000 were valued at about 13.5 billion NOK.

Achievements of the industry include:

- It takes 20-25 months to produce a 4-kg salmon today, compared to 35-40 months in 1975.
- It now takes 6-8 months to produce fingerlings (fish ready to be placed in a sea cage), compared to 24 months earlier.
- 1 kg feed is now needed to produce 1 kg fish, compared to 3.5 kg in 1975.
- The use of antibiotics has been reduced from 50 tons yearly in 1980 to a few hundred kilos at present. In the meantime the production of fish has quadrupled.
- About 1.45 billion NOK of state funds have been used for aquaculture research between 1988 and 1999. In the same period the exports were valued at 80 billion NOK.

Some notable research achievements that have supported this development:

- Systematic breeding has resulted in salmon that has a higher feed consumption pr. body weight and better feed utilisation. Brood stock selection has also increased resistance against disease, improved filet colour as well as fat distribution and fat contents. DNA fingerprinting and genome mapping will certainly improve the selection procedures.
- Feed technology knowledge of fish physiology has resulted in more correctly composed feed that contains more digestible components. A new extruding technique allows for more fat to be contained in the feed. New feeding techniques and equipment has resulted in substantially less feed waste and simultaneously improved the environmental situation around and below the cages.
- Use of artificial light prolongs maturity and improves the growth of the fish.
- At the end of the 1980s diseases were combated with antibiotics included in the feed. Unacceptable quantities ended up in the surroundings and in the sediment below the cages. New and efficient vaccines cured the problem. The use of antibiotics is vastly reduced. New vaccines are being developed. Those based on gene technology will have to be studied very carefully before a decision is made to put them to use.
- Cleanerfish have been introduced in the cages to eat salmon lice off the salmon. This has greatly reduced the use of chemical methods.

Fisheries technology

Along with enforcement of national and international rules and regulations, new fishing technology is a central factor in the achievement of responsible and sustainable fisheries, both in Norwegian and international waters. Norwegian research in this field, as well as Norwegian equipment suppliers, have a worldwide impact.

Up to 25 % of the total world catch is discarded because it is not specifically targeted by the fishermen. Selective fishing is a key issue. Based on new research fishing gear has been specifically designed to catch only the desired species and size that is wanted, excluding other

fish, which. The selective function is due to a grid placed in the mouth of the trawl. The design of the grid is specific for the different species and based on studies of fish behaviour.

- A Norwegian product, the “Nordmøre grid”, is used in shrimp fisheries throughout the world, and is legally mandatory in many places. The grid prevents small fish to enter the trawl, thus saving it for further growth.
- The “cod grid” has been mandatory in the Norwegian/Russian cod fisheries since 1997, and represents a milestone with regard to size selection.
- Apart from the responsible fishing aspect, the use of grids represents increased value of the catch for the industry as larger fish receive higher prices than small fish.
- Trawling is energy consuming. An aim is to reduce the towing resistance of trawls by 30 % by using new and thinner material. The energy consumption will be reduced correspondingly.
- Long lining is an energy efficient catch method, and it has good selective properties. New generations have been developed and new bait, called “artificial bait” based on fish by-products, has been developed. The bait is suitable for automatic baiting.
- Lost nets are a problem as they continue fishing after having been lost. A new pinger has been developed to recover the nets.
- Technology for transport and storing of living fish, e.g. cod, has been developed. This has the potential of enabling the delivery of fish throughout the year, and not only seasonally, which would increase the revenue.
- The value of the by-products is sharply increasing as they can be utilised for feed, food ingredients, and as basis for the biotechnological industry, which uses the properties of molecules and enzymes in its research and production. Technology to preserve the products on board fishing vessels has been developed.

Ocean research

High exploitation rates on the fish stocks require continuous development of the methods for stock size estimation and technology to monitor the fish resources, oceanographic parameters and environmental conditions.

- Due to recent problems with the estimation of cod stocks, a new model is now being developed. The aim is to obtain international acceptance of the model. This is of particular importance for Russia and Norway in their negotiations regarding stock quotas.
- The impact of minke whales on fish stocks is very substantial. It has been found that the whale diet ranges from herring, krill to cod, depending on the ocean area and the relative abundance of the respective stocks.
- A specimen-based life cycle model for capelin, which is important as feed for cod, has been developed. The distribution pattern of capelin in the Barents Sea has been confirmed. The method may be used as a general method to model distribution and population dynamics of fish stocks.
- The toxic effect of organic chlorine compounds on polar bear, seal, birds and some fish species has been studied. Indications that the immune systems of the species have been weakened have been confirmed.

2.2.2 Biotechnological and food science and technology research – achievements and impact

Food science and technology

The Norwegian food industry includes the fish processing and the agro-food industries. The two industrial sectors have very different market orientations. The fish processing industry exports most of its products worldwide, whereas the products from the agro-food industry are mainly found on the domestic market. The very different market strategies for the industry are of considerable importance for the research strategy in food science and technology. The target groups for the research activities have been the food industry and the governmental food authorities. Major achievements have been:

- The production of whey proteins and peptides for use in food products has been doubled, and several innovative applications have been developed.
- Equipment and processes for thawing of fish has been improved (speed, reduced loss and improved product quality).
- Several new products based on sous vide technology have been developed.
- Development of several flavouring ingredients based on careful control of Maillard reactions.
- Process development for *pre rigor* filleting of salmon.
- Development of the cod roe industry from handicraft to a highly controlled and automatic processing industry.
- Development of several novel analytical methods for the detection of early stages of fat/oil oxidation and for quantitative analysis of trans isomers of fatty acids.
- New bacteriocins: Isolation, identification, production and their application as preservatives for meat and fish products.
- Analytical methods for quantitative analysis of GMO in foods.

Biotechnological research

The biotechnology programme generates value through the support of basic research that eventually can be continued and applied as user directed projects. A major achievement has been the close networking obtained between the academic and industrial research areas due to funding of both types of projects in some programmes. This in turn has resulted in efficient patenting and industrialisation of research results and a better acceptance of modern biotechnology in the society. Grey zones and borders towards the other programmes have been discussed, and the programme has therefore tried to focus its funding towards development of new methods and implementation of new processes, rather than on the utilisation of established biotechnological methods and principles.

- Within microbial gene technology lactic acid bacteria have been studied with focus on the production and utilisation of antimicrobial peptides (bacteriocins) and the biotechnological production properties of these bacteria. Fermented milk products based on the probiotic effect of lactic acid bacteria metabolites have been developed and shown to induce beneficial health effects, especially in immune suppressed patients. This research has been done in close interaction with 5 EU-funded projects.
- Within fish and animal health, genome analysis has been in focus, and genome areas involved in mastitis (cows) and antigen response (salmon) have been identified. Extensive gene maps have been produced for both species. Fish vaccine development, antibiotic resistance and disease diagnostics are other areas where biotechnological knowledge and methods have been important. Norwegian research groups have been active both as coordinators and partners in EU-funded projects in these areas.

- Within agriculture, genes controlling grain quality and development have been important research areas. This has attracted both European and American research and industry partners. On the more practical side, the production of good-looking Christmas trees by embryo cloning technology has been successful. This will increase the competitive strength and earnings of this industry, and probably make it possible to develop this into a competitive industry in rural areas of Norway.
- Within the area of by-product and natural resource utilisation, enzyme studies have made it possible to transform kitin from shrimp and crab shells into high value kitosan products used in the medicinal, pharmaceutical and cosmeceutical industries. Biopolymers from marine algae (alginates) have been studied extensively and have resulted in many very interesting applications. Algae have also been developed for use in animal feed products, and protein hydrolysates from fish by-products have been utilised in the development of important feed ingredients for marine fry and larvae.
- Bio-prospecting in the cold marine environment have revealed enzymes with unique properties both as industrial and research tools, but also new antibacterial enzymes have been identified. Some of these discoveries have been commercialised by new biotechnological companies.
- In the user directed part of the programme, the end users have doubled the financial contribution provided (the programme contributed 33 % of the total). In a user survey among 20 of the supported projects, the end-users estimates the added value to be 2 billion NOK.

2.2.3 Agricultural research – achievements and impact

Agriculture in Norway plays various roles and meets serious challenges. The domestic markets have traditionally been protected from foreign products, however, this situation is gradually changing due to world trade liberalisation. The climatic conditions are not favourable compared to those of other nations. A main challenge is therefore to exploit the advantages Norway nevertheless has in relation to high quality production due to such factors as excellent plant and animal health, a generally sound environment, and a high standard of animal health in farmed animals.

The forest and forest industry is in another situation. It has a high share of exports and is competitive on the world markets.

The research includes both basic and applied research along the value-chain.

Plants and soils

- Basic competence in soil biology has been built through both Norwegian and Nordic co-operation. A mathematical model describing carbon and nitrogen dynamics in transition from plants to soil has been developed. The model has been used to test a hypothesis related to microbiological transformation of organic material.
- Methods for developing "risk maps" when using pesticides, based on research on transportation, distribution and biological effects of pesticides, have been developed.
- Basic and applied research on plant physiology in controlled environments (greenhouse) has resulted in substantial improvements with regard to production, quality and storability in plant production. This has improved profitability and created new jobs in the industry.
- Research in relation to organic farming has been given high priority. In several geographical areas one has succeeded in developing viable alternatives to conventional farming methods.

- Advanced storage methods (CA-controlled atmosphere) for fruits and berries have been developed, along with a new drying method. This has improved product quality and given a prolonged sales season. The above mentioned drying technology will also be introduced in the food processing industry.

Livestock

- Increased utilisation of Norwegian cereals as feed is a result of research on protein protection in ruminant feed. Steam heating makes starch more resistant to break down in the stomach, and expander treatment protects the protein.
- Development of a new energy estimation system related to feeding of pigs has resulted in energy standards that are optimal in relation to the pigs' digestion capacity. Further results are reduced feed requirements and improved economy.
- Gene analysis of sheep with scrapie and cows with BSE (mad cow disease) is carried out in comparison with non-infected animals. DPL-plymorphies in cattle does not appear to be associated with the presence of BSE. This is in accordance with data from the Creutzfeldt-Jakobs disease in humans.
- It has been shown that scrapie is present in certain genotypes of sheep. Research may help breed sheep that are resistant to scrapie, and this may be a way to combat scrapie. The sheep stocks increasingly consist of these genotypes. No negative side effects have been observed.
- Through gene mapping there is a basis for using molecular genetics in farm animal breeding. Commercialisation by selling disease resistant genes is now being planned.
- Ecological methods for disease control are emphasised through stimulation of the animal's natural resistance mechanisms. By adjusting the bacterial flora in the environment, including the one in the digestion system, a resistance to disease-causing bacteria has been achieved.

Forest and forest industry

- Research on biodiversity in Norwegian forests has contributed to forest management standards and certification of forest operations (some of the projects were carried out within the "Living Forest" project).
- Studies of natural tree mortality in different forest types and studies on the decay rate of fallen trees have been carried out. Dead and decaying wood is important for the biodiversity in the forest. Based on a total sample of 45,000 trees the average decay rates varied between 0.4 and 2.1 % for the main tree species. The results will have consequences for the recommended management practice of Norwegian forests, for instance less clearing operations and longer rotation times.
- Wood quality models based on objective exterior tree properties are defined and tested and partly taken into practical use by the forest industry for more profitable processing to lumber.
- Comprehensive transport studies of the forestry sector have documented the sector's transport efficiency and environmental status, and the most effective improvement actions have been mapped.
- Use of aerial laser scanning has in preliminary studies shown promising results for assessment of forest stand properties; the potential of the method will be further tested under more difficult terrain conditions.
- The cost of enforcing the national regulation regime for sale and settling on agricultural properties in connection with property sale has been studied. The study received considerable attention in connection with a recent adjustment of the regulation regime.

Market and society research – achievements and impact

The market and society research supports the industry's and the authorities' need for social research related to fisheries and aquaculture, agriculture, forestry and rural products. The social aspects of primary production and rural development are becoming increasingly important due to the growing public awareness regarding environmental issues, internationalisation, economic efficiency and consumer and market orientation.

- Research has shown the effect of governmental financial instruments on the development of the fish processing industry, and how governmental financial instruments have influenced private investments in the industry.
- Research on entrepreneurship in rural and coastal areas has shown that self-realisation is the most important motivation factor for entrepreneurship connected with establishing small companies, and that there are large variations with respect to how the local community supports entrepreneurship. The tendency is most dynamic in the more urban areas of the country.
- It is shown that 60 % of the households consider frozen fish as a good substitute for fresh fish. At the same time it is necessary to increase the customers' confidence in frozen fish, which today has a low quality image and is regarded as a "reserve product".
- Research related to consumers' confidence in foods has produced knowledge about various mechanisms and dimensions related to the consumer's confidence, as well as the consumer's wish to know more about the complexity of food processing. This complexity is coupled with the wish and need for simple everyday choices.
- Substantial efforts are being made to strengthen market research, an important but relatively small research area in Norway. A doctoral programme has been launched to improve the situation.

2.3 Future challenges for the Bioproduction and Processing Division

(For greater detail please refer to the Portfolio 2000-2004 section – chapter 4, and to the enclosed action plans for the research programmes.)

Some of the main challenges for the Bioproduction and Processing Division in the near future will be of political nature or associated with society's understanding of the importance of science and research, while others are more directly linked to scientific issues. Some of these challenges are of a more general nature, and the Bioproduction and Processing Division will thus only be able to influence them to a certain degree.

Political challenges

- To contribute to greater awareness and better understanding regarding the importance of R&D as well as scientific achievements and challenges by the government, industry and the general public,.
- To ensure the recruitment of young people to scientific careers especially within the fields of bioproduction and processing.
- To ensure that a significant number of Centres of Excellent Research are established within the BF area, in particular within the marine areas vital to the development of the bio-marine industry.
- To develop and optimise the institute sector's infrastructure with respect to the future needs of its users in industry and government.
- To focus and prioritise resources around selected target areas as presented in the White Paper on Research, in particular to secure increased financing for marine R&D.

Marine research

- Norway has two industry clusters within oil/gas and maritime sector. It is a challenge to use R&D to help build a third industry cluster in the marine area.
- A bottleneck for the substantial expansion of aquaculture may be access to the required amount of suitable feed. Research on alternative feed sources, e.g. cereals and other plants, and conversion of natural gas to proteins, is important. In particular there is a need to solve a potential lack of access to sufficient polyunsaturated fatty acids.
- In order to diversify the aquaculture industry, it is necessary to put additional species on stream commercially. Each species of marine fish and shellfish has specific challenges, which need targeted research in order to be solved.
- Norway has jurisdiction over vast ocean areas. Surveillance is extremely costly and complicated. Highly automated systems for above-water and through-water data collection and surveillance have to be developed.

Biotechnology

- To enhance the public perception of biotechnology and support communication between the public, non-governmental organisations, industry, scientific groups and governmental authorities.
- To develop new industries based on biotechnological research, and to implement the resulting knowledge in the entire food chain from primary production, through the food-processing industry, to the consumer. Furthermore, new insights must also be implemented within the governmental safety control authorities.
- To develop scientific groups with attractive competence for national and international partners. This relates to industry, partners in scientific projects and as members of international expert panels. This implies the development of scientific groups above critical mass (especially within the marine sector), to stimulate national and international networking and to focus on specific and nationally relevant research areas.
- One such area is research on Atlantic Salmon, which is the most important farmed fish species in Norway. To further improve breeding, health, etc., it is necessary to map important parts of the salmon genome in order to study and commercially exploit the properties of salmon. In addition, there are challenges concerning appliance of biotechnology on the breeding, feed and disease problems of other species.
- To do bioprospecting in the cold, marine environment and give this activity enough power to rapidly generate lead compounds for further studies.
- To develop relevant bioinformatics tools. This shall support both the genomic-, functional genomic-, proteomic-, and metabolic research at a level necessary to achieve a thorough understanding and important development in our fields. To develop bioinformatics into a leading national discipline with international qualities and collaborations is an integrated effort where several areas both within the Research Council and within the research community must interact.

Agriculture and food production

- The challenge for Norwegian food production and food industry is to become competitive with imported foods in an increasingly open market in Norway, where trade barriers are gradually being torn down in accordance with international trade agreements. It is a challenge for the BF Division to use R&D to support the food production and industry in this transition.
- The public confidence in food safety is at stake. This implies that BF's challenge is mainly to strengthen research within this area and to contribute to the implementation of

knowledge in the food industry and governmental authorities, as well as developing top-level scientific staff for recruitment to international expert panels.

- To increase the share of farmland used for profitable organic food production from 2 % to 10 % of the country's total agriculture land, while maintaining the same demands to food safety and quality and to the steady supply of products as for conventional products.
- To increase the awareness of research as a potential for the food industry which has a large proportion of small and medium sized enterprises.
- To improve the synergy between research related to marine and agricultural food industry.
- In order to increase added value creation and competitiveness in Norwegian food production, food and technology research is necessary to stimulate increased and more specialised food processing. In particular, there is a challenge to increase the processing of fish in Norway.

Forestry

- To obtain a broader and more varied utilisation of Norway's total forest resources, including higher wood rates, new products and new applications for wood. The research challenges are associated with sustainable forest management, better understanding of ecological systems and biological processes. The understanding of relevant forest organisms and their behaviour and reactions to both natural conditions and human activity will also be of importance.

3. Governance

3.1 Stakeholders

The Bioproduction and Processing Division's (BF) stakeholders are:

3.1.1 The research community

There are nine institutes in the agricultural and five in the marine area, as well as three university colleges, which are considered to belong to the "Bioproduction and Processing family of research institutions". The Norwegian School of Veterinary Science and the Agricultural University of Norway are independent university colleges, while the Norwegian College of Fisheries is organised as a faculty at the University of Tromsø. In addition, several departments at the universities with a significant amount of agriculture or marine research could be considered as "members of the family".

All institutions receive basic funding which in some cases is allocated via the Research Council. The Bioproduction and Processing Division supplies the basic funding for eight institutes in the agricultural area (Ministry of Agriculture), and three institutes in the marine area (Ministry of Fisheries). The Ministry of Education, Research and Church Affairs provides basic funding directly to the three university colleges. The Ministry of Fisheries provides the basic funding directly for two institutes. One institute (Matforsk) receives its basic funding from a separate levy.

The Bioproduction and Processing Division's responsibility for the various institutions within the "family" varies considerably. The division does not have ownership rights to any of them, but in our communication with the Ministry of Fisheries and the Ministry of Agriculture, the Bioproduction and Processing Division are instructed to varying degrees to fund these institutions with basic funding and Strategic Institute Programs (SIPs). From a practical point of view, the BF family of institutes receives the bulk of our SIPs, as well as individual grants from the Bioproduction and Processing value-chain programmes. However, the Bioproduction and Processing Division may give both types of grants to other institutions as well, such as university research groups, when they are competitive. The key here is the quality of the applications as well as the relevance to interests of our sector as expressed in strategy documents and program descriptions. On the other hand, our family of institutes may also apply for grants within other divisions of the Research Council. The Bioproduction and Processing Division has regular meetings with our institutes where we discuss topics of common interest. They also provide information regarding their activities, which allows the development of statistical data for the group.

3.1.2 Public authorities

The Bioproduction and Processing Division has close relations to the two sector ministries (Ministry of Fisheries and the Ministry of Agriculture). The Bioproduction and Processing Division receives 37 % and 53 % of its funding from these two ministries respectively (year 2000). The Bioproduction and Processing Division has monthly contact meetings with each of them. Occasionally representatives from other divisions of the Research Council may participate in these meetings.

The executive director of the Bioproduction and Processing Division has been given the responsibility to represent the Research Council towards these ministries and in that respect

also to coordinate the Research Council's activities in their areas. Twice a year there are formal meetings between the Research Council and each of the two ministries. In these meetings the executive director fronts a delegation from the Research Council representing all relevant divisions. In addition to these systematic points of contact, occasionally the Bioproduction and Processing Division also has contact with the ministries regarding specific projects such as conferences and preparation of strategic planning documents.

Each year the two ministries write a "budget letter" to the Research Council, specifying their demands and expectations regarding their budget. These specifications have traditionally been quite detailed, sometimes containing up to 100 individual items. Usually there is good communication between the Research Council and the ministries in the preparation of these budget letters.

The Research Council reports annually to the ministries according to specifications provided to the Research Council by the Ministry of Education, Research and Church Affairs. Recently both the Ministry of Fisheries and the Ministry of Agriculture have questioned whether or not the reporting is optimal. The Bioproduction and Processing Division has agreed to search for better ways of reporting the actual results and the impact of the research funded by the ministries.

In addition to the Ministry of Fisheries and the Ministry of Agriculture, we receive funding from the Ministry of Education, Research and Church Affairs for PhD recruitment purposes, and from the Ministry of Trade and Industry for food processing and biotechnology issues. Our relations to these ministries are mostly as part of the Research Council delegations in meetings, but occasionally more specific and on a one-on-one basis..

3.1.3 Industry and food producers

In the agricultural area, our main contacts are the food processing industry as well as farmers organisations. In the marine area our contacts include fisheries, aquaculture, fish processing industry and their organisations. In addition, there are some new biotechnology companies, mainly in the marine areas, which have the Bioproduction and Processing Division as their primary point of contact with the Research Council. In the forestry sector our contacts are mainly the woodland owners' organisations and the solid wood processing industry.

Through our collaboration with regional offices of the Norwegian Industrial and Regional Development Fund, the Bioproduction and Processing Division participates in a series of industry-driven R&D projects.

3.1.4 The general public

This group tends to be more weakly represented, but a significant number of conferences and seminars are organised, to which representatives of the general public are invited together with representatives from the research community. We reach a considerable percentage of the general public via dissemination efforts such as newspaper articles, TV-programs, conferences, books, web-sites, newsletters and journals.

3.2 The role of the Division Board

The Division Board has general responsibility for the activity of the Bioproduction and Processing Division. The board adopts objectives, strategies, allocates budgets to various

groups of activities and controls that the activities of the division take place in accordance with its decisions.

Regarding basic funding and SIPs, the board makes decisions on project/program level based on the recommendation of the Bioproduction and Processing administration. Regarding the eight value-chain programmes, the board allocates their budgets, and accepts their yearly working plans and reports. All activities on individual project level in the value-chain programmes are handled by the program board for each program, and supported by the Bioproduction and Processing staff functioning as secretary.

The Bioproduction and Processing administration always provides the necessary background documents and present proposals to the Division Board. Detailed minutes from the meetings are prepared and submitted to the Research Council's main board.

At present, the board has seven members and three substitute members. They are a mix of people from academia, the food industry and their organisations. They have been carefully selected to represent a mixed background from both the agricultural and the marine areas. They meet approximately seven times a year. Several of the meetings may be of two days duration, often in conjunction with meeting some of the research institutions. The Chairman of the Board participates in several of the Research Council's main board meetings, in particular in budget and strategy related matters. The Chairman of the Board also participates in his own meetings with the chairmen of the other boards of the Research Council and with the Director General of the Research Council. Occasionally the chairman of the Board and the executive director of the Bioproduction and Processing Division jointly meet the top management of the Ministries of Agriculture and Fisheries.

3.3 Links and collaboration with the other divisions

Contact with the other divisions in the Research Council takes place in the following ways:

- At top management level via the Bioproduction and Processing executive director's participation in weekly director meetings, chaired by the managing director of the Research Council.
- Contact in specific Research Council processes which are designed to include interaction with the other divisions
- Management to management meetings with the other divisions, primarily aimed at coordinating our activities
- Contact in specific coordinating bodies (i.e. the coordination of the biotechnology committee)
- Participation in joint research programmes
- Various informal and formal meetings, seminars and occasions, several of these made possible by our sharing of common office premises

Historically, there were some conflicts when the Research Council was established through a merger of several independent units. It seems that the level of conflict has been reduced. It is our experience that when a problem occurs, it is usually easily worked out with the management of the other divisions. There are also several good examples of joint initiatives where two or more divisions collaborate to reach a common goal (see chapter 1.3).

4. Portfolio og programmer 2000 - 2004

4.1 How the strategy is reflected in the programme and project portfolios

In order to understand how the Bioproduction and Processing Division's strategy is reflected in the programme and project portfolios it is necessary to briefly outline the interaction between the Research Council and the funding ministries via the budgetary process.

A technical description of the budget process is shown in the following table:

BUDGET PROPOSAL (year t)		
<ul style="list-style-type: none"> Guidelines from the Main Board to division boards for divisional budget proposals. <ul style="list-style-type: none"> - Based on "the research report" (White paper no 39), strategic plan for RCN (Forskning for fremtiden) and other white papers on research matters (for different sectors). - The guidelines are discussed with the division boards before finalised. 	Mid September	t - 2
<ul style="list-style-type: none"> <i>Guidelines (letter) from the Ministries to RCN for "Major research initiatives" (suggestions/proposals to the governments 1.budget conference in March (ca. 10th))</i> 	Prime October	t - 2
<ul style="list-style-type: none"> Division budget proposals from the division boards to Main Board 	End October	t - 2
<ul style="list-style-type: none"> Guidelines (letter) from the Ministries to RCN for the budget proposal 	Mid November	t - 2
<ul style="list-style-type: none"> Document on priorities and budget frames to the division boards produced by the administration to the Main Board for finalisation in January <ul style="list-style-type: none"> - Budget dialogue along the way with - and views from - the division (administration and boards) 	November/December	t - 2
<ul style="list-style-type: none"> <i>"Major research initiatives" (suggestions/proposals to the governments 1.budget conference in March (ca. 10th) to the Ministries</i> 	1 st of December	t - 2
<ul style="list-style-type: none"> <i>"Major research initiatives" - presented to the Main Board</i> 	Approx. 15 th December	t - 2
<ul style="list-style-type: none"> Decision in the Main Board: Priorities in the budget proposal to the Ministries and budget frames to the divisions. 	January	t - 1
<ul style="list-style-type: none"> Decision in the Main Board: RCN budget proposal to the Ministries 	End February/1 st of March	t - 1
ANNUAL BUDGET (year t)		
<ul style="list-style-type: none"> Proposition No 1 to the Storting (Governmental budget proposal) 	Prime October	t - 1
<ul style="list-style-type: none"> Decision in the Main Board: Budget frames to the divisions 	End October	t - 1
<ul style="list-style-type: none"> Draft budget letters from the Ministries to RCN 	November/December	t - 1
<ul style="list-style-type: none"> Draft divisional budget from the divisions to the Main Board 	Prime December	t - 1
<ul style="list-style-type: none"> Decision in the Storting - final budget 	15 th December	t - 1
<ul style="list-style-type: none"> Feed back from Main Board to divisions on their (draft) divisional budget. 	Approx. 15 th December	t - 1
<ul style="list-style-type: none"> Budget letters from the Ministries to RCN (final) 	December/January	t - 1/ t
<ul style="list-style-type: none"> Divisional budget (update) from the divisions 	Mid January	t
<ul style="list-style-type: none"> Final budget to the Ministries including division budgets 	Prime February	t

The Norwegian government has published general guidelines to aid in deciding on research priorities in its Parliamentary White Paper "Forskning ved et tidsskille" ("A new era in

Research”, St.meld. nr. 39, 1998-99). This so-called White Paper on Research states the following areas of priority:

- Marine R&D
- Information and Communication Technology
- Medicine and health
- Research in the overlap between environmental and energy issues
- Other basic research.

In addition to the general guidelines, the funding ministries also have their own research strategies for their respective sectors. In co-operation with the Research Council, the Ministry of Agriculture has developed a ”Long-term Plan for Agricultural Research 1996-2005”, the Ministry of Fisheries has prepared a strategic plan for ”R&D in Fisheries and Aquaculture, Harbours and Marine Transport Infrastructure”, and the Ministry of Trade and Industry has put forth a ”National Biotechnology Strategy”.

Accordingly, the Research Council has also prepared general and more sector-specific strategies: research for the future, business-oriented R&D, biotechnology, R&D in the food-processing industry, etc.

The Bioproduction and Processing Division’s current strategy is an updated version of BF’s strategy plan for 1996-2000. In addition, each of the eight value-chain programmes prepares its own programme and action plans.

The priorities drawn up by the Bioproduction and Processing Division and the Research Council of Norway are expressed via the budget proposals to the individual ministries. The Division Board for the Bioproduction and Processing Division prepares a budget proposal within limits decided by the Main Board. Based on the proposals from the Division Boards, the Main Board prepares a consolidated budget proposal for the Research Council.

The Research Council’s main board presents the overall priorities in its budget proposal. In recent years, it has also determined the framework for budget growth, which is proposed to each ministry. The main board’s priorities in this connection have been in accordance with the main priorities put forth in the White Paper on Research. For the Bioproduction and Processing Division, this implies that marine R&D is given priority along with research in the energy/environment overlap and R&D in the area of food and health. Since all of the funds allocated by the Ministry of Fisheries apply to marine R&D, this priority has resulted in a larger growth in the budget proposal to the Ministry of Fisheries than to the other ministries involved (Ministry of Agriculture, Ministry of Education, Research and Church Affairs, and Ministry of Trade and Industry).

Regarding the use of policy instruments, the Bioproduction and Processing Division has since 1997 given priority to allocating funds to strategic programmes, at the expense of the value-chain programmes, see also chapter 2.1.2. For the agricultural research institutes there has also been an intentional transfer of funds from the institutes’ basic funding to strategic programmes.

Following the treatment of the budget by the ministries, government and *Storting* (Norwegian Parliament), the funds are made available to the Research Council via so-called allotment letters. The sector ministries thus have a certain degree of control over the Research Council’s disposal of the funds via conditions stated in the allotment letters. In addition to this

procedure, the sector ministries have sometimes also asked the Research Council to submit the allocation proposals for the various instruments/programmes.

Formally, the funds allocated by the ministries are placed at the disposal of the Research Council's main board. The board then distributes the allocations to the divisions and programmes on the basis of the priorities in the budget proposal and the conditions stated in the allotment letter. Following the reallocation by the main board to the divisions, the division boards can decide upon priorities between the different instruments/programmes. The division boards can also state the terms governing the programme boards' use of funds or their research priorities.

The division's priorities and its allocation of resources to different instruments and programmes are thus the result of a long process involving the Research Council's administration, the division board, the main board and the funding ministry.

The distribution and priorities of various instruments for the years 1998-2000 are shown in Table 1: Total budget for the Bioproduction and Processing Division 1998, 1999 and 2000. (*See also appendix 1- p in NIFU's report of 07 June 2001.*)

Table 1 Total budget for Bioprocessing and production (BD) 1998, 1999 and 2000

(Based on 'revised budget' 1. sept. each year. 1 000 NOK)

Policy instrument/ Main activity	Budget 1998						Budget 1999						Budget 2000						
	Funding source					Total	Funding source					Total	Funding source					Total	
	Main ministry				Misc.		Main ministry				Misc.		Main ministry				Misc.		
	FID	KUF	LD	NHD		FID	KUF	LD	NHD	FID		KUF	LD	NHD					
User controlled progr.	57 100		13 785	16 100	8 500	95 485	57 280		12 800	14 700	7 900	92 680							0
Basic research progr.													5 500 ¹⁾						5 500
Action oriented progr.	78 100	4 100	78 183	12 400	514	173 297	81 100	4 100	84 762	11 000	4 500	185 462	127 200		98 785	27 300	11 748		265 033
Sum programmes	135 200	4 100	91 968	28 500	9 014	268 782	138 380	4 100	97 562	25 700	12 400	278 142	127 200	5 500	98 785	27 300	11 748		270 533
Scholarships		11 527	7 100			18 627		9 200	5 190			14 390		3 450	1 700				5 150
Project support			1 020			1 020	1 150		425			1 575			150				150
Other projects												0							0
Sum independent proj	0	11 527	8 120	0	0	19 647	1 150	9 200	5 615	0	0	15 965	0	3 450	1 850	0	0		5 300
Basic institute funding	12 200		97 800			110 000	12 200		93 925			106 125	12 200		88 000				100 200
Strategic programmes	14 800	2 290	32 600		100	49 790	17 750	5 200	37 180		100	60 230	25 495	37 050 ²⁾	53 177				115 722
Other infrastructure	1 500		6 300			7 800	3 050		2 100			5 150	1 975		3 125				5 100
Sum Infrastructure	28 500	2 290	136 700	0	100	167 590	33 000	5 200	133 205	0	100	171 505	39 670	37 050	144 302	0	0		221 022
Information/publication									28			28	741		541	400			1 682
Planning/evaluation	1 119		1 500			2 619	1 500		2 285			3 785	2 500		1 000				3 500
Stimulation/networks	2 312		1 905			4 217	2 100		1 578		92	3 770	3 830		1 876				5 706
Sum various R&D act.	3 431	0	3 405	0	0	6 836	3 600		3 891	0	92	7 583	7 071	0	3 417	400	0		10 888
Not spesified use	669		509			1 178	1000		-520			480	1 859		859				2 718
Total budget	167 800	17 917	240 702	28 500	9 114	464 033	177 130	18 500	239 753	25 700	12 592	473 675	175 800	46 000	249 213	27 700	11 748		510 461

¹⁾ Funding by Research Fund. Concerning financial support to the programme 'Overvåking' in division ST

²⁾ Includes 22 MNOK from Research Fund

4.2. Structure of the Bioproduction and Processing Division and function of the different departments

The Bioproduction and Processing Division consists of four departments, in addition to the Executive Director's support staff. Three of the departments have specific responsibilities for clearly defined professional areas, whereas the fourth is responsible for joint tasks such as institutional policy, budget and finance, reporting, etc.

(Please refer to table 2, pp. 26-27: Distribution of policy instruments and responsibilities by department.)

Each of the four departments is briefly described below.

4.2.1 Marine Department

The department is responsible for marine research within the division and for co-ordinating the Research Council's overall activities within the field. It is responsible for 30 strategic programmes and for the following three value-chain programmes:

- Aquaculture, production of aquatic organisms
- Marine resources, environment and management
- Fishery technology

Furthermore, within the Bioproduction and Processing Division the department is responsible for the institutions: Institute of Aquaculture research (Akvaforsk), Norwegian Institute of Fisheries and Aquaculture (Fiskeriforskning) and SINTEF Fisheries and Aquaculture, which all receive basic funding via the Research Council (funds from the Ministries of Agriculture and Fisheries), as well as the Institute of Marine Research and relevant departments at universities and colleges that are awarded strategic programmes.

The department is also responsible for the co-ordination of funding from the Research Council and the Fishery and Aquaculture Industry's research fund (see p. 34).

4.2.2 Agriculture Department

The Agriculture Department is responsible for research within the fields of agriculture and forestry. It is responsible for 33 strategic programmes and the following three value-chain programmes:

- Soil, plants and livestock
- Forestry – resources and added value creation
- Market and society (joint programme for the agriculture and fishery sector)

Furthermore, the department is responsible for the following institutions, which all receive basic funding via the Research Council:

- Centre for Rural Research
- Jordforsk - Centre for Soil and Environmental Research - (joint responsibility with the Environment and Development Division)
- NILF – Norwegian Agricultural Economics Research Institute
- NORSØK – The Norwegian Centre for ecological Agriculture.
- Planteforsk – Norwegian Crop Research Institute
- Skogforsk – Norwegian Forest Research Institute
- VI – National Veterinary Institute

as well as departments at universities and colleges that are awarded strategic programmes.

The department is also responsible for the co-ordination of funding from the Research Council and the foundation for the R&D levy on agricultural products (see p. 34).

4.2.3 Biotechnology and Food Department

This department is responsible for food and biotechnological research within the division and for co-ordinating the Research Council's overall activities within biotechnology. It is responsible for 18 strategic programmes and for the following two value-chain programmes:

- Biotechnology
- Food science and technology

Furthermore, the department is responsible for the institution Norconserv, which receives basic funding via the Research Council (funds from the Ministry of Fisheries), as well as the Norwegian Food Research Institute (Matforsk), the Directorate of Fisheries' Institute of Nutrition and relevant departments at universities and colleges that are awarded strategic programmes. The director of the department is member of the Norwegian Biotechnology Advisory Board.

4.2.4 Infrastructure and Finance Department

Responsible for institutional policy (organization, evaluation and funding of the institutional sector), strategic programmes, budgeting, annual reports and finances.

The operation of the various programmes is the same in the three professional departments. The division board is responsible for preparing and approving the programme plans, which are the result of a thorough process, including the participation of the respective funding ministry (-ies). This process is described in detail in chapter 2 (Strategy). The division board appoints the programme board members and asks the programme boards to prepare action plans for the use of allocated funds.

The division board distributes the funds (within the framework determined by the main board) among the various policy instruments, including the individual programmes (the funds are thus not allocated to the departments). The programme boards are then authorized to approve applications/grant funds for individual programmes. The advisers in the departments coordinate the different programmes. The three departments have the same administrative routines for preparing application forms, announcing grants and processing applications; carried out in accordance with the Research Council's general regulations.

With regard to strategic programmes, the scientific assessment is carried out in the respective departments, whereas the Infrastructure and Finance Department is responsible for the administrative procedures and for preparing the applications for the division board, which then makes the final decision. The same department is also responsible for budgeting and annual reports, based on scientific assessments and comments from the professional departments.

Table 2 (next page) gives an overview of the departments and their responsibility for the policy instruments.

Table 2: Distribution of policy instruments and responsibilities by department

Department	Agricultural Department	Marine Department	Biotechnology and Food Products Department
Programmes	Soil, plants and livestock	Aquaculture	Biotechnology
	Forestry	Marine resources, environment and management	Food Science and Technology
	Market and society	Fisheries technology	
Other activity	(The Forestry Development Fund)	(Commercialising Ideas for Farming of Marine Species – NUMARIO)	(Marin Biotechnology in Tromsø – MABIT)
Strategic programmes 2000/2001	Number: 33 Total budget: 262 mill. (all programs, all years) <u>Action area:</u> Soil and plant production (14) Animal and animal welfare (7) Forestry (7) Economy and social science (5)	Number: 30 Total budget: 324 mill (all programs, all years) <u>Action area:</u> <i>Aquaculture</i> - breeding (6) - feed (3) - health and disease (8) - technology (2) <i>Stock assessment</i> (5) <i>Fisheries technol.</i> (4) <i>Other areas</i> (2)	Number: 18 Total budget: 193 mill (all programs, all years) <u>Action area:</u> <i>Food</i> - food safety (5) - processing (3) - feed (1) <i>Biotechnology</i> - <i>marin biotechnology</i> (7) - microbial gene technology 2)
Coordination responsibility to R&D performing sector			

<p>Institutes with basic funding from the Research Council (BF)</p>	<p>Centre for Rural Research (Bygdeforskning) Norwegian Centre for Soil and Environmental Research (Jordforsk) National Veterinary Institute (VI) Norwegian Agricultural Economics Research Institute (NILF) Norwegian Centre for Ecological Agriculture (NORSØK) Norwegian Crop Research Institute (Planteforsk) Norwegian Forest Research Institute (Skogforsk)</p>	<p>Institute of Aquaculture Research (Akvaforsk)(LD) Norwegian Institute of Fisheries and Aquaculture (Fiskeriforskning) SINTEF Fisheries and Aquaculture</p>	<p>Institute of Fishprocessing and Preservation Technology (NORCONSERV) (FID)</p>
<p>Other institutes (with basic funding from ministries and special levy)</p>		<p>Institute of Marine Research (HI)</p>	<p>Norwegian Food Research Institute (Matforsk) Institute of Nutrition, Directorate of Fisheries (EI) Norwegian Herring Oil and meal Industry Research Institute (SSF)</p>

	Agricultural Department	Marine Department	Biotechnology and Food Products Department
Universities and higher educational Institutions	The Agricultural University of Norway (9 of the Institutes)		The Agricultural University of Norway (2 of the Institutes)
	Norwegian School of Veterinary Science		
	Norwegian University of Science and Techn (2 of the Institutes)	Norwegian University of Science and Techn (3 of the Institutes)	Norwegian University of Science and Techn (2 of the Institutes)
		The University of Bergen (2 of the Institutes)	The University of Bergen (1 Institute)
		The University of Oslo (Institute of Biology)	
	The University of Tromsø (2 of the Institutes)	The University of Tromsø (2 of the Institutes)	
	The Norwegian College of Fishery Science (2 of the Institutes)	The Norwegian College of Fishery Science(2 of the Institutes)	The Norwegian College of Fishery Science (Institute for Marin Biology)
	Norwegian School of Econ. and Business Adm.: Centre for the Economics of Fisheries		

4.3 Summary of the content and structure of the research portfolio per department

A brief summary of objectives, organization and project portfolio for each programme 2000 – 2004 is given below. (*For greater detail please refer to the enclosed action plans for the research programmes.*)

4.3.1 Marine research

Aquaculture

Funding: Budget 2001 56.6 mill NOK (*Ministry of Fisheries, Ministry of Agriculture*)

Project portfolio: A total of 113 projects (about 35 user-controlled)

Quality in production:

- Control of product quality, through better understanding of farmed species as raw materials
- Avoidance of quality loss during production, handling and transport
- Measurement techniques and instrumentation for grading and sorting

Slaughter, transport and distribution:

- Development of methods and technology for transport, handling and slaughter of fish
- Methods and technology of transport, handling and slaughter to ensure health and welfare of the fish
- Establish methods for the handling, transport and distribution of live and fresh material that will guarantee high-quality products

Production and operation:

- Biology of salmonids as basis for safe production of fish for stocking, smolt and fish for consumption
- Maintenance of breeding stock and safe production of marine fry of defined quality
- Necessary biological conditions for keeping fry and adult stages of marine species in aquaculture
- The effects of fish-farming environment on the organism and determine the cause of disease during production

Health and disease:

- Basic mechanisms involved in disease in salmonids and relevant marine species
- Combat and prevent disease in salmonids and other species in aquaculture
- Aids for better diagnostic techniques and effective preventive measures

Feed, nutrition, feeding and feed technology:

- Feeds for cost-efficient growth, normal development and defined quality
- Interaction of nutrition, environment and genetics in preventive health care
- Basic research in nutritional biology to guarantee production of high-quality eggs and fry

Breeding and genetics:

- Measurement methodologies and knowledge of basic genetic parameters of central production characteristics of farmed species
- Relevant breeding programs and improvement of their efficiency
- Genetic markers and how DNA technology can be exploited in breeding

Technology and equipment:

- Reducing escapes of farmed fish
- Improve work environment
- Ensure cost-efficient, environmentally friendly production

- Offer suppliers and technology companies competitive advantages in export markets

Environment:

- How escaped fish affect wild populations and reduce effects of escaped fish to wild population
- Reduction in transmission of disease, agents of infection and parasites
- Reduction of consumption of chemical inputs in aquaculture
- Prevent pollution around fish farms

Fisheries technology

Funding: Budget 2001: 11.6 mill NOK (*Ministry of Fisheries*)

Project portfolio: A total of 30 projects (about 7 user-controlled)

Harvesting and fishing gear technology:

- Resource friendly harvesting methods
- Development of fishing gears
- Fish behaviour in relation to harvesting
- Equipment for fish search and harvesting instrumentation
- Environmental effects from fishing

Fishing fleet research:

- Fleet structure and regulatory framework
- Development of fishing vessels
- Energy and environment
- Health, environment and safety
- Operation of vessels, IT decision support and communication systems

Harvest treatment and by-products:

- Harvest treatment aboard
- Harvest treatment of by-products and by-catch
- Harvest treatment of less exploited resources and new species

Increasing the value from marine resources through synergies between vessel and land:

- Logistics
- Demonstration projects
- Alternative operation and trade patterns

Marine resources, environment and management

Funding: Budget 2001 total 34.6 mill NOK spread over 3 divisions - 24.7 from Bioproduction and Processing, 5.0 mill NOK from Science and Technology and 4.9 mill NOK from Environment and Development .

Project portfolio: A total of 67 projects (about 3 user-controlled)

Marine ecosystems:

- Structure, function and bio-diversity of the marine ecosystem
- Bio-diversity focusing on harvestable resources
- Develop models to analyse variability in marine ecosystems
- Effect of pollution on the marine environment
- Increased harvesting through artificial fertilising of sea water

Harvesting of marine resources:

- Combining data from scientific surveys and fisheries and biology to develop population dynamic models.

- Uncertainty, changes in the populations and their productivity
- Dynamic and sustainable resource exploitation
- Survey and stock assessment methodology
- Uncertainty - population dynamic models
- Evaluation of effects of harvesting and non-harvesting on the marine environment

Resource management and bio-economics:

- Combination economic analyses and biology
- Bio-economical single- and multispecies models
- Models incorporating economics in relation to level of harvesting, harvesting pattern, fleet capacity and management decisions

Technology:

- Methods describing the physical, chemical and biological systems in the ocean
- Technology for marine research and surveillance
- Integration of measurement and models for surveillance of the marine environment and marine resources
- Numerical models and methods for validation of model systems

4.3.2 Biotechnology and food science

Biotechnology

Funding: Budget 2001: 39.0 mill NOK (*Ministry of Fisheries, Ministry of Agriculture, Ministry of Trade and Industry*)

Project portfolio: A total of 63 projects (about 25 user-controlled)

Biotechnological research:

- Molecular mechanisms, genome mapping, cell biology, protein modelling, protein engineering, fermentation, bio-informatics

Business development:

- Biotechnological methods and products integrated in the refinement of micro organisms, plants, farm animals and fish
- Commercial exploitation of biological resources, use of less exploited resources, by-products and waste.
- Efficient methods for diagnosis and prevention of sicknesses and damaging agents in production organisms and in environment
- Efficient biotechnological methods for quality assessment, increased utilisation of raw materials and advanced processing
- Development and improvement of methods for cleaning the environment

Safety, environment and society:

- Analyse development and evaluate consequences of use of modern biotechnology

Food science and technology

Funding: Budget 2001 44.0 mill NOK (*Ministry of Fisheries, Ministry of Agriculture, Ministry of Trade and Industry and Norwegian Food Control Authority*)

Project portfolio: A total of 72 projects (about 43 user-controlled)

Food quality, safety and Consumer

- Components (health detrimental and health promoting)
- Surveillance and control of ingredients in food

- Retaining nutritional qualities through processing
- Authorities' communication about foods, measures, regulations, supervision
- Consumers' values, attitudes and behaviour in relation to foods

Raw materials:

- Sustainable, industrial food production/resource exploitation
- Properties of raw materials, change through processing, conservation, storage and distribution
- Properties of raw materials in relation to processing, methods for analysis and documentation of quality

Processing, technology, environment, logistics and distribution:

- Methods and tools for control of processes
- Process control, production economy and planning
- Optimisation of processes in relation to energy use and environment
- Utilisation of by-products
- Logistics and information systems from raw materials to consumer
- Routines and tools for systems analysis and traceability
- Information systems and technology to promote rapid material flow and transactions

Products:

- Optimisation of receipts and new and improved products
- Quality and quality measurement
- Preservation and interaction between packaging and product

4.3.3 Agricultural research

Soil, plants and livestock

Funding: Budget 2001 49.3 mill NOK (*Ministry of Agriculture*)

Project portfolio: A total of 105 projects (about 33 user-controlled)

Sub-goals

- To ensure good plant health and production based on basic knowledge of the soil, plant nutrition and environmental toxins, including the effects of plant protectants.
- Ethically responsible animal husbandry that pays particular attention to the health and welfare of animals.
- Alternative operating methods, land-use, new products and industrial development.
- High-quality raw materials, for direct consumption and further processing.
- Adaptation to different market conditions by making primary production more efficient.

Soil and plant production:

- Soil physics, chemistry and biology, in order to ensure sustainable development and to supply the plant with nutrient in the long term.
- Plant production, material, health, quality, with high priority to the environment and product quality throughout the value chain.
- Organic waste and their suitability as soil improvers, methods and technologies for composting.
- Plant adaptation in different climatic conditions in Norway, including surviving in the winter. Consequences of possible climatic changes.
- Plant nutrition, including uptake of nutrient, cost/benefit ratio of individual input factors. Development of "precision agriculture".

Animals and animal welfare:

- Breeding and reproduction, concerning both production parameters and propensities to disease.
- Nutrition, with priority to optimal nutrition – including animal health as well as effects on human health.
- Feeding and feed quality, supporting integrated problems and natural field of cooperation for plant and livestock research groups.
- Pastoral land use, with research regarding both livestock and reindeer husbandry.
- Production buildings, to a reduced cost, and adapted to the climatic conditions
- Animal health, with high priority to all questions related to animal welfare.
- Family and sports animals.
- Ethology, with the aim to develop expertise both in basic and ethological and physiological questions related to animal welfare.
- Integrated plant and animal production, in order to develop integrated local production, capable to strengthening local value creation in both plant and livestock production.
- Quality of animal products, including development of measures and methods that will improve the product quality.
- Mechanisms of drug resistance.

Forests – resources and added value creation

Funding: Budget 2001 11.3 mill NOK (*Ministry of Agriculture*)

Project portfolio: A total of 33 projects (about 6 user-controlled)

Biological processes and organisms in the forest:

- Biological processes and organisms in relation to management of forests
- Consequences of human activity in forests
- Forest management to ensure bio-diversity

Varied and profitable exploitation of forest resources:

- Environment friendly and efficient exploitation of forest resources
- Methods and models for multi-use management of forests
- Improve competitiveness of forest based products
- Methods and models for development of forest based industries under changing conditions
- Forest management and use in relation to forest policy and socio-economic aspects

Market and society (Fisheries, aquaculture, agriculture and forestry)

Funding: Budget 2001 28.9 mill NOK (*Ministry of Fisheries and Ministry of Agriculture*)

Project portfolio: A total of 70 projects (about 8 user-controlled)

Business and market research:

- Business policy and business development
- Market development and market strategy
- Trade conditions
- Customer behaviour and market trends
- Conditions for market adjustment

Organisation and management:

- Organisation, ways of co-operation and networks
- Competence, management and recruitment

Area, resource and environmental management:

- Area management (land and sea)
- Resource and environment management
- Sustainable agriculture, forestry and fisheries

Development of rural areas:

- Multifunctional management
- Evaluation of non-marketed goods and services

Other activities

Marine Biotechnology in Tromsø (MABIT)

This is a 5-year program established in 1998 by the Ministry of Fisheries. The program is administered from Tromsø Research Park which also appoint the program board. The Board has an independent status but report to the Board for Biotechnology. The co-ordinator for Biotechnology program is observer in the MABIT board.

Funding: Budget 2001 15.0 mill NOK included 4,0 mill from Ministry of Fisheries sent through the Research Council of Norway (BF)

Commercialising Ideas for Farming of Marine Species (NUMARIO)

NUMARIO is a program run by The Norwegian Industrial and Regional Development Fund in co-operation with the Research Council of Norway (the Bioproduction and Processing Division – program for Aquaculture) regarding the scientific assessment of the applications which consist of a certain degree of research..

Funding: Budget 2001 16.0 mill NOK included 1 mill. NOK from the Ministry of Agriculture sent through the Research Council (the Bioproduction and Processing Division). Other financing sources are Ministry of Fisheries and Ministry of Local Government and Regional Development)

Project portfolio: A total of 21 projects (about 20 user-controlled)

Monitoring of Marine and Terrestrial Resources

Basic research program administered by Science and Technology (NT).

Funding: Budget 2001 12.5 mill NOK of this 5.0 mill NOK from the the new foundation for the founding of research and innovation channelled through Bioproduction and Processing. One of the advisor from the Bioproduction and Processing Division is observer in the board of the program.

The Forestry Development Fund

From 2000 the responsibility for managing this foundation was transferred to Bioproduction and Processing. The Ministry of Agriculture appoint members of the Board.

Funding: Budget 2001 3 mill NOK (Ministry of Agriculture)

Project portfolio: A total of 49 projects particular Agricultural University of Norway

The Fishery and Aquaculture Industry Research Fund

In 2001, a public fee for the support of research and development in the fisheries and aquaculture industry was introduced. It is estimated that the fee will generate about NOK 100 million annually. The Ministry of Fisheries has appointed a committee to allocate these funds. The director of BF's Marine Department is an observer on this committee.

The Agricultural Product Research Fund

Furthermore, a research levy on the turnover of agricultural products was reorganised in 2001. The funds generated by the levy are to be allocated by a committee, and shall be used for research in primary production and food processing. The Norwegian Food Research Institute (Matforsk) is one of the institutions to be funded by the funding scheme. The director of BF's Agriculture Department is an observer on the committee.

4.4 Brief explanation of the programme and project management process

4.4.1 Programmes

All of the Bioproduction and Processing Division's programmes are so-called value-chain programmes. These include both strategic basic research and applied research throughout the entire marketing channel from raw material to finished product. The programmes are open for both user-directed and researcher-directed projects.

When the current eight value-chain programmes were established, committees were appointed to prepare programme notes describing the field of research and priorities within the field. The programme notes were finalised after an extensive process, which resulted in a final resolution by the Division Board, please refer to the description in chapter 2.1.2.

The division board appoints a board for each of the eight programmes, and approves the budget for the programme boards' activities. The programme boards prepare annual action plans, which are approved by the division board. The programme boards are free to apply the allocated funds, as long as they remain within the framework of the action plan, the general conditions put forth by the ministry in the allotment letter, and any scientific and/or administrative conditions made by the division board.

Programme funds are announced in joint ads in the daily press and on the internet. The joint application deadline is June 15th for researcher-directed projects. For user-directed projects the deadlines are October 1st, February 1st and May 1st. All applications are peer-reviewed.

4.4.2 Basic funding and strategic programmes

The Bioproduction and Processing Division allocates basic funding to eight agricultural and three fishery research institutes. These are institutes covered by the guidelines for State funding of research institutes, issued by the Ministry of Education, Research and Church Affairs, and where the funding ministry has decided to channel the funds via the Research Council. The Research Council proposes the distribution of funds to the individual institutes via its budget proposal to the ministry, or possibly as a separate item. The ministry comments the proposal in its allotment letter. For the agricultural research institutes, basic funding is a separate (sub-) entry in the national budget. In the case of the fishery research institutes, basic funding is included in the general allocations to the Research Council.

The Division Board makes the final decision on the distribution of the basic funding among the various research institutes. These can freely employ the basic funds within the framework

of the governmental guidelines and the scientific conditions put forth in the allotment letter. The actual amount of basic funds allocated to each institute is more or less a result of a "historical" process of budget decisions and approvals in the financing ministries and reflects the tasks and role(s) of the various institutes. The Research Council has only limited authority to make changes or to propose alternative distribution of the basic funds. Many institutes carry out a great deal of management support and scientific advisory services for the government .

There is also a great variation between the institutes regarding ownership, relations to the Government, customers, economic structure etc. The Research Council has not yet developed overall guidelines or a master plan for distribution of the basic funding to the institutes. At present, the Bioproduction and Processing Division is developing control procedures that will allow tri-annual allocations of basic funds. These procedures will take into consideration an institute's public role and tasks, its research results and quality, the market situation, etc.

Strategic programmes are approved and awarded following a thorough two-step process including the programme boards, the Bioproduction and Processing Division's administration , external referees and the division board. To start with, institutes, universities and colleges within the Bioproduction and Processing Division's field of responsibility are invited to submit short drafts of potential strategic programmes. The relevance of these drafts is evaluated by the respective programme boards. The division executive director then selects those drafts that are to be elaborated into final strategic programme applications, and informs the applicants thereof. Following this step, the final selection needs to be approved by the division board, which also has the authority to request additional programme drafts to be further developed into complete applications.

Final applications for strategic programmes, based on approved programme drafts, have to be submitted before the main application deadline (June 15th). The applications are then sent to two international referees for assessment. The referees are expected to submit a joint statement/assessment, but if they cannot agree, the application shall be forwarded to a third referee.

The applications are handled by department advisers, and the divisional administration jointly decides upon a recommendation based on the programme boards' assessment of the project's relevance, the international referees' evaluation and an assessment of the available expertise and other aspects of institutional policy at the applying institution. The division executive director puts the case before the division board, which then makes the final decision regarding the approval of applications and the awarding of (research) grants.

The process thus starts as a "bottom-up" process (draft phase), but then is finalized in a "top-down" fashion (application phase). The university and college sector and institutes (both those with and without basic funding from the Bioproduction and Processing Division) compete on equal terms. The applications have to be divided into two groups, depending on whether the Ministry of Agriculture or the Ministry of Fisheries would be funding the programme. In addition, joint funding of strategic programmes is possible in cases where they are relevant for both ministries.

Table 3 on the following pages shows the distribution of BF's strategic programmes by departments

No.	Title of the projects	Executing institute	Start	End	Total budget
Agricultural Department					
Soil and plant production					
124025	Ecology of recirculation	Norwegian Centre for Soil and Environmental Reseach	1.1.1997	31.12.2001	5 000 000
124026	Surface drainage and drainpipes	Norwegian Centre for Soil and Environmental Reseach	1.1.1997	31.12.2001	3 250 000
124023	Sustainable agriculture	Norwegian Centre for Soil and Environmental Reseach	1.1.1997	31.12.2002	2 330 000
143294	Soil quality and precision farming	Norwegian Centre for Soil and Environmental Reseach	1.1.2001	31.12.2005	11 000 000
112557	Environmentally friendly farming	Agricultural University	1.1.1996	31.12.2001	10 200 000
143250	Predictive model synthesis of plant-insect interactions	University of Science and Technology	1.1.2001	31.12.2005	12 200 000
124359	Protection of plants in ecological farming	The Norwegian centre for ecologcial agriculture	1.1.1998	31.12.2002	5 550 000
119043	Stabilisation of gras production in Nothern Norway	The Norwegian Crop Research Institute	1.7.1997	30.6.2001	6 500 000
130154	Strategies for the development of the cultural landscape	The Norwegian Crop Research Institute	1.1.1999	31.12.2003	7 500 000
130163	Molecular diagnostics of insect pests	The Norwegian Crop Research Institute	1.1.1999	31.12.2003	10 700 000
114342	Natural resistants	The Norwegian Crop Research Institute	1.1.1997	31.12.2001	9 114 000
124101	Plant nutrition in ecological farming using small quantities of manure	The Norwegian Crop Research Institute	1.1.1998	31.12.2002	10 390 000
135842	Optimalization of biological nitrogen utilization in the production of forage	The Norwegian Crop Research Institute	1.1.2000	31.12.2004	10 000 000
134336	Plants and environment protection	The Norwegian Crop Research Institute	1.1.2000	31.12.2004	9 000 000
Animal and Animal Welfare					
130165	Healthy cow - Dairy Cattle Records - A tool for improved animal health	Agricultural University	1.7.1999	30.6.2003	7 200 000
143196	Proteines from natural gas - a new source of feed	Agricultural University	1.1.2001	31.12.2005	14 500 000
111775	Ecological control of infections and immunity	College of Veterinary Medicine	1.1.1996	13.04.01	6 249 998
136326	Økologisk infeksjonskontroll og uspesifikk immunitet	College of Veterinary Medicine	1.1.2000	31.12.2004	9 500 000
127124	Animal health and ecological farming	The Norwegian centre for ecologcial agriculture	1.7.1998	31.3.2003	4 120 000
135147	Mineral content in plants and mineral supply for ruminants in organic agriculture	The Norwegian centre for ecologcial agriculture	1.1.2000	31.12.2004	6 450 000
119044	Risk analysis in animal, plant and human health	National Veterinary Institute	1.7.1997	30.6.2001	4 700 000
Forestry					
119045	Plants and soil interaction	The Norwegian Forest Research Institute	1.4.1997	31.12.2001	8 100 000
135573	Carbon dynamics in forest soil	The Norwegian Forest Research Institute	1.1.2000	31.12.2004	14 100 000
143276	DNA markers for characterization of genetic variation of Norwegian forest trees	The Norwegian Forest Research Institute	1.1.2001	31.12.2004	8 100 000
124100	Modelling of forest production for ecological and economical forest management	The Norwegian Forest Research Institute	1.1.1998	31.12.2002	7 000 000

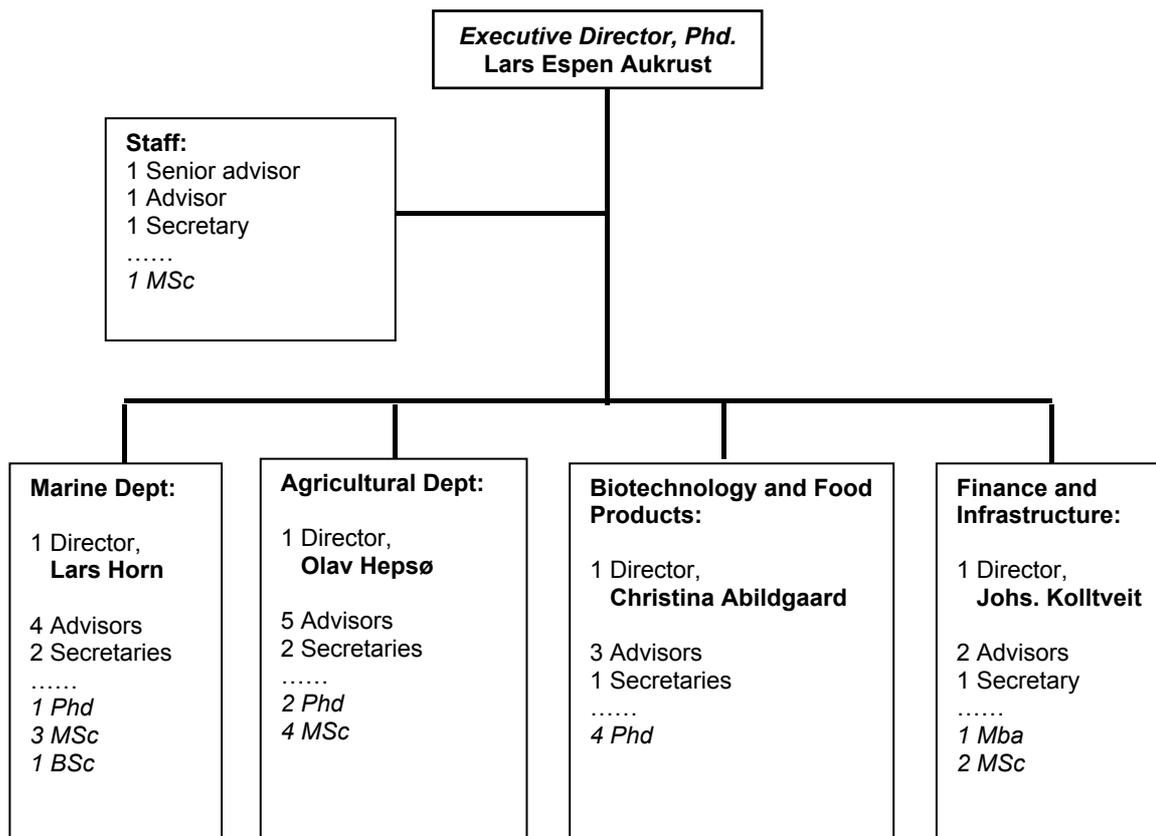
117925	Molecular markers as indicators of stress	The Norwegian Forest Research Institute	1.4.1997	31.3.2001	8 712 000
130153	Value creation in rural areas based on resources from the forest and outlying field	The Norwegian Forest Research Institute	1.1.1999	31.12.2002	5 000 000
130159	Molecular basis of climatic adaptation in forest trees	The University of Tromsø	1.1.1999	31.12.2002	4 000 000
Economy and Social Science					
143278	Rural and urban cultural influences in the Norwegian Society	The Centre of Rural Research	1.1.2001	31.12.2005	9 500 000
134305	Business strategies for regional food supply chains (REGMAT)	The Centre of Rural Research	1.1.2000	31.12.2005	9 500 000
115558	Restructuring of the food supply value chain	The Centre of Rural Research	1.1.1997	31.12.2001	4 000 000
114478	Agromanagement	Norwegian Agricultural Economics Research Institute	1.1.1997	30.6.2002	9 920 768
134251	Developments in the business environment of the food processing industry	Norwegian Agricultural Economics Research Institute	1.1.2000	31.12.04	9 500 000
135847	Value creation for Norwegian industry of seafood	Norwegian College of Fishery Science Science	1.1.2000	31.12.2004	10 500 000
Marine Department -					
Aquaculture					
Breeding					
113052	Breeding research	Institute of Aquaculture Research	1.1.1996	31.12.2000	6 000 000
143045	Future animal breeding goals. Product development in aquaculture and livestock production	Institute of Aquaculture Research	1.1.2001	31.12.2005	9 400 000
130162	Development and use of gene maps in fish and cattle breeding	Institute of Aquaculture Research	1.1.1999	31.12.2003	11 900 000
139630	Reproduction and Breeding in Marine Fish	Institute of Marine Research	1.7.2000	31.12.2004	14 660 000
124098	Sustainable, intensive production of fresh water fish	Agricultural University	1.1.1998	31.7.2001	3 330 000
136260	Smolting in Atlantic salmon	University of Bergen	1.6.2000	31.7.2005	9 700 000
Feed					
130195	Nutrition in larvae and juveniles of the Atlantic halibut	Directorate of Fisheries, Institute of Nutrition	1.1.1999	31.12.2003	9 200 000
135841	From feed to table. The significance of feed fats from juvenile feeding to table	Institute of Aquaculture Research	1.1.2000	31.12.2003	6 000 000
143184	Exploitation of zooplankton as bio-resource for fish feed and industrial raw material - A	Norwegian university of science and technology	1.1.2001	31.12.2005	12 700 000
Health and Disease					
124043	Wolf fish - immunal defense and receptiveness of infectious diseases	Norwegian College of Fishery Science Science	1.1.1998	31.12.2002	8 700 000
143213	Reared fish welfare	Norwegian College of Fishery Science Science	1.1.2001	31.12.2005	15 500 000
142495	Fast growth and welfare in Atlantic Salmon and Rainbow Trout	Institute of Marine Research	1.1.2001	31.12.2005	20 000 000

136261	Molecular biological studies of salmon lice (<i>Lepeophtheirus salmonis</i>)	Institute of Marine Research	1.1.2000	31.12.2004	9 000 000
111257	Immunological defense and receptivity of viral and bacterial infections in marine fish	College of Fishery Science Science	1.1.1996	31.12.2000	7 200 000
139593	Marine algal toxins, ecology, analysis and toxicology	College of Veterinary Medicine	1.5.2000	31.12.2004	14 800 000
124210	Diseases in marine reard fish	National Veterinary Institute	1.1.1998	30.6.2002	7 420 000
143286	Virological investigations on emerging disease conditions in domestic animals and fish	National Veterinary Institute	1.1.2001	31.12.2005	19 500 000
Technology					
114514	Processes and equipment for marine fish in aquaculture	Foundation of Scientific and Industrial Research, Fishery and Aquaculture	1.1.1997	31.1.2001	7 000 000
143223	Safe and environmentally friendly aquaculture production equipment	Foundation of Scientific and Industrial Research, Fishery and Aquaculture	1.1.2001	31.12.2005	10 000 000
Stock Assessment					
140290	Capelin and Herring in the Barents Sea - coexistence or exclusion (basecoex)	College of Fishery Science Science	1.1.2001	31.12.2004	11 200 000
114646	Theory an experimental study on marine fish recruiting.	University of Bergen	1.3.1995	11.4.2001	7 200 000
143249	Absolute abundance estimation of fish	Institute of Marine Research	1.1.2001	31.12.2005	7 500 000
130197	Stock assessment methods for precautionary fisheries management	Institute of Marine Research	1.1.1999	31.12.2003	14 500 000
130192	Environmental influence on fish stocks	University of Bergen	1.1.1999	31.12.02	7 300 000
Fisheries Technology					
117377	Killing methods for minke whale, seal and big game	College of Veterinary Medicine	1.1.1997	31.12.2000	4 059 999
134850	Selection in tawl and Danish seining. Gear design, survival and effects on stocks	Institute of Marine Research	1.1.2000	31.12.2002	8 500 000
114529	Fisheries 2010 - Fishing Vessel Research	Foundation of Scientific and Industrial Research, Fishery and Aquaculture	1.1.1997	31.12.2000	8 000 000
134407	Increased value creation from by-products and by-catch. Exploitation of synergies bet	Foundation of Scientific and Industrial Research, Fishery and Aquaculture	1.1.2000	31.12.2004	22 000 000
Other areas					
114535	Reproduction of cod- effects of natural and antropogenesous environmental factors	Institute of Marine Research	1.1.1997	31.12.2001	10 000 000
134278	Variation in space and time of cod and other gadoids: the effects and density depend	University of Oslo	1.1.2000	31.12.2004	11 500 000

Biotechnology and Food Products Department					
Food					
Food Safety					
51120	Management of product quality and safety in the food, feed and process industry	Norwegian Food Research Institute	1.1.1996	31.12.2000	3 800 000
142468	Food quality and consumer safety of seafood	Direcorate of Fisheries, Institute of Nutrition	1.1.2001	31.12.2005	8 000 000
134988	Quality of fish muscle - the extracellular matrix	Norwegian College of Fishery Science	1.1.2000	31.12.2003	5 700 000
136430	Genetically modified organisms (GMOs) in foods; Qualitative and quantitative detection	National Veterinary Institute	1.1.2000	31.12.2003	1 500 000
124097	Control of pathogens and other quality reducing bacteria through processing	College of Veterinary Medicine	1.1.1998	1.5.2001	7 180 000
Processing					
136338	The effect of thermal processing of powder and oil products based on raw material	Norwegian Herring Oil and Meal Industry Research Institute	1.1.2000	31.12.2004	11 000 000
124042	Technology for minimally processed food	Research Institute of Fishprocessing and Preservation Technology - College of Food Technology and Processing	1.1.1998	31.12.2002	9 000 000
145634	Efficient and economic sustainable fish processing industry	Foundation of Scientific and Industrial Research at the Norwegian Institute of Technology, Fishery and Aquaculture	1.1.2001	31.12.2005	15 000 000
Feed					
108917	Development of technology for the production of feed	Agricultural University	1.3.1995	31.12.2000	4 640 000
Biotechnology					
Marine Biotechnology					
142474	Traceability and physiological effects of using modified plant ingredients in feed for Atlantic salmon	Directorate of Fisheries, Institute of Nutrition	1.1.2001	31.12.2005	15 200 000
139617	Salmon Genome Project (SGP)	College of Veterinary Medicine	1.5.2000	31.12.2004	41 500 000
134314	Optimisation of protein expression and secretion in lactobacilli	Norwegian Food Research Institute	1.1.2000	31.7.2003	6 000 000
142656	Development of DNA-microarray technology for functional genomics related to food-protection	Agricultural University	1.1.2001	31.12.2004	10 800 000
134674	Marine biopolymers, structure-function relationships	Norwegian University of Science and Technology	1.1.2000	31.12.2004	12 000 000
139710	Isolation of apoptosis-modulating substances from marine micro-organisms; exploitation	University of Bergen	1.5.2000	3.12.2004	7 780 000
143450	Marine biomolecules; properties and mechanisms	University of Tromsø	1.10.2000	31.12.2004	19 720 000
Microbial Gene Technology					
111256	Marine phospholipids - purification and application	College of Fishery Science Science	3.9.1996	2.9.2000	3 700 000
134426	Molecular mechanisms of importance for the development of DNA vaccines and gene	College of Veterinary Medicine	1.1.2000	31.12.2003	11 300 000

Additional information - mail of 26.06

(1) Organogram



(2) Staff background

In 1993 the Bioproduction and Processing Division (BP) consisted of 30 persons: 11 from NFFR, 10 from NLVF, 5 from NTNF, 1 from NAVF and 3 new.

BP staff today is 27 persons:

Executive Director: Recruited 1999

Staff: senior advisor NFFR, advisor recruited 2000, secretary NLVF.

Marine Department:

Director NTNF

4 advisors: 1 NFFR, 1 NTNF, 1 recruited 1993 and 1 recruited 1997

2 secretaries: 1 NTNF, 1 NLVF

Agriculture Department:

Director NLVF

5 advisors: 2 NLVF, 1 recruited 1994, 1 recruited 1996 and 1 recruited 2001

2 secretaries: 1 NLVF, 1 recruited 1999

Department of Biotechnology and Food Products

Director: recruited 1994, director from 2000

3 advisors: recruited in 1998, 2000 and 2001

1 secretary: 1 NLVF

Department of Finance and Infrastructure

Director: recruited 1996, director from 1998

2 advisors: 1 NFFR, 1 NLVF

1 secretary: 1 NAVF

(3) Staff qualifications

Directors, senior advisors and advisors have following qualifications:

8 PhD (1 dr.philos. allergy and immunology, 2 dr.philos. biochemistry, 1 dr. scient. microbial biotechnology, 1 dr.scient. wood science and technology, 1 dr.philos. biology/zoophysiology, 1 dr.ing. biochemistry/microbiology, 1 dr.med.vet/dr.scient. toxicology).

11 university degrees on master level and higher in geography, marine zoology, engineering (3), agricultural degree/nature management (5) and business administration, and bachelor degree (2).

(4) External training and development of staff

The amounts spent on external training "directly" were 94.000 NOK in 2000, 117.000 NOK in 1999 and 129.000 NOK in 1998.

The division has developed a plan for building capacity/ developing the staff. External and internal courses are only a part of this effort. Participation in scientific meetings - national /international, tours/visits with important partners, seminars etc. are considered to be most important. E.g. in 2000 two persons from Division visited Japan and three persons visited San Francisco area studying Biotechnology. The amount spent on travelling expenses were 632.000 NOK in 2000, 778.000 NOK in 1999 and 723.000 NOK in 1998.

(5) Programmes running

Year	Number of programmes ¹⁾	Number of programmes jointly funded	Number of programmes funded by ministry and the ministry's total funding to these programmes (mill. NOK)					Miscellaneous funding Mill. NOK	Total programmes funding ³⁾ Mill. NOK	Mean size of programmes Mill. NOK	
			FID	KAD	KUF	LD ²⁾	MD				NHD
1994	23 ⁴⁾	6	13 (119,6)			9 (34,5)	2 (4,1)	4 (5,6)	3 (0,5)	164,3	6,8
1995	15	6	10 (123,8)	1 (0,4)	1 (2,94) ⁵⁾	10 (84,2)	1 (1,50) ⁶⁾	2 (16,6)	2 (0,7)	230,1	15,3
1998	14	7	11 (132,3)		2 (12,1) ⁹⁾	9 (85,6)	2 (6,0) ¹⁰⁾	2 (28,5)	4 (9,1)	272,6	19,5
2001	8	5	6 (127,8)		2 (11,0) ¹¹⁾	6 (99,5)	1 (4,9) ¹²⁾	2 (32,3)	1 (6,9)	281,4	35,2

- 1) Programmes wic BF has established and appointed boards
2) Incl. Funding by the Agricultural Agreement
3) Incl. The financial support from NT and MU to the programmes MARINE and from IE to the programme HELSE
4) Programmes established by the former research councils FRC (NFFR), ARC (NLVF) and NCSIR (NTNF)
5) Financial support from NT to the programme MARINE
6) Financial support from MU to the programme MARINE
7) Incl. financial support from NT with 8,0 mill. NOK to the programme MARINE
8) Incl. financial support from MU with 6,0 mill. NOK to the programme MARINE
9) Incl. financial support from NT with 8,0 mill. NOK to the programme MARINE
10) Incl. financial support from MU with 5,0 mill. NOK to the programme MARINE
11) Incl. financial support from NT with 6,0 mill. NOK to the programme MARE
12) Incl. financial support from MU with 4,9 mill. NOK to the programme MARE

(6) Applications for programmes and SIPs/SUPs

Number of applications	1998					1999					2000				
	Agric. Dep.	Marine Dep.	Biotech. and Food Prod. Dep.	Finance and Infra-struct. Dep.	Total	Agric. Dep.	Marine Dep.	Biotech. and Food Prod. Dep.	Finance and Infra-struct. Dep.	Total	Agric. Dep.	Marine Dep.	Biotech. and Food Prod. Dep.	Finance and Infra-struct. Dep.	Total
Programmes	136	389	152	0	677	89	334	110	0	533	260	353	113	0	726
SIP/SP ¹⁾				36	36				65	65				74	74
Independent ²⁾				19	19				31	31				0	0
Total	136	389	152	55	732	89	334	110	96	629	260	353	113	74	800

Number of granted (new) projects	1998					1999					2000				
	Agric. Dep.	Marine Dep.	Biotech. and Food Prod. Dep.	Finance and Infra-struct. Dep.	Total	Agric. Dep.	Marine Dep.	Biotech. and Food Prod. Dep.	Finance and Infra-struct. Dep.	Total	Agric. Dep.	Marine Dep.	Biotech. and Food Prod. Dep.	Finance and Infra-struct. Dep.	Total
Programmes	33	121	50	0	204	34	123	29	0	186	98	98	40	0	236
SIP/SP				10	10				9	9				19	19
Independent ²⁾				8	8				15	15				0	0
Total	33	121	50	18	222	34	123	29	24	210	98	98	40	19	255

1) Drafts of potential strategic programmes

2) Independent projects are scholarships, mainly stay abroad

(7) Data on the extent of the total budget 1993, 1997 and 2001 – for the Research Council and for the Bioproduction and Processing Division specifically

	The Research Council	The Bioproduction and Processing Division
1993	2 364 MNOK	386 MNOK (16,3 % of RCN's total budget)
1997	2 561 MNOK	448 MNOK (17,5 % of RCN's total budget)
2001	3 174 MNOK	562 MNOK (17,7 % of RCN's total budget)

(8) Boards members

Boards members are appointed mostly for the programme periode: 5 years.

The administration propose to the Division Board on the composition of the board in question, based on an initial assessment on:

- the relevant scientific disciplines/ research areas should be covered,
- an appropriate board size (mostly between 7 and 10)
- a balanced mixture of distinguished scientists from the university and institute sector, authorities representatives and representatives from the industries or industry organisations
- minimum 40 percent of each sex
- a certain degree of regional national coverage
- the need for appointing representatives from other countries (mostly Nordic) for scientific and legal competence reasons.

The Chairman should be selected within the same frame, and should preferably be a highly qualified, credible and scientifically broadly interested person, preferably with as few as possible conflicts-of-interest when it comes to application processing, and with abilities to manage the Board professionally as the Research Council's representative.

The administration advisors utilise their general knowledge about the Norwegian research system, as well as their networks, in composing the Board. The ministries are contacted informally in the selection process. The Division Board appoints the Programme Boards based on the Director's proposal, and may of course change some names during its meeting. Therefore, the administration does not contact any of the potential members in advance. This procedure may in turn lead to a situation where a proposed member refuses to enter the board, thus necessitating finding alternative candidates.

(9) Sub-committees

The Bioproduction and Processing Division has no sub-committees in 2001.

(10) The use of peer review

All applications from the research institutions are usually scrutinized by two referees, on special occasions more than two.

Earlier the Bioproduction and Processing Division did not use referees for applications from industries (user directed projects). However, referees are increasingly being used these applications too.

Action Plan for

1. BIOTECHNOLOGY

2. Background of the Programme

The programme is a continuation of the current Biotechnology Programme run by the Research Council of Norway's Division of Bioproduction and Processing (BF). It is also based on the Research Council's "Strategy for Biotechnology". According to this strategy, the Research Council will prioritise food production and marine biotechnology as national areas of special effort in biotechnological R & D, in addition to research for the medical and health sector. The Programme covers biotechnology in agriculture, marine biotechnology and related industrial activities. An increase in the intensity of efforts in marine biotechnology is desirable while efforts in agriculture should be maintained at least at their current level. The Programme will focus particularly on the application of biotechnological methods in the production and inspection of foods.

Biotechnological methods have given us considerable insight into the basic processes of life. This has resulted in the development of a comprehensive set of working tools that make possible the precise and versatile analysis of biological material (i.e. the use of biotechnology as an analytical tool). Biotechnological methods also improve the exploitation of resources and make possible a wider range of utilisation of raw materials (i.e. biotechnology as a manufacturing tool). Biotechnology includes gene technology, methods in molecular biology, fermentation technology, separation technology, cell biology and immunology.

National needs for competence

National knowhow strengthens our ability to control the use of biotechnology in society. The need for a high degree of competence in biotechnology must be seen in the light of the rapid development of biotechnology at international level, as well as of the industrial potential of this field. National centres need to have sufficient personnel with basic competence if they are to be able to evaluate international developments. At the same time, the development of top-level expertise must be adapted to match national conditions and requirements, e.g. those based on marine resources.

It will be particularly important for the Biotechnology Programme to strengthen basic competence in R & D centres while helping to build up competence and greater appreciation of R & D in industry.

The Programme Board believes that it is essential to further develop biotechnological competence in the following fields:

Food quality and consumer safety

Marine biotechnology

Environmental biotechnology

Genetic characterisation

Other areas such as forests, house-plants and animal feed.

In all of these areas it is essential to identify environmental, safety and ethical issues that require special evaluation and treatment by research. It is also necessary to build up national competence in evaluating any unexpected consequences for the environment and health of using and releasing genetically modified organisms (see "Action Plan for Biotechnology 1998 - 2002, adopted by the Divisional Board for Bioproduction and Processing, January 23, 1998).

The Programme will promote the industrialisation of research results. For this reason, it will be important to establish forms of cooperation and networks involving research groups and industry. The programme has thus been organised as a set of sub-programmes for researcher- and user-controlled projects. This structure will make it possible to establish close links between R & D groups and industry.

3. Objectives and sub-goals

Principal objectives

1. High international standard of biotechnological research within the main areas of concentration of the Programme.
2. High international standard of researcher training in order to ensure a supply of competent personnel for recruitment to industry, R & D and the public sector.
3. Increased creation of value via the use of biotechnology in primary industries and in the utilisation of marine resources, processing and industrial applications.
4. Understanding of the consequences of using modern biotechnology for safety, the environment and society.

Sub-goals:

- 1.1 High level of competence in research on molecular mechanisms, genome mapping, cell biology, protein modelling, protein engineering, fermentation and bioinformatics.
- 2.1 Training and development of doctoral candidates via the Programme.
- 3.1 High level of competence in the utilisation of microorganisms in manufacturing processes.
- 3.2 Integration of biotechnological methods and products into the processing of microorganisms, plants, domesticated animals and fish.
- 3.3 Commercial exploitation of biological resources and wider utilisation of underexploited resources, by-products and waste.
- 3.4 Efficient methods for the diagnosis and combatting of diseases and injurious agents in organisms of production and the immediate environment.
- 3.5 Efficient biotechnological methods for qualitative assurance of the value chain, improved utilisation of raw materials and a greater degree of processing.
- 3.6 Development and improvement of methods for environmental cleansing.
- 4.1 Analysis of the development, and evaluation of the consequences, of using modern biotechnology.

Relevant target groups for the Programme include centres of education and research, industry, industrial organisations and the authorities.

4. Prioritisation of research tasks and activities

Most of the researcher-controlled projects will be concerned with strategic basic research. These projects will be prioritised according to their quality and relevance. The quality assurance process will include evaluations by referees.

The Programme will encourage closer links between R & D groups and industry. This will help to stimulate companies to involve themselves in R & D and create a basis for research-based industrial development. At the same time, researchers will gain insight into the challenges facing industry.

The sub-programme for user-controlled programmes is market-driven. The programme users themselves will be the applicants and will define the premises for the activities involved. In order to ensure that the demand for a high international standard of biotechnological research is met, and that this country will have access to sufficient competence, doctoral training will form an integral part of both the research-controlled and user-controlled parts of the Programme

A great deal of stress will be laid on the possibility of researcher mobility between Norwegian universities, research institutes, industry and foreign institutions.

The Biotechnology Programme will prioritise basic and applied research in the following areas:

4.1 Development of general strategic competence:

- Model organisms for studies of fundamental processes and effects of genetic modification
- Genome analysis
- Microbial gene technology, including gene mapping, characterisation and regulation
- Protein modelling and protein engineering
- Bacteriocines, enzymes and other bioactive agents.

4.2 Biotechnology in domesticated animal production:

- Gene mapping, and characterisation
- Genetic technology in domestic animal breeding
- Embryo technology.

4.3 Plant breeding, plant production and plant health (including forest trees):

- Cell and tissue culture
- Molecular biology of plants
- Molecular plant physiology
- Biotechnology in plant protection.

4.4 Biotechnology in fisheries and aquaculture:

- Molecular biology and marine organisms
- Fish immunology
- Genetics and genetic methods in aquaculture
- Embryo technology in fish and other marine species.

4.5 Ensure supplies of raw materials and food production:

- Authentication
- Microbial diagnostics and epidemiology
- Control and prevention
- Removal of hazardous substances and combatting pathogenic organisms
- Resistance to antibiotics and disease-promoting properties of micro-organisms
- Probiotics
- Increase in the “shelf life” of end products.

4.6 Better utilisation of raw materials:

- Utilisation of marine raw materials, including biopolymers
- New processing methods
- Development of new animal feeds
- Fermentation and ensilage methods in animal feed production

- Efficiency improvements in animal culture and plant growing conditions
- By-products and organic waste
- Natural gas and resources with new potential applications.

4.7 A clean, safe environment:

- Bioremediation
- Effects of biological improvement methods on the environment
- Environmental monitoring
- Methods applicable to the concept of “closed manufacturing conditions”
- Mechanisms for natural gene transfer between organisms
- Alternative methods for the selection of transgenic organisms
- Consequence analyses of the use of the above methods.

Most of the projects in the researcher-controlled part of the Programme will lie within the first five areas, i.e. 4.1 - 4.5.

In the user-controlled part of the Programme, most of the projects will be in the last two areas, i.e. 4.6 - 4.7.

Biotechnology and society:

In general, the Programme will stress projects that have integrated ethical and socially relevant issues. Special research tasks related to the following topics will be sent for treatment to Programme 6: “Market and Society”.

- Consumer attitudes and underlying ethical and normative considerations regarding the use of generically modified organisms (GMOs) in food and animal feed production.
- Mapping consumers’ needs for information and communication regarding foods that include components of GMOs, as a basis for selecting food.

5. Cooperation and project initiation

The Biotechnology Programme deals with a field that touches on several other Research Council programmes. This Programme will therefore cooperate with them.

The Programme will play an active role in encouraging the submission of good projects, stimulate cooperation among various participants and cooperate with other instances such as the State Fund for Industrial and Regional Development (SND), the State Agriculture Bank (SLB) and the Trade Council of Norway. In areas in which the Programme believes that too little R & D is being done, or in which the quality of R & D is not good enough, it will actively initiate a dialogue with relevant participants with a view to producing project submissions. In the user-controlled part of the Programme the secretariat will work proactively with users.

Application forms are available from the Research Council of Norway, and can also be downloaded from the Internet (<http://www.forskningsradet.no>).

6. Budget

The Programme has a total budget of NOK 29.5 million in 2000. Around MNOK 15 is already earmarked for projects (including MNOK 7.5 for user-controlled projects).

7. Information dissemination

Projects that receive support from the Programme will be published in the project catalogue and Internet pages of the Division of Bioproduction and Processing. Research results of projects will also be presented in popular science publications, e.g. in the form of a newsletter. Interdisciplinary seminars may also be held, for example in order to shed light on ethical and social questions that are relevant to biotechnology research within the areas covered by the Programme.

At the end of the Programme a final report will present all the projects that have received support from the Programme. This report will be published in December 2004. A final seminar will also be organised at the end of the Programme, in which selected projects will be presented.

Action Plan for

1. FISHERIES TECHNOLOGY

2. *Programme background*

The creation of value and the export revenues of the fisheries industry have both shown a good rate of growth in the course of recent years.

In 1998, the total annual catch came to about 2.8 millions tons of fish and shrimp, with a first-hand value of NOK 10.4 billion. In that year, the total value of Norwegian exports was NOK 28 billion, of which aquaculture was responsible for NOK 9 billion. The supply industry also exported fisheries-related equipment to a value of some NOK 3 - 4 billion.

The utilisation of fish by-products is currently responsible for an added-value of more than NOK 1 billion, including animal feed and products for human consumption.

The fishing fleet has laid the foundations for significant creation of value and an internationally leading industry in the development and manufacture of fish capture and fishing vessel technology, production and safety equipment. In view of the status we already have in these sectors, we can also expect exports of know-how and technology to be of growing interest.

Fishing fleet catches cannot be expected to grow in the immediate future. Variations in the resource base, combined with a market that is out of step with quotas and availability, are important premises for the activities of this industry. Future research should concentrate on the implementation of a selective, responsible and sustainable fishery, rational, sustainable exploitation of resources and equipment, treatment of catches that will add value and better utilisation of bycatches and byproducts. This programme will deal with relevant research topics related to fish, shellfish, marine mammals and species much further down the food chain.

To a large extent, the "Fisheries Technology" research programme may be regarded as a continuation of the "Technology Development in the Fisheries Sector" programme, which lasts from 1995 until 1999.

The new programme will also continue and follow up those projects in the "Technology Development in the Fisheries Sector" programme that have been awarded funding for 2000 and 2001.

This action plan is based on the programme plan which was drawn up by a planning group in 1998 and distributed to central bodies within the R & D system, the fisheries industry and the Ministry of Industry for their comments. The action plan was subsequently approved in autumn 1998 by the Research Council of Norway's Divisional Board for Bioproduction and Processing. The programme plan has been adopted as the basis for the work of the action plan. The action plan concretises, prioritises and provides a plan for implementation of the Programme. It is intended to act as a guideline document for project applicants and as a basic document for the work of the programme board.

Organisation and resources

On the basis of the guidelines provided by the Divisional Board, this Programme will be a value-chain programme which will comprise basic research projects, action-oriented projects and user-controlled projects within the framework of one and the same programme. The necessity for developing competence also means that funds will be made available from the Programme's budget for doctoral training, post-doc fellowships, overseas fellowships and fellowships for visiting scientists. Development of competence under the auspices of the Programme should be seen within the context of activities under various strategic institute and university programmes.

Strategic basic research will be aimed at the university and institute sector, and will involve basic research projects that include a need for competence development.

Action-oriented research involves research that aims to satisfy the requirements of industry and the authorities, and the research institutes will perform most of this type of research, which may be on any of the topics covered by the Programme.

User-controlled research will be aimed at one or more companies in this industry, and industrial organisations are also potential partners in connection with joint projects that concern the whole industry or parts of it. User-controlled projects will usually involve cooperation between an R & D institution or institutions on the one hand and a company or companies and/or organisation on the other. The Programme will also be capable of supporting cooperative projects in which several companies participate, for example in cooperation with research institution(s) in joint projects intended to benefit parts of a branch of industry.

User-controlled projects will observe the EEC regulations concerning the proportion of public-sector finance, which usually lies between 25 and 50%.

Application deadlines

User-controlled programmes will be dealt with on an ongoing basis, i.e. at the first meeting of the programme board after they have been received (about six meetings a year). The deadline for other types of application is June 15.

From the year 2000, the strategic institute and university programmes will gain considerably in scope.

These programmes are intended to produce competence and tools oriented towards long-term needs, while the research programmes are intended to generate knowledge. The strategic institute and university programmes are reserved for institutions for which the Division has basic funding responsibility, and institutions that are of fundamental importance to the Bioproduction and Processing sector. The Programme will offer its opinion on any applications for strategic institute and university programmes within the scope of the Programme.

Cooperation with the county offices of the State Industrial and Regional Development Fund (SND) on the question of finance for the fishing fleet and for companies working on development projects in fisheries technology must be continued and strengthened. For example, major pilot projects may be appropriate for co-financing when investments are also required for equipment.

It may also be appropriate to cooperate with other schemes in the public-sector support apparatus. The Fish Export Committee, for example, may be another relevant partner.

Objectives and sub-goals

Objectives

The principal objective of the Programme is to utilise a broad knowledge base and technological R & D to help the fishing fleet to increase its creation of value and harvest marine resources in a sustainable manner. It is also intended to support the development of competence and a broad basis of knowledge at the fishing/fishing fleet stage, in order to enable Norway to play a leading role in practical fisheries and in the development of competitive products and systems by the Norwegian supply industry.

The Programme has the following sub-goals:

To develop technology and competence that will improve the size and species selectivity of fishing, and to reduce by-mortality as much as possible. It is also expected that the development of new types of fishing gear and fish-finding equipment will contribute to the more resources-friendly and cost-effective exploitation of resources. Our understanding of fish behaviour relevant to capture techniques and of the effects of fishing gear on resources and the environment will also be improved.

The Programme will contribute to the development of competence and technology needed to ensure more rational operation and more appropriate vessel design. This will also involve a reduction in energy consumption in the fishing fleet from current levels, which will help to meet the objectives of the Climate Convention and of our other international environmental obligations.

The Programme will help to improve safety and the work environment, with a view to reducing the number of human accidents and vessel losses in the fishing fleet to below current levels.

The Programme will help both to raise our current level of knowledge and improve the quality of the raw materials supplied by the fishing fleet, as well as of the exploitation of by-products and other products. Raw materials derived from underutilised resources will also be taken up and used more efficiently than they are today. Help must also be given to adding value to existing catches, for example in connection with improved catch processing, where the objective will be new markets or new products.

The Programme will exploit competence and technology development related to improved logistic systems and land/sea synergy effects to support value adding in the total catch for the duration of the Programme.

Priority research tasks and activities

Programme area 1: Fish capture and gear technology (30%)

1. Resources-friendly fish-capture techniques
2. Gear development - new types of gear
3. Fish behaviour relevant to capture techniques
4. Fish-finding equipment and fishing instrumentation
5. Environmental effects of fishing.

Programme area 2: Fishing fleet research (25%)

1. Fleet structure and frame conditions
2. Development of vessel concepts
3. Energy and the environment
4. Safety, work environment and competence
5. Vessel operation, including the use of IT decision-support and communications systems.

Programme area 3: Catch processing of raw materials and by-products (30%)

1. Improvements in onboard catch processing
2. Processing of by-products and by-catches
3. Processing of underutilised resources and new species.

Programme area 4: Increased creation of value from marine resources via land/sea synergy effects (15%)

1. Logistics in the value chain
2. Demonstration projects

3. Alternative forms of operation and sales.

Project initiation

For various reasons, such as potential conflicts of interest and questions of scientific competence, it may be necessary to send applications from R & D groups to English-speaking referees for their opinion. For this reason, we would prefer applications to be written in English. In such cases, a short summary in Norwegian should be included in the normal way.

Applications for user-controlled projects may be written in Norwegian.

It will be important for the Programme to pay annual visits to the most important research groups. It may be most appropriate to arrange such visits in the spring before project applications are submitted, so that any necessary signals can be passed on in addition to the annually updated action plan.

As far as user-controlled projects are concerned, experience to date has been that it may be necessary to actively advertise that funds are available. It may also be fruitful to hold meetings with central organisations and industrial associations. From the point of view of the Programme's management, it is important to maintain direct contact with relevant companies, for example in the equipment supply industry, in order to discuss project proposals and to provide information regarding the possibilities of support. User-controlled projects will be dealt with on an ongoing basis, i.e. at the first meeting of the programme board after they have been received (about six meetings a year).

Budget

In 2000 the Programme will have a budgetary framework of about NOK 12 million. For that year, some NOK 3.8 million has already been earmarked for ongoing projects, leaving a total of about NOK 8 million for new projects. About NOK 3 million will be allocated to user-controlled projects.

The budget will be allocated to the sub-programmes/activities as follows:

Fish capture and gear technology:	(30%)
Fishing fleet research:	(25%)
Catch processing of raw materials and by-products:	(30%)
Increased creation of value from marine resources via land/sea synergy effects:	(15%)

Action Plan for

1. Forests - Resources and Creation of Value

2. Programme background

This programme is a continuation of the Forestry Programme (1995 - 1999). In anticipation of the Action Plan, two sets of recommendations were drawn up, and these should be seen in a joint context: *The Forestry Industry*, which was produced by a planning group appointed by the Research Council's Divisional Board for Bioproduction and Processing, and the *Joint R & D Strategy* drawn up by the Forestry and Timber Industry's Research Association (SSFF).

This Action Plan concretises the planned implementation of the Forests - Resources and Creation of Value Research Programme during the programme period. One point of departure of the Programme is the above-mentioned sets of recommendations, which should be regarded as a general description of problems and tasks that ought to be the subject of research and development. The *Long-Term Plan for Agricultural Research*, and White Paper (Parliamentary Report) no. 17 (1998 - 99) *Creation of Value and the Environment - potential for the forestry sector*, have also been important guideline documents.

The Action Plan describes the objectives, sub-goals and R & D tasks that will be given priority, the budget that will be made available, and how the Programme will operate to achieve its aims. The plan is thus a tool for the implementation of the Programme, and provides a background for potential applicants.

Organisation and resources

The Forestry Programme is a value-chain programme that starts with the resources base and ends up with the needs of society for forestry-derived goods and services, including a number of collective goods of great social importance. The Programme consists of goal-oriented basic research, applied research and development components. Within the Programme's budget, objectives and core problems there may be a need for greater or better competence, and project funding will be made available for further education in the form of support for doctoral grants. Support of this sort may be given to both research groups and companies.

Forestry research operates to some extent in a very long-term perspective, and forestry has a wide-ranging production of collective goods, while conditions related to the structure of ownership are aspects that argue for continued strong public-sector R & D efforts.

Nevertheless, the forestry and timber industries must be encouraged to become more involved in R & D and to raise their level of competence and ability to make use of research results. A significant number of user-controlled projects are envisaged under this Programme. In addition to the annual financial framework of NOK 10 million from the Ministry of Agriculture, it is expected that the forestry industry will make available at least MNOK 4 in funding a year.

Objectives and sub-goals

Principal objectives

The Programme will raise our level of understanding of the importance of natural and anthropogenic processes for the total resources of our forests, and will contribute to an increased creation of value.

Sub-goals

1. To improve our knowledge of biological processes and relevant organisms in forests, and of their reactions to natural conditions and human activities, as a basis for sustainable development.
2. To raise the level of knowledge and competence that contributes to the diversified and profitable utilisation of resources within the framework of sustainable development.

Prioritisation of research tasks and activities

Products and goods

As a point of departure the Programme will cover the whole of the forestry sector, with the resources, process and products and services that this sector includes. The basis of production is land, including such production factors as soil, water and climate. In simple terms, products and goods may be grouped as follows:

- biological diversity (genes, species (microorganisms, lichens and fungi, insects, plants and animals) and ecosystems)
- landscape (cultural remains, experience of nature, outdoor life)
- timber (timber itself, timber-based products)
- products of forests and outlying areas for commercial exploitation
- other non-commercial products, goods and services related to forests, e.g. effects on water quality and climate.

Review of core tasks

This section describes core research and development tasks that will be given priority by the Programme. Within the Programme's priority areas competence will be developed at a high international level. Research and development tasks are allocated to one of two sub-goals. The tasks related to sub-goal 1 will be capable of developing knowledge, basic data and information that will be useful, and in some cases essential, for work on problems related to sub-goal 2.

Core tasks related to these two sub-goals include the following:

Sub-goal 1: Biological processes and organisms in forests

The Programme will:

- improve our knowledge of biological processes, organisms and natural conditions and interactions between them, when these are relevant to forest management.
- improve our knowledge of the consequences of human activity on biological processes and organisms in forests, and of how forests can help us to fulfil important environmental objectives.
- clarify the demands that must be made of forest management in order to ensure the survival of viable populations of various species in Norway.

Sub-goal 2: Diversified, profitable utilisation of forest resources

The Programme will:

- increase our knowledge and reinforce such competence as is capable of contributing to the environmentally friendly, efficient and diversified utilisation of all forest resources, including a greater degree of processing, new products and applications, the necessity for greater cooperation between industrial sectors, quality assurance and documentation.
- raise the level of competitiveness of forest-based products in traditional and new areas of application, and improve knowledge of market conditions, organisation, technology and other factors that affect profitability.
- increase knowledge of the properties and value of commercial products from forests and outlying areas, of how such products can be affected and exploited optimally, and how such production affects non-commercial values in forestry.
- develop models and methods for analysing the development of the forestry sector under changed frame conditions.
- increase our knowledge of how different types of forest owners manage their forests and outmark, what social currents affect them and what developments can be expected to occur in the future, including improving our understanding of how private and public financial conditions, frame conditions and the social structure affect the forestry sector, and the importance of the frame conditions of the forestry industry for owners, employees and society.

- develop knowledge of local adaptations of forest management and operation in the light of expected developments in the forestry sector and in relation to our cultural environment and biological diversity.

The projects will be followed up individually with respect to their objectives and those of the Programme, and to the routines of the Research Council.

Project initiation and processing of applications

The Programme will play an active role in adopting good projects, stimulating cooperation among participants (R & D groups, the authorities and industry) and with other resources such as the State Industrial and Regional Development Fund and the National Agricultural Bank. In fields in which the Programme believes that insufficient R & D is being done, or that the quality of what is being done is not good enough, it will initiate an active dialogue with relevant participants with a view to identifying projects. One objective will be to engage external (i.e. user) funding in order to extend the range of activity of the programme and to ensure the transfer of its results. A particular challenge will be to adopt good projects that have a significant degree of user funding and possibly of user control.

If necessary the Programme Board will engage such expertise as it lacks itself in the form of expert groups, sub-committees, peer-review groups, etc. Applications from research groups will normally be professionally and/or scientifically evaluated by one or more external experts. Where applications from R & D groups are concerned, it may be desirable for various reasons, such as potential conflicts of interest and questions of scientific competence, to send applications to English-speaking referees for their opinion. For this reason, we would prefer applications to be written in English.

If English is employed, a short summary in Norwegian should be included in the normal way. Applications for user-controlled projects should be written in Norwegian.

Budget

The budget for the Programme in the year 2000 will be around NOK 10.5 million. In that year, some MNOK 2.5 has been earmarked for projects which have already been started, leaving a total of about MNOK 8 available for new projects.

Around MNOK 4 of the total budget will be used for user-controlled projects.

Action Plan for

1. MARINE RESOURCES, ENVIRONMENT AND MANAGEMENT (Mare)

2. *Background*

The “Marine Resources, Environment and Management” (MARE) research programme is a continuation of the earlier “Marine Resources and Environment” and “Management of Marine Resources” programmes, which were launched in 1995 and will come to an end in 1999. The MARE programme will run from 2000 until 2004.

The action plan is based on the programme note of June 15, 1998, which was produced by a planning group and which has been sent out for consultation to central national bodies. The action plan is both a concretisation, a set of priorities and a plan for the implementation of the programme, and it is intended to provide a starting point for applicants who wish to submit project applications within the framework of the plan.

The action plan also takes as its point of departure the objectives and research and development tasks outlined in Report to the Storting (White Paper) no. 51 (1997 - 98) entitled “Perspectives on the development of the Norwegian Fishing Industry”, the Ministry of Fisheries’ “Strategic Plan for Research and Development in Fisheries and Aquaculture and Harbours and Infrastructure for Marine Transport until 2003”, White Paper no. 58 (1996 - 97) “Environmental Policy for Sustainable Development - Joint Efforts for the Future”, the Ministry of Environment’s Strategic Plan and the Godø Committee’s report “Methods for Fishery Resources - Status and Potentials of Marine Resource and Environment Monitoring”.

The Norwegian fjord, coastal, and oceanic regions are of enormous value in terms of resources and environment, and we have a responsibility to manage these areas in a sustainable manner.

International conventions ratified by Norway are accompanied by a need for research and methodological development in order to guarantee sustainable use of the marine ecosystem. Particularly challenging in this respect are methods for implementing the precautionary principle, including the development of measures of uncertainty, stock-specific reference points and guidelines for management decisions under various harvesting situations.

Knowledge of marine ecosystems and of their most important species and stocks is an essential condition for being able to provide the fisheries and environmental authorities with good advice, and will support the sustainable management of stocks as resources. Research is the most important source

for updating and renewing our knowledge, and basic marine knowledge is the foundation of renewed scientific insight. MARE will have special responsibility for introducing new perspectives, knowledge and methods into science, resource management and industrial activity.

Organisation and methods

The Programme covers a wide area and has therefore been divided into four sub-programmes:

- Our marine ecosystems
- Harvesting marine resources
- Resources management and bio-economics
- Technology.

In addition to these sub-programmes the Programme wishes to establish what might be called "core areas" which will attempt to solve important problems within individual sub-areas or combinations of them. We wish to utilise these core areas to stimulate research groups to establish cooperative relationships which will integrate interdisciplinary challenges. It is hoped that the core areas will be used to tackle basic research tasks of relevance to the management of our marine environment and resources, and they will require inter-institutional collaboration. The Programme Board will therefore request proposals and outlines of projects for the core areas that are capable of being integrated into the action plan for next year.

The programme invites the submission of user-controlled projects that lie within the definitions of its sub-goals. Some 10% of the total budget will be allocated to user-controlled projects, which will be required to be 50% financed by their users.

Development of competence within the programme should be seen in relation to the Research Council's strategic programmes.

The Programme will continue the practice of utilising independent experts to evaluate project applications.

The Programme will organise two to four large-scale meetings of researchers in the course of the programme period. The purpose of these meetings will be to disseminate the results of the Programme to the authorities, industry and the research community, to promote cooperation among the scientists involved in the Programme and with other scientists, and to evaluate the progress and results of the Programme and its projects. These meetings will be held in the Autumn, in order that written progress reports to the Research Council can be coordinated with the oral project reports presented at the meetings. We may also seek to collaborate with other bodies in organising such gatherings of scientists.

In previous programmes, doctoral training has been regarded as an important means of recruiting researchers. This will also be an important task for this Programme. Both with respect to recruiting researchers and in order to ensure that efficient efforts are put into meeting the research goals as outlined in the Programme, it will also be necessary to employ newly qualified researchers with doctorates (post-docs).

Objectives and sub-goals

In addition to acquiring new scientific knowledge, among the clear objectives of the Programme is to help develop those disciplines in marine science that will support the future creation of value within the framework of sustainable development.

Sub-programme A: Our marine ecosystems

This sub-programme aims to acquire new knowledge of the structure, processes, production, temporal and spatial variability of ecosystems and anthropogenic effects on the ocean and its resources. It will also stimulate a general build-up of basic knowledge and studies of specific conditions in Norwegian waters, with emphasis on acquiring an overall understanding of ecosystem structure, function and species diversity.

It will gather knowledge of the diversity of marine biological systems, focusing on species and populations that are harvested or that are directly or indirectly affected by harvesting.

It will acquire basic knowledge of physical, chemical and biological driving forces and sub-processes.

It will develop integrated multidisciplinary models capable of explaining and analysing variability in our marine ecosystems.

It will improve our understanding of the effects of environmental toxins on our marine environment, with particular focus on harvestable resources.

It will acquire knowledge capable of making a contribution to new possibilities in the cultivation and harvesting of our coast and ocean regions.

Sub-programme B: Harvesting marine resources

This sub-programme will develop cost-effective monitoring systems capable of combining data from scientific surveys and information obtained from commercial fishing with new basic scientific knowledge, in order to construct realistic analytical tools and models of population dynamics. Unanticipated changes in assessments of stocks and their production are signs of weaknesses in the

methodological foundations of resource management. The implementation of new technology and knowledge in the evaluation and management of resources, with a corresponding reduction in uncertainty, is capable of leading to significant economic gains and will be required if we are to adapt to the future demands of international conventions and guidelines.

The programme will improve the basis of knowledge for the dynamic, sustainable exploitation of resources.

It will stimulate a innovation in assessment methodology.

It will raise the degree of realism of traditional population dynamics models and stimulate the establishment of better systems for evaluating resources, with corresponding points of reference and uncertainties.

It will acquire knowledge and develop tools for evaluating the effects of commercial harvesting, or the absence of harvesting, on the marine environment.

Sub-programme C: Resources management and bio-economics

This sub-programme will stimulate the development of methodology which encompasses social economic aspects of marine resources management. Via a broader understanding of the interactions of human beings and the marine environment in various models and management strategies, and their social consequences, it will attempt to develop a better integrated basis for making regulatory choices.

It will develop basic bio-economic knowledge and model tools for the establishment of bio-economic single- and multi-species models.

It will develop models that realistically incorporate important economic conditions, and sketch the consequences of various catch levels, catch patterns, fleet capacities, and regulatory choices.

It will utilise the above models in connection with various management strategies, at both national and international level.

Sub-programme D: Technology

This sub-programme will develop measurement systems and models that will offer us better insight into our marine ecosystems and improve the monitoring of marine resources and the marine environment. In the field of basic marine research we are dependent on access to tools capable of “imaging” the physical, chemical and biological states of the ocean.

The programme will develop measurement technology for use in marine research and monitoring.

It will develop systems that integrate measurement data and models for optimal monitoring of the marine environment and marine resources.

It will develop numerical models and methodology for the validation of model systems.

Initiating projects

The Programme wishes to support brainstorming sessions and working meetings that will aim to shed light on problems and provide ideas for solving problems that lie within the individual sub-programme areas. In particular, it wishes to receive applications that attempt to utilise interdisciplinary and inter-institutional collaboration to cast light on central problems with a view to establishing core areas (see above). These core areas will be the basis for the allocation of priorities within the central tasks of the sub-programmes.

For various reasons, such as potential conflicts of interest and questions of scientific competence, it may be necessary to send applications from R & D groups to English-speaking referees for their opinion. For this reason, we would prefer applications to be written in English. In such cases, a short summary in Norwegian should be included in the normal way.

Applications for user-controlled projects may be written in Norwegian.

Budget

In the year 2000 the Programme will have a budget of NOK 35.5 million. Around half of the budget for the first year of the Programme is already earmarked for projects from the two earlier programmes: "Marine Resources and Environment" and "Management of Marine Resources".

It is intended that, in the course of the Programme, some 10% of the total budget will be allocated to user-controlled projects. Funds for core-area projects and user-controlled projects will be divided among the sub-areas.

The budget suggests a tentative allocation of funds among the sub-areas, and to a certain extent, funds intended for one particular area may be transferred to another. Quality and relevance will be the most important criteria to be taken into consideration when applications are being processed. The Programme Board wishes to distribute the funding available for projects as follows:

Sub-programme A: 40%

Sub-programme B: 25%
Sub-programme C: 10%
Sub-programme D: 25%

Action Plan for

1. MARKET AND SOCIETY

2. *Programme background*

The point of departure of this programme lies in the needs of industry and the authorities for social research related to fisheries and aquaculture, agriculture, forestry and rural products, not least in the light of the challenges that follow in the wake of the greater emphasis now being laid on environmental perspectives, internationalisation, economic efficiency and consumer and market orientation.

The action plan has been drawn up by the Programme Board, and is based on a programme note approved by the Research Council's Divisional Board for Bioproduction and Processing on November 5, 1998. In the course of its work the Programme Board has drawn on the Long-term Plan for Agricultural Research 1998-2005, the Ministry of Fisheries' Strategic Plan for Research and Development, and White Paper (Parliamentary Report) no. 17 (1998 - 99) Creation of Value and the Environment - potential for the forestry sector.

Organisation and resources

The Programme has a broadly defined and complex need for competence. It will put a significant amount of effort into developing research competence, for instance by enabling basic and methodological research to play their natural roles. Among other things, the Programme will continue previous efforts to strengthen market competence in research centres that serve the bioproduction sector.

The Programme has the primary responsibility for market research in the area covered by Bioproduction and Processing. With the exception of market studies, etc. in connection with user-controlled projects and perspective analyses related to biological and technological research in the value chain programmes, all R & D related to industry-oriented market research will lie within the scope of the Programme. This will primarily apply to research that deals with developmental tendencies, frame conditions and consumer perspectives, and research based on social economics, productivity and international trade.

Within the scientific and budgetary guidelines that have been laid down for the Programme, the Programme Board intends for the time being to evaluate efforts within individual areas on the basis of an overall assessment of research challenges and requirements. Nevertheless, in the course of the Programme funds may be earmarked for work on special topics. As well as sector-specific research requirements, the Programme will also deal with supra-sectoral

problems and comparative studies. Projects that encourage interdisciplinary and institutional collaboration will be given priority.

The Programme will also attempt to achieve a higher proportion of user funding of research projects, and a generally greater involvement on the part of industry's professional and economic organisations in the implementation of industrially oriented social research.

Objectives of the Programme

The Programme is intended to strengthen the social science knowledge base as a means of support for resources and environmental management, industrial development and the manufacture, distribution and sales of goods and services in fisheries and aquaculture, agriculture, forestry and rural products. The Programme will also develop competence within subjects and disciplines that serve this research requirement.

Priority research tasks

The Programme is organised in terms of four topics: *Market research; Industrial development; Land-use, resources and environmental management; and Organisation and management.*

Market research

In the field of market research the programme will help to develop competence that will strengthen the ability of the bioproduction sector to operate on the basis of market

orientation and to meet challenges related to consumer behaviour and market dynamics, market access and changes in institutional frame conditions.

The aim of research on markets, developmental tendencies and frame conditions is to acquire basic information and better knowledge of general developmental tendencies regarding supply, demand, the competitive situation, distribution conditions, and purchasing behaviour. There is a need for better knowledge of the effects of these developments on the individual links in the bioproduction value chains.

Trade in foodstuffs is one of the most highly regulated areas in world trade. There is a need for knowledge of the political, administrative and economic processes that help to shape international standards and quality requirements in individual markets, combined with studies of the relationship between processes of this sort and industrial innovation processes. There is a need to develop research-based insight into the conditions, mechanisms and processes that lie behind success in developing brand recognition aimed at international markets. In view of the relatively large resources that are put into marketing, there is a need to develop methods for evaluating marketing efforts.

The importance of consumer perspectives on bioproducts has increased in the course of the past few years. Efficient communication regarding environmental qualities and the origin of products will be an important competitive element in the future. Consumer attitudes and the underlying ethical and normative considerations regarding the use of modern biotechnology make up another important field of research.

Industrial development

In the field of industrial development the Programme intends to help improve our insight into interactions between national industrial policy and international frame conditions, conditions for innovation, market-adapted production and local industrial development.

In the future, industrial development in the primary industrial sector will be based to a greater extent on consumer and environmental perspectives, economic incentives, competitive conditions and international frame conditions. Problems specifically related to agriculture are particularly concerned with restructuring and alternative products, as well as to the role of agriculture in village and rural development. The Programme will help to shed light on industrial policy and on the consequences of various forms of regulation for industrial participants and for society itself. One high-priority area is research into the conditions that encourage innovation, creativity and industrial development

There is a need for insight into the effects of official regulations on industrial adaptations to new market conditions, and to determine the overall effects of public-sector measures for improving industry's profitability and competitiveness. There is a need to improve our knowledge base for the support of political decision-making in the future development of the primary production sector, with special emphasis on the relationship between the production of private and collective goods. This will also include the social evaluation of such goods.

In forestry, an important challenge in the future will be to ensure that a suitable balance is achieved between the production of timber and environmental products. The future development of this sector will be determined to a great extent by our ability to match production to market demands. The same can be said of agricultural "niche products" (see section on the development of ecological agriculture). In coastal areas, new aquaculture species, alternative forms of aquaculture and integration with other industrial activities, (such as traditional fishing and tourism) could pave the way to new industrial adaptations.

There is a great deal of variation in the success of start-up companies under apparently identical socioeconomic conditions. This raises the questions of just what is a good environment for starting companies, for example in terms of professional competence, and of what are the other critical factors for success in local industrial development.

Land-use, resources and environmental management

In the field of land-use, resources and environmental management the Programme intends to develop competence and methods for land use and resources management as well as methods for environmentally friendly production.

More knowledge will be needed if we are to be able to assess the effects of protective measures on industrial development and in order to develop improved, more functional planning processes. It is also important to have consequence analyses carried out in connection with the utilisation and change of use of agricultural areas and the use of outlying areas. There is a similar need to build up competence in aquaculture and coastal zone planning.

Outlying areas are input factors in the production of both private and common goods. The demand for environmental goods and recreational areas is increasing, as are conflicts over land use in the wake of industrial development. There is a need for knowledge related to alternative management regimes for outlying areas.

New environmental problems have led to changes in our view of what agricultural areas ought to be preserved. Another factor is the transfer of decision-making authority to the local government level in planning cases. There are also significant unsolved problems related to the development of more environmentally friendly forms of production in the primary production sector.

Norway manages important marine resources and large ocean areas. There is a great need for better insight into the social consequences of various management regimes in order to acquire a basis of research for the development of methods that will be capable of ensuring legitimacy for management aims and providing research-based understanding of optimal resources management. It would be desirable to develop models of resources management that include participation at local level.

Organisation and management

In the field of organisation and management the Programme will strengthen competence in organisational development, cooperative solutions, changes in corporate character, competence development and recruitment. There is a considerable need for research-based competence as a basis for the organisation of future industrial development.

A typical feature of the industrial sector based on natural resources is its large proportion of small and medium-sized enterprises, which are often organised in the form of family companies. It is to be expected that in both agriculture and the fishing and aquaculture industries a significant degree of organisational restructuring will take place. There is a need for more systematic knowledge of the conditions and requirements that will enable these companies to successfully develop internally and to cooperate both formally and informally with others.

Given the increasing demand for professional competence in business and industry, there is a need for knowledge of appropriate means of stimulating the development of up-to-date competence. Knowledge is required of the relationships between the work environment, competence and recruitment. There is also a need for studies of the interaction between the public sector and industry's own organisations. The same applies to changes in the relationship between the State and the social partners and to how these organisations adapt themselves to the conflicting demands of their members, the market and the work of the authorities.

Project initiation and processing of applications

For the most part, the Programme Board will base its work on the open advertisement of research funds, but it will also be able to invite appropriate research groups to draw up project proposals, particularly in cases where the Board identifies a need for knowledge in one of the central areas of interest of the Programme, and furthermore primarily when the expertise necessary is easily identifiable and exists in a small number of research groups.

Projects can usually be given a framework of three years, although in special cases financing may be provided for longer projects. Applications to the Programme should be drawn up in English. However, applications for user-controlled projects should be written in Norwegian.

Budget

The budget for the Programme in the year 2000 will be around NOK 24 million, of which MNOK 15 is expected to be used for market research. In 2000, some MNOK 7 is earmarked for projects which have already been started, leaving some MNOK 17 available for new projects. Of this amount, about MNOK 8 will be put into new market research projects and about MNOK 9 into new projects in the other three research topics.

Additional funding will come from sources outwith the budgets of the ministries, and MNOK 5 in user finance is expected to be available in 2000.

Information dissemination

The Programme Board will place a great deal of emphasis on disseminating the knowledge generated by the research projects. One of the aims of the Programme is to communicate project results in such a way that the knowledge produced can be utilised by industry, the authorities and the research sector. Project managers will be required to draw up a plan for dissemination of results and will be responsible for ensuring that the results of their projects are passed on by means of international publications, articles in trade magazines and

lectures at conferences and professional meetings. At least one academic article should be produced by each project.

For its part, the Programme Board will be responsible for disseminating information about the Programme and its activities to industry, the authorities and relevant research groups. Projects supported by the Programme, for instance, will be published in the Research Council's Bioproduction and Processing project catalogue and Internet pages. In view of the principal direction of the Programme, significant emphasis will be placed on dissemination and discussions with industry via its organisations. A special challenge will be to create meeting places and to establish good communications and cooperative relationships. The Programme Board will dedicate considerable resources to ensuring that this is done in an appropriate manner.

Action Plan for

THE “FOOD” RESEARCH PROGRAMME

Programme background

The food industry sector is responsible for 25% of the gross manufacturing value of Norwegian industry, and it employs 55,000 people, which is equivalent to 20% of industrial employment in this country. Until now, the agriculture-based food industry has primarily supplied the domestic market under stable conditions, and with only a limited degree of competition from imports. The fish industry has long exported about 90% of its production, and has to adapt itself to market cycles and the availability of raw materials. The intensity of R & D in the Norwegian food industry sector is 0.1% of turnover, while the average level in OECD countries is 0.3%. The other Nordic countries lie well above the Norwegian level.

Increasing exports of agriculture-based products, rising imports and demands for a greater degree of processing of fish will create new needs for competence. This places heavy demands on industry's know-how and on its ability to predict and understand needs and to build competence of this type into its products. Industry and the food industry sector (including the supply industry) must improve their ability to build up their own R & D activity and to adopt existing and newly generated knowledge, so that they will have a reasonable possibility of understanding and communicating their own R & D requirements.

These trends imply considerable, and in some cases long-term, challenges for the authorities and public inspectorates. Research and development of knowledge are among the most important resources available to the authorities in their efforts to achieve goals related to food safety, quality and health. An internationally recognized and authorized production control system in the food industry sector is a prerequisite for a competitive industry.

In some important areas Norway has research groups at a high international level of expertise in food science. It is very important to maintain and develop existing competence and stimulate good research, particularly in areas in which Norway has natural advantages and potential. Furthermore, the research institutes ought to improve their industrial competence by creating closer contacts with the food industry.

Important areas for future R & D efforts include:

- Food quality and safety
- Consumer confidence
- Raw materials
- Process and technology
- Products

- Logistics and distribution.

Organisation and resources

The Programme consists of two parts of the knowledge chain:

- **Researcher-controlled projects** (40% of the total budget of the Programme)
 - Competence development in industry
 - Competence development in public authorities
- **User-controlled projects** (60% of the total budget of the Programme).

The researcher-controlled part of the Programme is aimed at the university, college and research institute sector. There is a widespread need for both basic and applied research in the food sector in order to ensure that the necessary platform for the future know-how requirements of industry and the authorities is available. The knowledge sector will be developed in order to enable it to provide the competence, quality and capacity that the authorities and the industry of tomorrow require. For this reason, researcher-controlled projects must be seen in the light of, and be coordinated with, the resources represented by the strategic programmes in the Research Council's Division of Bioproduction and Processing. Projects that include doctoral training will be given high priority.

The Programme manages fundings in the areas of food quality and consumer safety which are channeled via the Norwegian Food Control Authority in order to meet the authorities' needs for expertise.

The research area Bioproduction and Processing and of Medicine and Health collaborate on research in the field of food and health. A principal criterion for support is the participation of at least one research group from each of the two fields of nutritional research and food research.

The user-controlled part of the programme is intended to cover the whole of the target group in the food industry and its related supply industry. The Programme will support user-controlled projects from individual companies, groups of companies in cooperation, or whole sectors. User-controlled projects will normally be carried out in collaboration with R & D groups at the universities or at research institutes in order to guarantee a high socio-economic effect.

Industry must be encouraged to enter long-term R & D investments producing substantial socio-economical benefits. Similarly, the Programme will encourage more companies to work systematically on their own development, and as part of this process, to involve themselves in R & D in order to increase number of R & D-oriented companies. More research and development in the food industry should be encouraged by ensuring that the development of technology and competence and the transfer of results form part of R & D efforts in individual projects. The Programme will also attempt to ensure that projects

initiated by companies with significant R & D competence include a doctoral training component.

The industry's own organisations should collaborate with the institute sector in initiating user-controlled network projects with novel R & D of a generic character, including the transfer of competence and results. Central generic R & D projects should be located in industry or company networks in preference to individual companies.

User-controlled projects will be coordinated and possibly co-financed with other parts of the public-sector funding system.

Objectives

The Programme will help to reinforce the research-based knowledge base in such a way that:

- Norwegian research groups will possess and develop research competence and capacity at an international level, adapted to the short- and long-term requirements of industry and the authorities.
- The Norwegian food industry shall appear as a market-oriented, competitive, environmentally friendly and profitable industry capable of creating and exploiting national advantages related to raw materials, technology, product quality and competence.
- The ability of the authorities and industry to ensure that safe and healthy food is available on the Norwegian market will be improved, and Norwegian international interests in this area are taken care of.

The priority of research tasks and activities

The Programme has been organised into six thematic areas; each with target groups and priorities.

Food quality and safety

Target group: Authorities and industry

Priority: 30 % of Programme funds

To be developed:

- Knowledge of the occurrence and effects of components (both injurious and beneficial) in food
- Methods for monitoring and controlling individual components in food

- Knowledge and tools that will help to prevent the occurrence of unhealthy materials in food
- Systems assuring the nutritional quality of food throughout the value chain.

Consumer confidence

Target group: Authorities

Priority: 5% of Programme funds

To be developed:

- Knowledge of the effects of information supplied by the authorities on food and diet
- Knowledge of consumer values, attitudes and behaviour with regard to food
- Knowledge of social aspects of legislation, inspection and other aspects of food management policy

Raw materials

Target group: Industry

Priority: 10% of Programme funds

To be developed:

- Knowledge of sustainable industrially oriented food production and utilisation of resources
- Knowledge of the properties of raw materials and of how these can be modified/ controlled during processing, conservation, storage and distribution
- Knowledge of the relationship between the properties of raw materials and processing
- Efficient rapid analytical methods for documenting the quality of raw materials.

Process and technology

Target group: Industry

Priority: 25% of Programme funds

To be developed:

- Process technology, including methods and tools for process control
- Knowledge of production processes, process control and manufacturing economics and planning
- Knowledge aimed at the optimisation of processes with respect to energy consumption and environmental loading
- Knowledge of the use of byproducts for profitable and environmentally friendly manufacturing
- Knowledge about the optimisation of the characteristics of raw materials by means of process control.

Products

Target group: industry

Priority: 20% of Programme funds

To be developed:

- Knowledge of recipe optimisation and new, improved products
- Knowledge regarding quality and quality measurement
- Knowledge regarding conservation processes
- Knowledge regarding interactions between packaging and product.

Logistics and distribution

Target group: Industry

Priority: 10% of Programme funds

To be developed:

- Logistics and information systems from primary production to consumer
- Routines and tools for system analyses and traceability
- Information systems and technology for the rapid flow of goods and transactions.

International cooperation

The Programme has operational responsibility for international R & D cooperation within its thematic areas. The Programme will place great stress on encouraging international cooperation as one aspect of its objective of increased internationalisation, acquisition of knowledge and research quality. In line with the Research Council's overarching strategy the Programme will focus its efforts on the following cooperative programmes and regions:

- The EU's Fifth Framework Programme
- EUREKA
- The Nordic Industrial Fund
- South-East Asia.

The Programme will organise an annual International Day with the participation of research groups that have received positioning funding for the EU's Fifth Framework Programme and industry with international R & D experience, in addition to the Research Council's international infrastructure departments.

Initiation of projects

For the year 2000 the Research Council's normal practice, with a June 15 application deadline for completed applications for researcher-controlled projects, will be followed. For user-controlled projects the Programme plans to implement a two-phase application procedure in which project outlines will be followed up by complete applications.

The Programme in cooperation with other programmes will take the initiative to launch major R & D projects in selected core areas. These efforts will be coordinated with strategic programmes and will be based on the industry's need for knowledge and competence in prioritised areas.

The Programme aims to produce 15 doctorates in the course of its lifetime- Ten of these will be based on researcher-controlled projects and five on user-controlled projects.

Budget

The Programme expects to have a budget of MNOK 42 for 2000. This budgetary framework includes MNOK 7 of food quality and consumer safety funding which is managed by the Programme and channelled through the Norwegian Food Control Authority. Of the remaining budget of MNOK 35, the Programme has already made commitments for MNOK 18 million for 2000. The budget for the researcher-controlled part of the Programme will be tight in the year 2000.

Dissemination of results

One of the aims of the Programme is to communicate the results of projects in such a way that know-how based on research can be utilised by the food industry, the authorities and the research community. Each project will be responsible for disseminating the results of its own work via international publications, user-oriented professional articles, reports, patents and by means of presentations and talks at conferences, meetings and workshops.

Action Plan for

1. Soil, Plants and Livestock

2. Programme background

With effect from 2000 the new programme “Soil, Plants and Livestock” will finance research in those areas which have been dealt with since 1995/96 by the programme “Plants and Soil, Livestock, the animal health aspects of the “Fish and Animal Health Programme” and the agricultural aspects of the “Innovation Programme”.

Developments in agriculture and related industries are making ever greater demands of research-based knowledge and expertise. New frame conditions in the wake of the EEZ Agreement and the forthcoming negotiations in the World Trade Organisation (WTO) will face the primary agricultural industry with major challenges. The costs of production must be kept down, while demands for quality and environmental safeguards will become more stringent. It is important to underline that the new programme will finance research over a wide range of subjects, including some outwith those traditionally related to primary production. Both strategic basic research, applied research and user-directed research will be covered by the programme.

As well as research aimed directly at current challenges in primary agriculture, the new programme will contribute to the development of general research-based knowledge in our universities and colleges. This is a long-term investment which will also strengthen research-based teaching. The institute sector, which represents the more applied part of the research sector, must also be encouraged to develop its expertise and knowledge in a long-term perspective.

3. Organisation and resources

The Programme Board has decided to structure the scientific activities of the programme in terms of the following programme areas:

- *Soil and plant production*
- *Animal husbandry and animal health*
- *Forms of operation, industrial development and economics*

As might be expected, there will be a certain amount of overlap between individual areas of the programme. A number of possible project areas are

discussed under each programme area. Potential research topics for user-directed projects are also mentioned.

The institutions finance their research via funding from the Research Council of Norway, various research funds and their own budgets. Industry supports research through its own funds, for example via the Agricultural Agreement and various activities in the Agricultural Cooperative Movement. Funds from the public-sector industrial support apparatus are also an important source of finance for research and development. This refers to funds for rural development distributed through the Agricultural Agreement (BU funds) and funding from the State Industrial and Regional Development Fund (SND), the State Bank for Agriculture (SLB), the Agricultural Marketing Board, the Norwegian Trade Council, county council funds, regional development projects, municipal development funds, etc. The Programme Board believes that an important aspect of its work is to encourage close cooperation between public- and private-sector participants, in order to realise a good distribution of the financial responsibility for individual tasks.

The board for research funds financed by the Agricultural Agreement prioritises applied research and development projects. These funds are currently used to complete the financing of a number of projects which are managed in scientific terms by the Research Council. They are also utilised to co-finance programme areas and projects. The board for these funds wishes to see this source of finance used to meet industry's share of user-directed projects supported by the Research Council.

4. Objectives and sub-goals

The Programme will support the build-up of knowledge useful for the development of primary agricultural production. Emphasis will be placed on the sustainable use of input factors throughout the production chain, so that the bases of resources and production can be managed in a long-term perspective, with sharp focus on the environment, the cultural landscape, health and quality of life. Norwegian competitive advantages will be exploited in order to promote product quality, productivity and profitability throughout the industry

Sub-goals

- To ensure good plant health and production based on basic knowledge of the soil, plant nutrition and environmental toxins, including the effects of plant protectants.
- Ethically responsible animal husbandry that pays particular attention to the health and welfare of animals.
- Alternative operating methods, land-use, new products and industrial development.

- High-quality raw materials, for direct consumption and further processing.
- Adaptation to different market conditions by making primary production more efficient.

5. *Prioritisation of research tasks and activities*

5.1 *Introduction*

Value chains are a basic element of the thinking of the Programme. For this reason, integrated projects in which several institutions and scientific groups collaborate to solve common problems are of importance. The Programme Board wishes to stimulate research capable of achieving good interactions between researcher-driven and user-directed projects. The Board will normally demand an element of industrial finance in areas in which there are private or cooperative movement-based interests..

Central tasks for research in primary agriculture will be related to:

- the development of industry so as to ensure economic benefits for producers, with better utilisation of the totality of resources used in production.
- the development of new concepts capable of ensuring future production and creation of value, based on Norwegian resources and the knowledge that has been accumulated in agricultural and medical science.

5.2 *Programme area: Soil and plant production*

Soil resources are of particular interest for agriculture in two respects: both as a basis for plant production and thereby also animal husbandry in a sustainable perspective, and as a location where various types of contamination can be utilised and/or made innocuous, in order to prevent them from spreading to the atmosphere or water resources.

Plant production must both be profitable and satisfy demands for quality and quantity. It must also be sustainable and environmentally friendly. Land is utilised for a wider range of purpose than farming and market gardening, greenhouse production and forestry. There is a need for better understanding of requirements regarding soil properties and soil improvement measures in the course of revegetating highway cuttings, sports arenas and other recreational facilities. Plant material adapted to the Norwegian climate will have to be developed for such purposes.

Project areas:

Soil physics

The hydrological and heat-transport properties of soils are important factors in models of the mobility and transport of environmental toxins. Norway's special climatic conditions mean that there is a great need for knowledge of processes that are affected by freezing and thawing processes. Examples of such processes are the transport of water and various ions in soils, the occurrence of surface water and erosion.

In evaluations of the suitability of soils for safe use in agriculture and for rendering added matter safe, it will be necessary to develop functions in which information regarding known properties of soils can be utilised to derive other related properties, such as in connection with water and ion transport in soil. Using soil to utilise and detoxify undesirable materials will also require a higher level of knowledge with respect to interactions between soil physics and soil biology.

Soil compression is a problem that is growing in pace with the use of heavy machinery on agricultural land. Soil structure can be destroyed well below ploughing depth, affecting its infiltration and gas-exchange characteristics. Root development downwards through the soil profile deteriorates. The consequences of soil compression must be studied more closely, with regard to both plant production, erosion, the breakdown of organic material, including plant protectants, the creation of climatic gases and the transport and loss of plant nutrients and environmental toxins. The development of mechanised systems suitable for our climate and of machinery for working the soil at lower surface pressures are examples of tasks that would be appropriate for user-directed projects in which the agricultural machinery industry would be the central participant.

Soil chemistry and biology

The bioavailability of nutrients and undesirable materials (heavy metals, pesticides, etc.) varies with their concentrations, chemical composition and how they are bound to the soil. There is a need to develop methods capable of better quantifying the availability of various substances in the soil. This would make models of the uptake, transport and loss of substances from the soil and plant systems more reliable with respect to different types of soil and a varying climate.

In order to ensure sustainable development we need better understanding of the ability of the soil to supply plants with nutrients in the long term. The breakdown of mineral materials, for example, liberates plant nutrients in the soil. The quantification of such processes provides an important foundation both for planning fertilisation programmes and for the development and testing of analytical methods. The build-up and turnover of organic material under various climatic conditions is also important for the long-term sustainability of the soil. Organic material in the soil also plays a role in the binding and

liberation of plant nutrients, undesirable metals and organic environmental toxins. The binding and breakdown process of pesticides and other environmental toxins are not completely understood. Given the development of recently developed chemical analysis methods and Norway's particular climatic conditions, research in this area should be strengthened.

The interface between plant roots and the soil (the rhizosphere) is of great interest in connection with the uptake of nutrients and environmental toxins. There is a need for more knowledge of how roots and mycorrhiza affect the uptake and liberation of plant nutrients while the plant is protected against toxins and root pathogens. There is a great need for basic research on root development and the rhizosphere. This environment is dominated by complex interactions between roots, soil moisture, mycorrhiza and other microorganisms. This would be a suitable topic for user-directed research.

Organic waste

Organic wastes should be studied in more detail with respect to their suitability as soil improvers, sources of nutrients and carriers of environmental toxins. Methods and technologies for composting and of treating wastes and composts should be developed so as to enable the agricultural sector to deal with a larger proportion of such material. This is another suitable topic for user-directed research.

Plant production

Profitable, environmentally friendly and sustainable agriculture and market gardening depend on the availability of good plant material that is suitable for our climate, resistant to disease and capable of making good use of the nutrients in the soil. Sustainable agriculture, with its demands for quality as well as quantity in production, requires the correct application of fertilisers and pesticides. There is also a necessity to develop biological measures against vermin, as well as for more environmentally friendly plant protectants.

Plant material

Sustainable plant production requires the availability of plant material that is suitable for the climatic conditions in different agricultural areas. If plant breeding and seed genetics research are to benefit Norwegian agriculture, the whole value chain from genetics research via the development of new strains to cultivation must be considered as a whole. It is also important to develop competitive strains with a view to export. It is important to improve profitability and the competitive situation of seed cultivation. The revegetation of outdoor facilities and of the cultural landscape ought to be based as far possible on local Norwegian plant material. Emphasis should be placed on research which will encourage the conservation and use of local genetic resources. User-directed projects would be appropriate in these areas.

Climatic adaptation

In Norway plant material must be capable of adapting to wide variations in local climatic conditions, where weather conditions are often extreme. Surviving the winter is a particular problem. Further studies of the role of plant nutrition in such properties are required. The consequences of possible climatic changes are another relevant topic of research.

Availability of nutrients

In the field of plant nutrition and plant production there is always room for development with respect to the cost/benefit ratio of individual input factors. It is important to improve the uptake of nutrients from fertilisers in order to reduce runoff and leaching. This can be achieved, for example, by the development of "precision agriculture". A great deal of research has been carried out on the effects of nutrients on product quantity. The need at present is for better understanding of their effects on product quality, both in foodstuffs and animal feed. This is an appropriate topic for user-directed projects.

Plant health

We know too little about how plant nutrition, the climate and other growth factors affect the development of disease and attacks of vermin in cultivated plants. Protective measures against disease, vermin and weeds are important elements in the quality assurance of Norwegian plant production. A continuous process of research and development will lay the foundations of good plant health. More work needs to be done on environmentally friendly plant protection measures in order to meet national objectives for reductions in the use of chemical plant protectants. High-priority areas of research include environmentally friendly measures against diseases of plants, vermin and weeds, and a lower incidence of mycotoxins. Particular emphasis must be placed on preventive strategies based on ecological principles. This is an appropriate topic for user-directed projects.

Plant quality

Research on the development of high-quality plant products should be given priority, with both direct consumption and further processing in mind. Emphasis should be placed on studies of quality and on the development of processes and systems for controlling, raising and guaranteeing quality throughout the value chain. Research must contribute to the development of foodstuffs that have documented positive supplementary health properties. Such products must be based on integrated evaluations of diet and quality.

Research that will improve the feedstuff quality of Norwegian raw materials for the animal feed industry must be given priority. The same applies to the development of new criteria for the evaluation of forage quality. It is important to determine the importance of micronutrients in this connection, and on how these affect forage composition and animal health. This is of particular

importance in ecological agriculture, where the availability of plant nutrients is limited and depends to a greater extent on the natural state of the farm.

There is a need for more research into how individual input factors affect the storage characteristics of various products.

5.3 Programme area: Animal husbandry and animal health

Project area:

Breeding and reproduction

The livestock organisations have taken over the practical design of breeding programmes for most economically important livestock species. Studies of breeding theory, concerning both production parameters and propensities to disease, are performed by the research sector. Developments in breeding theory and studies of the consequences of various forms of livestock selection should be financed in cooperation with the breeding organisations. Given the international situation in poultry breeding, the Programme Board will not support production-oriented poultry breeding research. However, research that considers relationships between types of animal and future animal housing systems may be relevant. Basic research related to genes involved in production control is particularly relevant in areas that are capable of being related to improved product quality, prevention of disease and improved animal welfare. Semen is an important tool in breeding. User-directed projects are a prerequisite for supporting research in this field.

Nutrition

Optimal nutrition improves reproductive capacity and resistance to disease. A good understanding of nutrition is also of importance for the efficient and environmentally friendly utilisation of feed resources. The Programme Board regards research in this area as complementing the efforts of the agricultural authorities in registering the prevalence of disease. The Programme Board will prioritise research that is capable of documenting and improving the nutritional situation with respect to important macro- and micronutrients in Norwegian livestock. This research will also have positive effects on human health and should be seen in connection with Norwegian animal feed production (integrated research). International research suggests that the causes of several of the most important metabolic diseases in dairy cattle can be traced back to changes in metabolism or immunosuppression at the time of calving. It ought to be possible to finance research in this field partly in collaboration with the animal feed industry and the producer organisations. The nutritional requirements of individual domesticated species have already been determined to a great extent through the efforts of international research. This topic will not be given priority unless new knowledge can help to reduce the effects of animal husbandry on the environment (manuring, grazing, erosion).

Feeding and feed quality

Research on animal forage is a natural field of cooperation for plant and livestock research groups. In this field, the Programme Board will support project applications which present integrated problems and which cover the entire chain from working the soil and fertilisation to plant production and nutritional value. Research on animal forage currently lacks an “owner” organisation, unlike the situation in nutritional research and the feed concentrate industry. In view of the central role of forage in livestock production, the livestock organisations etc. ought to provide financial support for research in this field.

Most Norwegian corn production is processed into human food “via” livestock production. The Programme Board will stimulate integrated research into Norwegian-produced corn and protein-rich forage species which, either directly or after processing, can offer improved product properties and higher forage value.

Research on the production of feed concentrates has become more intensive in the course of the past few years, in part as a result of the development of the Animal Feed Technology Centre in Ås. The Programme Board stresses that the industry must continue to support this field under the new programme. It will also be necessary to continue to develop basic competence in Norwegian feed concentrate technology.

Grazing and the use of grazing areas

Grazing gives livestock exercise and an opportunity for natural behaviour. Research on grazing areas has been given low priority during the past few years. The economic utilisation of grazing resources in inmark and outmark is also of importance in areas in which livestock predators are also found. As well as its effects on direct livestock production, grazing is also a cost-efficient method of protecting the open landscape. Former stock grazing land can be an important additional resource for reindeer husbandry, a supplement to areas which have traditionally been used as summer grazing. The Programme Board wishes to prioritise research on grazing lands, for example in the context of integrated studies that also pay attention to types of vegetation, cultivation and to the various species that graze on inmark and outmark land.

Buildings

Norwegian agriculture has Europe’s highest building costs. This is due in part to climatic conditions. Experience suggests that new technologies will enable us to improve animal welfare, reduce the likelihood of infection and reduce costs. Research capable of helping to develop more objective welfare parameters based on physiology and behaviour will be given priority, together with research on simple building technologies which will allow production to take place within acceptable economic and welfare conditions. Applicants

should be able to document good contacts with relevant user and research groups in Norway and abroad.

Animal health

The pharmaceutical industry in Norway is small and the development of medicines for livestock is a low-priority area. For this reason, it is unrealistic to expect major contributions to user-directed studies of therapeutic regimes or the development of vaccines for livestock. The Programme Board thus regards it as reasonable to emphasise preventive measures against livestock diseases as its first priority in the field of animal health. On the basis of experience gained during the past few years it will also be necessary to raise our level of expertise in areas related to risk analysis, particularly with regards to infectious diseases, basic studies of the efficiency of preventive measures and cost-benefit analyses. These areas require a combination of statistical epidemiological approaches and thorough knowledge of local conditions.

The Programme Board will give priority to the prevention of diseases that are of economic significance in the type of livestock concerned. Studies of basic utility in understanding resistance to disease in livestock will also be given priority. The same can be said of research on immunological and nutritional mechanisms for the prevention of disease and breeding measures capable of improving animal health in the long term. The Programme Board will encourage collaborative research that is capable of shedding light on interactive effects involving resistance to disease, nutrition and breeding factors. Better understanding of metabolic illness and mastitis is important. The Programme Board will place emphasis on research that can improve animal welfare, for example by reducing the incidence of mastitis and bone disease.

Research in connection with monitoring and reducing the incidence of disease of livestock must be seen in connection with the financing of management measures carried out by the agricultural authorities.

Family pets and animals in sports

Family pets and animals used in various types of sport are of great importance for the quality of life of large sectors of the population. Livestock producers near large cities can both win goodwill and make a reasonable living by developing expertise-based services related to horse-riding and kennel operation. The social effects of this type of animal husbandry are much wider than can be measured in monetary terms. The Programme Board believes that researchable problems in this field should trigger research within a few selected topics.

Research on the physiology of training in Norway is weak. For example, little research has been done on the sufferings of horses as a result of "high performance". The relationship between feeding and performance is another relevant topic for research. Scientific activity in this field must be based at the Norwegian Agricultural University (NLH) and the Norwegian College of

Veterinary Medicine (NVH) and should take place in collaboration with important user groups such as the Norwegian Trotting Association and the Norwegian Horse Centre.

Most of the dog food on sale in this country is imported. In the course of the past few years a number of Norwegian products have been developed. It is important to improve these products in order to make them more competitive. The Programme Board regards this area as very suitable for user-directed research.

Research on important hereditary illnesses and diseases with a genetic disposition should be given priority, e.g. skeletal, immune and tumour diseases. Norway has international responsibility for seven races of dogs. Mapping the genes that cause disease in these races could be an appropriate user-directed project.

Animal husbandry in areas containing livestock predators

In some parts of the country, sheep and goat farmers find the predator situation a serious problem. Some of the measures that have been implemented in order to deal with the situation have negative effects on animal health (parasite infection) and productivity. The predator management authorities need more knowledge of the effects of predation. The Programme Board will give priority to cooperation with outmark research in the Research Council's Division of Environment and Development (MU), with a view to project collaboration.

Behaviour

A number of problems related to domestic animal welfare can be studied via ethological and physiological methods. In the course of the past few years user-directed research in this area on fur-bearing animals, pigs and poultry has been carried out. This work should be extended to cover cattle and should be linked with research on more reasonable animal housing methods, with a view to economic and welfare-related benefits. There is a great need for further work on more animal-friendly forms of production in the poultry industry. The Programme Board also wishes to encourage the development of expertise in basic ethological and physiological questions related to questions of animal welfare.

Integrated plant and livestock production: special products

In collaboration with the Food Programme and the Rural Development Fund, the Programme Board is prepared to co-finance the development of integrated local production that will be capable of strengthening local value creation in both plant and livestock production. Developing quality lines for pork or poultry products is an example of this sort of effort.

Quality of livestock products

In collaboration with the Food Programme the Programme Board should contribute to the rapid development of measures and methods that will improve the quality of Norwegian beef. Among other relevant areas of collaboration, research on fatty acid patterns in dairy products and on poor-tasting milk and pork is worth mentioning.

Development of resistance

The development of resistance to antibiotics in livestock production is making the treatment of infectious diseases more difficult. Such resistance is also a threat to human health. There is a sharp media focus on this topic, even though this phenomenon is not a significant problem in Norwegian animal husbandry. The Programme Board believes that there is a need for a deeply rooted reinforcement of the expertise of research groups in this field. This can be achieved most efficiently via a *strategic programme*. There is also a need for more work to be done on alternatives to the use of coccidiosis preventers in poultry-keeping.

Programme area: *Forms of operation, industrial development and economics*

Project areas:

Cost-reduction measures and economic results

In order to meet the pressure exerted by growing international competition it is important to lay great stress on reducing costs. In all links of the value chain, therefore, there is a need for knowledge adapted to Norwegian natural and structural conditions which may help to produce more reasonable solutions. Production systems and operating forms change in the course of time, but they are often characterised by long-term capital being tied up in buildings, machinery and other basic capital goods. More emphasis must be laid on rational technical systems and cost reductions, while not neglecting environmental considerations. Relevant projects might deal with buildings, techniques, the choice of technologies suitable for our climate, scope of production and operating forms. Emphasis will also be placed on projects capable of leading to better operating economy in various types of production, improvements in the overall economic situation and more efficient financial control. Projects that take up questions of improved organisation and new forms of cooperation may also be supported.

Quality and quality documentation

The most important advantages of Norwegian agriculture will continue to lie in its environmentally friendly and ethically acceptable production, which help to guarantee its safety and ensure its acceptance by Norwegian consumers. Reinforcing and developing this quality profile, e.g. by means of documentation and quality control, will be of decisive importance in assuring Norwegian products a large share of the market. The Agricultural Quality System (KSL) is

still in its development and introductory phase. The Programme Board feels that projects that can follow up and evaluate the work of KSL, both as a practical tool for the individual farmer and as a means of communicating the quality profile to consumers, ought to be encouraged. Projects in this area must be implemented in collaboration with industry.

Health, environment and safety in agricultural workplaces are important aspects of the quality system. Even though a good deal of work has been done in this area, risk factors still need to be evaluated, while preventive measures capable of reducing the frequency of accidents, injuries and physical deterioration of the workforce need to be developed. The insurance sector could be an appropriate partner in user-directed projects.

Innovative goods and services

If innovation is to be encouraged it will be necessary to employ resources to exploit small-scale commercial units, local advantages and rural traditions. The Programme Board believes that financing such projects is not the role of this programme, and that BU funding would be a more appropriate source of finance.

The organic waste produced by our industrialised society is a major environmental problem which is capable of being turned into a resource and of being used for new value creation in agriculture. Waste can be used for soil improvement, animal feed, fertiliser and as a source of energy. The prerequisite is that this should be done in such a way as to support the quality profile of agriculture and promote consumer confidence in Norwegian food production.

Changes in frame conditions are arousing interest in alternative uses of agricultural land. There is a need for research on alternative crops and on how these can be utilised, e.g. oilseed rape, turnip rape and linen for oil and fibre products. There is also a growing interest in health foods and in herbs and spices, and in the use of plant-derived substances for the production of dyes, cosmetics and medicines. Better knowledge of the quality criteria for production of this sort can improve profitability and open up new applications.

Ecological agriculture is being given high priority by the authorities. For this reason it will be necessary to increase our research efforts in this area. The Programme Board refers in this context to the Ministry of Agriculture's Action Plan for Ecological Agriculture (1988-1999) and to allocations in the National Budget and the Agriculture Agreement. The Programme Board will be able to support projects in this area as an integrated part of the research in the areas covered by the programme.

Action Plan for

1. AQUACULTURE - Production of aquatic organisms

2. Objectives

Secure and develop the technological and professional bases of a market-oriented, environmentally and resources-friendly production of aquatic organisms.

Subgoals

- To acquire new knowledge for the development of salmonids via the optimisation of production methods.
- To create a technological basis for the commercial production of marine and other species by obtaining well-founded knowledge of the biology of the species concerned, and of their requirements in the context of aquaculture.
- To acquire knowledge that will help to ensure the quality of the product throughout the value chain, with due regard to the wishes of the market.
- To acquire knowledge that will guarantee the safety of the food production process, the environment in which the animals live, and their welfare.
- To provide knowledge capable of offering new openings for aquaculture businesses .

The programme is organised in terms of the following eight sub-programmes

Sub-programme 1: Quality in production

Objectives:

- To gather knowledge capable of providing a basis for the control of product quality, particularly through better understanding of farmed species as raw materials.
- To gather knowledge of how loss of quality can be avoided, both at the farming stage and during handling and transport.
- To gather knowledge of relevance to the improvement of measurement techniques and instrumentation for quality-oriented research, grading and sorting.

Sub-programme 2: Slaughter, transport and distribution

Objectives

- To acquire knowledge of relevance to the development of methods and technology for the transport and handling of fish and other farmed species.
- To develop methods of transport, handling and slaughter that take the welfare and health of the fish into account.
- To establish methods for the handling, transport and distribution of live and fresh material that will guarantee high-quality products.

Sub-programme 3: Production and operation

Objectives

- To develop our basic knowledge of the biology of salmonids in freshwater and seawater as a basis for an efficient and safe production of high-quality fish for stocking, smolt and fish for consumption.
- To establish a better knowledge base for the maintenance of breeding stock and for the safe production of marine fry of well-defined quality.
- To acquire new knowledge of the biological conditions necessary for keeping fry and adult stages of marine species in aquaculture.
- To improve our understanding of the effects of the fish-farming environment on the organism, as a basis for scaling up and developing new production strategies and systems.
- To determine the causes of disease during production in intensive aquaculture systems.

Sub-programme 4: Health and disease

Objectives

- To acquire knowledge of the basic mechanisms involved in the development of disease in salmonids and relevant marine species.
- To acquire knowledge that will enable us to combat and prevent disease in salmonids and other relevant species in Norwegian aquaculture.
- To develop methods and aids for better diagnostic techniques and more effective preventive measures.

Sub-programme 5: Feed, nutrition, feeding and feed technology

Objectives

- To develop basic knowledge relevant to the development and use of feeds for cost-efficient growth, normal development and defined quality in relevant farmed species.
- To improve our understanding of the interaction of nutrition, environment and genetics as a principal element in preventive health care for all farmed species.

- To utilise basic research in nutritional biology to generate knowledge that will guarantee the production of high-quality eggs and fry of relevant marine species in aquaculture.
- To extend our knowledge of alternative feedstuffs.

Sub-programme 6: Breeding and genetics

Objectives

- To develop measurement methodologies and acquire knowledge of basic genetic parameters of central production characteristics of important farmed species.
- To acquire knowledge for the development of relevant breeding programmes and improve their efficiency.
- To acquire knowledge of genetic markers and of how DNA technology can be exploited in breeding.

Sub-programme 7: Technology and equipment

Objectives

To acquire knowledge which will enable players on the Norwegian aquaculture scene to develop technology and equipment capable of:

- reducing escapes of farmed fish
- improving the work environment
- ensuring cost-efficient and environmentally friendly production.
- offering Norwegian suppliers and technology companies competitive advantages in their export markets.

Sub-programme 8: Environment

Objectives

- To understand how escaped fish affect wild populations, and to acquire knowledge regarding measures capable of reducing the negative effects of escapees on wild fish.
- To develop knowledge capable of leading to a reduction in the transmission of disease, agents of infection and parasites between wild and farmed populations.
- To acquire knowhow which will bring about a reduction in the consumption of chemical inputs in aquaculture.
- To acquire knowledge that can help to prevent areas around fish farms from becoming overloaded.

Industry and Energy Division
Briefing material for Divisional Review

Evaluation of the Research Council of Norway

Briefing Material prepared by the Industry and Energy Division

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Appendix 1: Strategy for industrial research and development (1998)

Appendix 2: The enabling technology and knowledge areas of the Research Council

Appendix 3: Industry and Energy Division - Programme Catalogue 2001

1. History, Scope and Changes in the Industry and Energy Division

1.1. Background

To really understand the historical development of what is now the Division of Industry and Energy (IE), it is necessary to go back to the founding of the Royal Norwegian Council for Scientific and Industrial Research (NTNF) and trace the most important events and changes from the political perspective.

The best, most authoritative description of developments up to the establishment of today's Research Council of Norway may be found in Appendix 2 of NOU 2000: 7 "New impetus for innovation" (the Hervik Committee). This appendix was written by Olav Wicken of the University of Oslo, and is entitled "Industrial R & D - a historical perspective". Parts of the content of this chapter are based on Wicken's descriptions.

1.2. R & D as science policy (ca. 1950 - 1965)

In 1947 it was decided to set up a research council for industrial and technological research, NTNF. NTNF's activities during the 1950s and 1960s were largely an implementation of the idea of the importance of building up a sector for the development of "science-based technology" as a foundation for industrial development. A number of institutes were established to address the task of technological development in various fields. NTNF also gradually established specialised institutes that were not directly involved in technology development. The growing institute sector and NTNF were run by researchers, most of whom were technologists. Throughout the science policy period, it was the "research engineers" who had the strongest influence on how resources were employed and which projects were launched. Researchers became the dominant group in the formation of industrial science policy.

1.3. R & D as industrial research policy (ca. 1965 - 1980)

In the early 1960s, research and education emerged as basic factors in the development of society. For the first time, research was directly involved in a more concrete industrial policy. Products based on a higher degree of processing had to be developed to promote further growth and a higher standard of living, and they depended on high levels of research input and a highly qualified workforce. Some representatives of industries with low R&D levels criticised NTNF and the institutes for their lack of interest in collective research (research aimed at whole industrial sectors). Attempts were made to obtain a larger share of public-sector funding for research of this type.

Criticism of the conditions of that time created a climate of consensus regarding the need to raise the level of technology and research in industrial companies.

Industrially-Operated Projects (1967) was the result of pressure put on NTNF to give industry more control over projects financed by the Council's funds. During the first period (until 1974) about half of the funding was allocated to the institutes and half to individual

companies. The scope of this scheme was considerable, and as early as 1970 it accounted for 40 per cent of all the project funding channelled through NTNF.

1.4. R & D as technology policy (ca. 1978 - 1992)

At the international level, the downsizing and reorganisation of industry raised the level of unemployment in Europe and engendered interest in growth and new policies for growth. Technology was regarded as the dynamic force driving the renewal of the economy, and new technologies with the potential for growth were defined as target areas for industrial policy.

The formalisation of a new industrial policy, i.e. a technology policy, was expressed through a series of public sector studies and reports in the early 1980s. The development of what were known as the “Growth Packages” in the Ministry of Industry was the dominant influence on industrial R & D policy. The “main target areas” policy was put into effect starting in 1986 - 1987, and lasted until 1990 - 1991. In ideological terms there was a shift towards greater emphasis on the role of the market in industrial development. This had consequences first and foremost for the institute sector in NTNF. In the mid 1980s, the institutes were “demerged” from the Research Council, i.e. they were no longer owned by NTNF, but in most cases were reorganised as independent foundations.

The Technology Agreements were among the most important means of promoting R&D during this period. The oil companies were given credits according to the amount of R&D carried out in Norway. These credits were taken into account when the oil companies were evaluated for the awarding of new licences.

Practical policy-making arrived in advance of more wide-ranging studies of the new direction in industrial policy from the end of the 1970s. In 1977, NTNF, which had aroused little interest among politicians during the period of economic downturn, realised that there was a possibility of getting back into closer contact with political circles. The Research Council managed to obtain extra funding of NOK 30 million to distribute to industry in 1978, a sum that climbed to MNOK 50 for each year that followed until 1982, making a total of MNOK 230 (the Innovation in Industry Plan).

1.5. R & D as innovation policy (ca. 1993 to the present)

Introducing user-driven research

The Norwegian economy’s crisis years after the end of the 1980s had consequences for the country’s economic policy. Industrial policy formed part of a broader political framework, the aim of which was to make “Norway Ltd” more productive and efficient. The industrial policy concept also implied that the service sector be included in the range of measures employed.

Industrial policy also became regional policy, in which SMEs were given a place. “User-driven research” was introduced as a concept by NTNF at the beginning of the 1990s, and this soon became the predominant means by which NTNF distributed its industrially relevant R & D support. This system put industry in the driver’s seat, since it was up to industry to submit applications for research grants, while contracts for public-sector support were signed with companies or consortia rather than with institutes, universities or colleges.

The complex range of measures was employed. Prior to 1993, there was a series of reorganisations of the measures employed in some parts of these areas. The Norwegian Industrial and Regional Development Fund (SND) was established by merging the Industrial Fund, the Small Companies Fund, the Industrial Bank and the Regional Development Fund. At the same time, Norway's five research councils were merged to form the Research Council of Norway (RCN).

Division boundaries in the Research Council of Norway

The new Council was organised into six divisions. The all-encompassing vision that underlay the new structure was that everything from basic research to applied research could be dealt with under the same roof. Ideally, therefore, the Industry and Energy (IE) and of Science and Technology (NT) divisions should have been made into a single division. For the sake of balance in the Council and the (budgetary) size of these two areas, industrial research was divided between IE and NT, in that IE was given responsibility for applied industrial research, and NT for basic industrial research including strategic institute and university programmes. In many ways, this organisational solution was an anomaly, given the original concept of integration within the Research Council's individual divisions.

Efforts towards serving a wider range of users

Experience from NTNf had shown that most funding for user-driven research went to a relatively limited number of major primary producers and engineering companies. This group gradually expanded to include a few electronics and IT companies. This was the situation throughout the history of NTNf, and was particularly true during the final phase of the NTNf from 1987 to 1993. This appears to have gradually changed following the establishment of the Research Council. The fact that user-driven research is now less concentrated in the hands of the large R & D-intensive companies is also clearly reflected by the design and underlying intentions of many of the user-driven programmes. A growing number of projects involve SMEs with low R & D intensity. Especially since the launch of the Research Council in 1993, more emphasis has been placed on measures related to building bridges between companies, universities and colleges and the research support system, as well as on the commercialisation of R & D results. Examples of such programmes and sub-programmes in IE include BRIDGE, TEFT, SME-Competence, SME-College, RUSH, REGINN and FORNY. These programmes have been developed in close co-operation with the Ministry of Local Government and Regional Development, which has also provided a significant proportion of their funds, together with NHD (the Ministry of Trade and Industry). Programme activities of this type in IE have grown from an insignificant level in 1993 to a financial scope of MNOK 96 in 2001, which amounts to 14 per cent of IE's total budget. The scope of IE's other programme activities has experienced a reduction during the same period, from MNOK 620 in 1994 to MNOK 591 in 2000.

Programmes aimed at aspects of knowledge generation other than research alone, many tailored for small companies, were also launched. Programmes were launched to develop management, strategic and organisational competence in companies (e.g. BU 2000). All in all, there seems to have been a tendency to broaden the scope of the measures under the category of "knowledge". The combination of industrial and regional policy designed to promote

companies and industries has also created links between SND and IE at the local level, where SND's regional apparatus is now being used to involve local companies in IE's programmes.

When the Research Council was set up in 1993, IE took over a portfolio of 50 programmes from NTNF, each of which had its own programme board and programme manager. These programmes were predominantly sector-oriented, and many were relatively limited in scope. During the whole of the subsequent period until the present day, one express aim has been to cut down the number of programmes and the amount of administration related to programme activities. By 1996, the number of IE programmes had been reduced to 16 broader programmes, a figure which was reduced to 10 by the recent restructuring in 2001.

2. Strategy

2.1. A new strategy for industrial R&D

As mentioned in the previous chapter, a major strategic shift took place around 1990 with the introduction of the UOR schemes (User-Oriented R&D Support to Industry). Government support was channelled through industrial enterprises, rather than directly to the R&D –institutes performing the research. Programme boards were to consist of researchers and industrial partners alike, with the latter having decisive influence on the programme agenda. There was an overall evaluation of this new approach in 1996, covering all UOR programmes in the 1990-95 period (around NOK 4 billion in funding).

The evaluation in 1996 and a customer survey made in 2000 confirmed the need to make certain changes in the Research Council:

- improved co-ordination of the Research Council’s various instruments
- closer collaboration between divisions with regard to the long-term building up of knowledge and approaches to meeting trade and industry’s needs for knowledge.
- greater openness, flexibility and competition with regard to project funding.
- better adaptation of programmes (designs) to variations in target group needs and supporting R&D institutions’ areas of expertise

Work on a new strategy for the overall industrial R&D started in 1997 and the Executive Board approved the «Strategy for Industrial R&D» in February 1998 (see appendix 1). This strategy conceives two pillars: the UOR schemes as the first, and support for industrially relevant strategic basic research as the other. The vision is to stimulate ‘winning R&D coalitions’. Public support was believed to be most valuable in cases where various industrial and knowledge institutions offered each other mutual benefits by bringing together complementary competencies and resources and by forming strong alliances. The strategy thus stresses the need to assess the value of the R&D support within the context of value chains and industrial clusters.

2.2. Implementation: R&D structure for value creation (FFNV)

The implementation of the strategy has been given the name R&D structure for value creation (FFNV). It involves all divisions of the Council, but mainly IE and NT. FFNV highlights technology and other areas where there is a need for stronger co-operation within the Council, for example concerning the “enabling technology and knowledge areas” described below.

To implement the new strategy, as well as to meet the demands brought forward by the evaluation of 1996 and the customer survey of 2000, in 2001, the Industry and Energy Division (IE) has restructured its programme portfolio for research and development aimed at business and industry. The division has also improved the administrative routines for operative and strategic co-operation.

IE’s new portfolio

The new programmes will be put into operation from 2002. Ten new “innovation programmes” will replace the current 20. These programmes will address broader target

groups than the previous programmes, and are thus expected to promote keener competition and raise project quality. Furthermore, the new programmes are aimed more at clusters and value chains than at single sectors, and are intended to combine competence in new ways. Three of the ten innovation programmes differ from the others: They focus on encouraging companies to do research and on commercialising R&D results.

As a part of the innovation programmes, one new policy instrument has been introduced parallel to the user-driven projects: enabling strategic projects with user participation (KMB), as described below. IE has also introduced calls for applications to user-driven projects. However, new customers will be treated on a continuous basis.

Innovation programmes

IE's innovation programmes are justified on the grounds that commercial R&D is expected to trigger a large potential for value creation. Public funding makes research projects financially viable and thereby reduces the risk for the companies involved. In addition, IE's intervention enhances external economies by extending networks and broadening project goals. The new programmes are partially cluster-oriented and partially technology oriented. The Programme Boards of these programmes will be responsible for the user-driven innovation projects and the enabling strategic projects.

- ***User-driven projects*** represent the most important instrument. Commercial players are responsible for carrying out the projects, and the enterprises finance at least 50 per cent of the costs.
- ***“Enabling strategic projects”*** (KMB projects). In areas where the business community perceives a need for greater expertise and this is not being funded any other way, the Industry and Energy Division will provide up to 80 per cent of the funding for a project, provided commercial players provide at least 20 per cent in cash. R&D-institutions apply to and serve as contract partners for these projects. This instrument will focus on a number of enabling technology and knowledge areas.

Enabling technology and knowledge areas

The enabling technology and knowledge areas are arenas of co-operation between research communities and trade and industry and arenas for co-operation between the various different Research Divisions in the Research Council of Norway. These areas are briefly described in appendix 2.

In addition to being assessed on the basis of their scientific and academic quality, these special areas must be deemed to be of special importance for future innovation and value creation in business and industry.

What the restructuring is expected to achieve

The restructuring is expected to result in:

- a closer connection between strategic research at universities, colleges and institutes and user-driven research;
- a better project portfolio as a result of greater competition for project funding;
- stimulation for more collaboration between companies in value chains and clusters;

- greater clarification of the criteria for funding that are given the highest priority in the processing of applications, better information about the instruments available and greater openness in connection with the processing of applications;
- improvement of routines and competence in the Research Council's administration.

Consequences for the organisation within the Research Council

One important objective of the restructuring is to promote closer contact and greater interaction between the user-driven research performed under the auspices of the Industry and Energy Division and the more fundamental industrial research performed under other divisions of the Research Council. In addition, commercial players will have more opportunity to influence the long-term production of knowledge at universities, colleges and research institutes, at the same time as they will become more familiar with the possibilities for innovation that research communities envisage. Thus the implementation of the strategy involves most of the divisions in the Council. Success will depend on close participation with the other divisions. This is particularly important with a view to the development of new enabling technologies. The Strategy points out the need to identify and concentrate resources in 'Key Areas'; i.e. fields of technology where it is of national importance that Norway remain in the forefront of developments. "Keys areas" are defined as focused areas within the enabling technology and knowledge areas.

The skills and expertise required by trade and industry are often based on a synthesis of knowledge from several different subject areas and scientific disciplines, as they are conventionally defined and delimited at universities and colleges. It is precisely this kind of expertise which must always be kept up-to-date to allow commercial players to apply it and/or adapt it to create innovations, large and small alike.

Portfolio monitoring and evaluation

One important task entrusted to the Research Board of the Industry and Energy Division is the adjustment of the programme portfolio to ensure compliance with requirements regarding quality, strategic considerations and political constraints. Based on the evaluation framework of 1996, there have been annual follow-up portfolio reviews. A new evaluation strategy is currently being prepared.

2.3. Achievements and impacts

In co-operation with professor of economics Arild Hervik, efforts have been made to assess the economic value of IE's activities. Its economic value might be broken down as follows:

1. Direct impact of R&D/Innovation project on the financial statements of participating enterprises.
2. Value of competence improvements (beyond the scope of the project supported) for participating enterprises.
3. Value of improved networks (beyond the scope of the current project) for participating enterprises.
4. Value of improved competence to the institutes performing R&D.
5. Consumer surplus of new products and services.
6. Increased value of natural resources and the environment.

Only the first of these components can be quantified, and only around 1/3 of the enterprises are in a position to deliver such estimates, due the large uncertainty of outcomes. However, based on the information available, the conclusion is that the portfolio shows a small, but significant net return considering the first component alone. Based on qualitative assessments of the relative importance of the various economic value components, there is reason to think that (2) and (3) might be as important as (1). (4) is significant, and may be comparable to the costs of the R&D carried out during a project, i.e. the R&D institution gets paid for its products and services in addition to experiencing an equally large net benefit. (5) is probably quite large, but there are no methods available to assess this component. (6) is quite large for particular projects. Overall, there is no doubt that the IE portfolio has a significant and positive impact on Norway's economy.

Scientific and industrial achievements are reported on an ongoing basis. Among the major indicators in 2000 are (all figures are approximate):

- 800 new or improved products/models/prototypes
- 350 published articles in refereed journals
- 110 new patents
- 90 new companies established
- 80 new business areas developed within existing companies
- new technologies introduced in some 1000 Norwegian companies.
- 80 new Ph.D.s (and close to 250 Ph.D. students in the pipeline).

2.4. Strategic plans for the future

IE is about to start the process of developing a new divisional strategy. This formal requirement has evolved as a consequence of an effort to simplify the structure of the documents that govern the Research Council. The structure of strategies will then be commensurate with the organisational structure, i.e. one division, one strategy. However, from the point of view of IE this is the next-best solution. Given the need for cross-divisional and multidisciplinary R&D for industrial innovation activities, the current Council-wide 'Strategy for Industrial R&D' would have been preferable. The new divisional strategy will be predicated on the same basic way of thinking, but more explicitly consider how IE can achieve the same goals by means of networking and collaborating with the other divisions. IEs is about to start the process of developing a new divisional strategy.

3. Governance

3.1. Stakeholders

The Government

The Royal Norwegian Ministry of Trade and Industry (MoTI) is by far the most important ministry for the Industry and Energy Division. MoTI provides the lion's share of the funding for Industry and Energy. MoTI is responsible for the majority of industrial policies and the ministry is the main target of IE's research policy advice.

Other important governmental stakeholders are the ministries of Petroleum and Energy, Environment, Communications, and Local Government and Regional Development.

Industry and Energy bears the formal responsibility for maintaining and developing relations with MoTI and the Ministry of Petroleum and Energy. IE has regular (monthly) meetings with MoTI.

Relevant industrial enterprises and service providers

Industrial enterprises and service-providers are the main source of project funding (minimum 50 per cent of total costs) and the primary users of the R&D results of user-driven innovation projects. The enterprises flesh out the content and plan project implementation. Projects awarded funding will in most cases be implemented by several enterprises in co-operation, but the project-consortium will be fronted by one of the participants acting as the Research Council's official contractual partner. R&D activities under the projects will ordinarily be carried out at an institute or university.

Occasionally, industrial organisations such as the Federation of Norwegian Manufacturing Industries (TBL) will apply on behalf of a rather large number of enterprises on issues of more general interest.

The research community

As described in Chapter 2, institutes and universities apply to and serve as contract partners for Industry and Energy in IE's new enabling strategic projects (KMB). These projects are carried out in close contact with industry, and industrial participants are expected to finance at least 20 per cent of total costs.

The institutes are usually responsible for carrying out R&D activities under user-driven projects. Funding from Industry and Energy provides the means to purchase R&D services from institutes.

3.2 Description of Governance in Industry and Energy (IE)

IE's Research Board

IE's Research Board bears the overall responsibility for activities within the division's sphere of responsibility. The Board adopts objectives, strategies and budgets and acts as a discussion

partner for the administration. The Board endorses new research programme proposals and approves programme plans. The Board appoints the members of the Programme Boards and allocates annual programme budgets.

IE's Research Board consists of seven members and three deputies. Members are appointed by the Research Council's Executive Board for a four-year term and are eligible to be re-appointed for a second four-year period. They do not represent the institutions by which they are employed. The Research Board has a wide range experience and expertise and is composed to reflect the main responsibility of Industry and Energy, i.e. to support national value creation by promoting R&D in industry and service.

The Division's Research Board meets six to eight times a year, normally for half a day. One meeting each year is devoted mainly to strategic issues and lasts one-and-half to two days. Agendas and preparations for proposals are handled by the administration, which also presents items at the meetings. The Research Board generally performs its functions at the meeting. Rather substantial authority is delegated to the administration. The current Research Board was appointed in March/April 2001, and Industry and Energy is in the process of establishing working relations with it. The Division Director and the chair of the Research Board are frequently in close contact between meetings. The chair takes part in some of the Research Council's Executive Board meetings (particularly the budget and strategy meetings) and meets with the chairs of other research boards and with the director general of the Research Council.

IE's Programme Boards

IE's research activities are currently organised into 10 multi-annual programmes with a duration of eight years. Programme Boards consisting of seven to nine members are appointed for each programme. The Programme Boards are responsible for achieving the objectives set for the various programmes by selecting from among solicited proposals and determining the most appropriate funding. The administration prepares project assessments and proposals for review and decisions. Programme Boards develop their own priorities within the boundaries of the programme plan and annual budgets allocated by the Division's Research Board. A Programme Board submits a programme budget for the following year and reports programme results to the Division's Research Board on an annual basis. The Programme Board is intended to advise the IE's Research Board on strategic issues related to the relevant programme.

Programme Boards consist of members from industry and the research community.

3.3. Creating links to other divisions

Contacts with other divisions are both formal and informal and may take different forms:

- contact in dealing with matters that require co-ordination;
- contact through projects (internal) organised as joint projects;
- contact through jointly organised programmes;
- contact at management level through weekly directors' meetings;
- specific processes that involve interdivisional co-operation.

Formal links are established through a few shared programmes/target areas

IE/Medicine and health	Commercialisation and capital gains from medical research (MEDKAP)
IE/Culture and Science	Value-creation 2010 (VS 2010) The knowledge basis for industrial and innovation policy (KUNI) (under planning) Language technology (on project basis)
IE/Science and Technology/ Environment and Development	Industrial ecology
IE/Science and Technology	ICT strategy, assessment of SIP and SUP
IE/All divisions	Budget forum

There are numerous co-ordination and project groups, e.g. for Centres of Excellence, ICT Forum, Environment and Climate Technology, Performance management system, Research Council strategy, international strategy, annual reporting, application procedures, etc.

As described in Chapter 2, IE's recently established KMB is based on the Research Council's defined enabling technology and knowledge areas. The description and elaboration of these areas has been carried out through an interdivisional process which has involved most of the divisions, but mainly Science and Technology.

Formal contacts are established through the participation of the chairs of all divisional Research Board meetings when matters relating to strategy and budget issues are discussed. IE's Research Board has met with the Science and Technology's Research Board on several occasions. The Director General has attended IE Research Board meetings on several occasions, and the executive directors of other divisions have been invited to IE Research Board meetings when appropriate.

4. Portfolio of Activities in 2000/2001

4.1. Introduction

The Industry and Energy Division of the Research Council of Norway (IE) is organised in three operative departments, and one department for strategic affairs and international relations. The activities of the four departments will be described in detail in this chapter.

The three operative departments bear strategic responsibility for all aspects related to innovation and industrial research policy within their program areas. This means initiating and planning analyses and strategies within defined areas, activities and programs. These departments are also responsible for strategic activities on the behalf of the Research Council in general within relevant fields. In addition to their program responsibilities, administrative activities at the divisional level are divided among the operative departments.

The Department for Strategy and International Relations has been responsible for the new "research strategy for industrial value creation" and for developing new programmes and key areas, as described in Chapter 2. This strategy is now at the implementation stage. Other major areas for this department are the division's international relations, general relations, and a variety of programmes at the divisional level and projects outside the specific programmes.

As described in Chapter 2, a new portfolio of innovation programmes has been designed to encourage keener competition and better projects, as well as to increase co-operation along value-chains and within industrial clusters. The new portfolio will be effective as from 2002. This implies a reduction from the former 20 programmes to ten innovation programmes:

- Maritime and offshore operations
- Oil and natural gas
- Information and communications technology (ICT)
- Services, commerce and logistics
- Energy, environment, building and construction
- Process and biomedical industry
- Manufacturing and materials industry – Manufacturing and material conversion
- Mobilisation for R&D-related innovation (Programme for bridging the gap between industry and research)
- Commercialisation/FORNY – the creation of research-based new businesses
- Value Creation 2010

The first seven are user-driven innovation programmes and will support the user-driven innovation projects as well as the enabling strategic projects that address the Research Council's enabling technology and knowledge areas, as presented in Chapter 2.

The following three programmes are of a different nature, and will be described in chapter 4.4.

- NIN - National Information Networks
- HOYKOM – Broadband communications in the public sector

- FAKTA - Knowledge of Technology and Industrial Policy

The total budget of the programmes aggregated MNOK 694.7 in 2001. Table 1 specifies the programmes that are effective as of 2001. These programmes are described in more detail in the programme catalogue in appendix 3. The table also shows how the programmes are allocated to the operative departments.

The remainder of this chapter is structured in accordance with the new programme portfolio which will be effective from 2002. Table 2 shows how the 2001 budget would have been divided under the new programme structure.

Table 1. Actual budget for programmes as of 10 May 2001

Energy and the process industry		
Power exchange and distribution monopolies	EFFEKT	35,4
Efficient, renewable energy technologies	NYTEK	30,5
NATURAL GAS - goods, services and processes 7	NATURGASS	13,1
Offshore 2010 8	OFFSHORE	30,7
The development and application of new knowledge to promote sustainable dev. in Norway's process and materials industry	PROSMAT	87,0
Economic Development for Medical Research	MEDKAP	9,7
ICT, service and manufacturing		
Programme for the building and construction industry	BA-programmet	26,1
The IT industry and the graphics industry	PROGIT	92,1
Programme for services/infostructure	TYIN	57,3
Programme for logistics, IT applications, transport	LOGITRANS	16,1
Maritime activities	MARITIM	49,0
R&D programme for the manufacturing industry	VARP	35,5
Productivity 2005	P 2005	18,0
Environmental technology programme	NORMIL	8,6
Technology for reducing greenhouse gas emissions	KLIMATEK	47,3
Innovation and technology networks		
Programme for bridging the gap between industry and research	BRO	61,1
Knowledge of Technology and Industrial Policy	FAKTA	4,4
The creation of research-based new businesses	FORNY	30,9
National information networks	NIN	23,7
Value Creation 2010	VS 2010	18,1
	Sum programs	694,7

**Table 2.
Budget for 2001 according to new programme structure**

Energy and the process industry	
Oil and natural gas	36 554
Energy, environment, building and construction	152 834
Process and biomedical industry	59 153
ICT, service and manufacturing	
Maritime og offshore operations	49 026
ICT	97 202
Services, commerce and logistics	70 511
Manufacturing and materials industry	81 438
Innovation and technology networks	
Bridging the gap between industry and research	102 947
The creation of resaerch-based new businesses	40 650
Knowledge of Technology and Industrial Policy	4 402
Total, programmes	694 717

4.2. Department for Energy and Process Industry

4.2.1. Description of the department

The department is in charge of the following R&D programmes:

- Energy, Environment, Building and Construction
- Oil and Natural Gas
- The Process and Biomedical Industry

The total budget for the project portfolio amounts to MNOK 630 in 2001. Public funding accounts for MNOK 245 of this. Three ministries contribute to the public funding for the budget:

The Ministry of Trade and Industry	MNOK 110
The Ministry of Petroleum and Energy	MNOK 110
The Ministry of the Environment	MNOK 25

Permanent personnel:

1 director, 3 programme co-ordinators, 4 advisers, 4 executive officers (12 man-years of labour)

Hired personnel:

7 programme advisers (6 man-years of labour)

4.2.2. The R&D Programme: Energy, Environment, Building and Construction (EMB)

Thematic research initiatives and target groups

As from 2002, the EMB program will cover the following areas:

- Energy: Energy systems, large hydropower systems, new renewable energy sources, end-use energy technologies, including the use of natural gas in the energy system
- Environment: Environmental technology, environmental aspects related to the sectors in the programme, technology for reducing the emission of CO₂, etc.
- Building and construction industry: All aspects of building and civil engineering construction and architecture, except for offshore construction.

Links to former R&D programmes

In 2001, there were six programmes covering the activities related to the EMB programme:

- EFFEKT, covering the hydropower industry and energy system;
- NYTEK, covering new renewable energy sources and efficient energy technology;
- NATURGASS, covering the distribution and use of natural gas in the energy system, and processes for converting natural gas to more valuable products;
- KLIMATEK, covering in particular technology for gas-fired power plants with minimal emissions of CO₂, but also other technologies for reducing CO₂ emissions;
- NORMIL, covering environment technologies;
- BYGG/ANLEGG (BA), covering the building and construction industry.

Important areas of research under the EFFEKT programme are:

- Technology, systems and environmental challenges in connection with power exchange with Europe;
- Distribution technologies and the regulation of effective distribution monopolies;
- Deregulated energy markets;
- Safety and the outdoor environment.

Important areas of research under the NYTEK programme are:

- Solar cells with emphasis on solar grade silicon, and solar energy integration in buildings;
- Energy from biomass and waste with low emission combustion systems;
- Large-scale wind turbines and grid integration;
- Hydrogen systems with focus on hydrogen storage;
- Power from salt gradients.

Important areas of research under the NATURGASS programme are:

- Small-scale production and distribution of LNG;
- Combined heat and power technology, with emphasis on low NO_x burners;
- Gas to liquid processes.

Important areas of research under the KLIMATEK programme are:

- Power generation from natural gas with decarbonisation and CO₂ capture;
- CO₂ sequestration (ocean storage, geological formations, biological fixation);
- CO₂ reduction from Norwegian offshore industry and land-based process industry;
- Greenhouse gas reduction from waste disposal.

Important areas of research under the NORMIL programme are:

- Waste management;
- Noise pollution monitoring;
- Ground water pollution;
- Green waste water treatment.

Important areas of research under the BA programme are:

- Energy and resource optimisation in building construction;
- Building infrastructure for transport and communications, and the environment;
- Construction processes and organisation, and the use of ICT.

Budgets and the allocation of resources

The total budget for the six programmes in 2001 is MNOK 152 (Research Council contribution).

In 2001, 75 per cent of the funding was allocated to user-driven projects, and the rest to the new enabling strategic projects. In addition to the MNOK 152, the participating enterprises are contributing MNOK 225 to the projects. Around MNOK 180 is being spent by universities and institutes, indicating that university/institute activities are higher than Research Council allocations.

Results

The statistical material from 2000 shows that the six programmes resulted in 70 articles published in refereed journals, and more than 300 presentations in newspapers and other mass media. A total of 68 new products were developed, as were 27 new processes, and 15 patents were taken out. Twenty new enterprises were established, and 19 doctoral students finished their theses (close to 100 doctoral students are engaged in the programme).

4.2.3. The R&D Programme: Oil and Natural Gas

Thematic research initiatives and target groups

As from 2002, the Oil and Gas programme will be focusing on the following thematic areas:

- Improved technology for underwater and down-hole processing and the long distance transport of oil and gas;
- Improved technology for geophysics, characterisation and control of reservoirs;
- Improved technology for exploration and drilling;
- Reduced emissions of greenhouse gases to air;
- Gas to liquids.

The programme will also help increase the ability of small and medium-sized enterprises (SME: <100 employees) to use R&D as a means of commercial innovation. Preference will be given to projects involving co-operation between oil companies, institutes/universities and supplier/service industry.

Links to former R&D programmes

The programme is a continuation of the research programme Offshore 2010 that has concentrated on two major areas of commitment:

- Down-hole and underwater processing and long distance transport of oil and gas;
- Small and medium sized enterprises (SME) – Innovation and commercialisation.

Budgets and the allocation of resources

The programme funds are granted by the Ministry of Petroleum and Energy (MPE) and the Ministry of Trade and Industry (MTI). Budget for 2001: MNOK 36 (MPE: MNOK 24, MTI: MNOK 10).

Public funding accounts for approx. 30 per cent of the total project. About 25 per cent of the funds are spent on long-term enabling strategic projects contracted directly to institutes or universities, while 75 per cent goes to innovations projects contracted to Norwegian enterprises.

While the oil companies are heavily involved in initiating and financing the projects, they are not involved in performing the research. The research is performed by the institute/university sector (35 per cent) and the supply industry (65 per cent). The focus on the SME sector is reflected by the fact that 50 per cent of the contracts are awarded to SMEs.

Major areas:

- Down-hole technology 29 per cent
- Subsea processing 46 per cent
- Wellstream transport 11 per cent
- SME (other areas) 14 per cent

Results

In 2000, the programme supported 40 projects, involving 57 Norwegian enterprises. The projects have an average of 3 partners. Ten per cent of the projects had international partners, and 55 per cent had some kind of international co-operation. Among the results were 29 new or improved products, six patents and 18 new or improved services. Project results have been presented at 47 international meetings/conferences and in 19 publications with peer review. The programme has 14 doctoral students.

4.2.4. The R&D Programme: The Process and Biomedical industry

Thematic research initiatives and target groups

As from 2002, the Process and Biomedical Industry programme will be focusing on:

- the production of tailor-made materials;
- environment-friendly production of materials and chemicals;
- new fine-grade and speciality chemicals based on modern biotechnology methods.

The programme will support innovation and knowledge building that is essential for the Norwegian process industry, biotechnology and the biomedical industry. The challenges facing the various sectors are clearly reflected in the main research topics.

Links to former R&D programmes

The programme portfolio autumn 2001 represents the main part of the portfolio from the PROSMAT-programme (1996-2001). The main research topics in this programme are: For the *pulp and paper industry*, representing 16 per cent of the funding, emphasis is on process improvements; effective power utilisation, environmental aspects and the development of new customer tailored products. In the *production of light metals* (aluminium and magnesium; 12 per cent of funding) emphasis is on increased production efficiency and output, internal and external environmental issues, and material properties as well as new concepts for electrolysis cells. The *ferroalloy and silicon industries* (7 per cent) emphasise process optimisation and control as well as the reduction of pollution. For the *petrochemical industry* (11 per cent), here mainly represented by enterprises that produce various polymers, the highest research priority is given to new catalysts, new methods for polymerisation and reactor technology. In the *biotechnology sector* (32 per cent), the main topics are the development of new medicines (antibiotics, cancer therapy, HIV/Aids medicines) and diagnostic/new analysis systems. Enabling strategic projects are in two areas: fermentation and bioinformatics. 50 per cent of the participating enterprises are recently established biotechnology enterprises.

Budgets and the allocation of resources

Total funding from the Research Council amounts to MNOK 62, where MNOK 55 goes to innovation projects and MNOK 7 (11 per cent) to Enabling strategic projects, KMB. The total

budget for 2001 is approx. MNOK 150 and MNOK 70 to 80 will be spent at the participating research institutes and universities. Doctoral studies carried out as an integrated part of the projects are strongly emphasised. In 2000, there were 53 doctoral students in the portfolio, and doctorates were awarded to 17 doctoral students who had grants from this part of PROSMAT. Emphasis is also attached to projects that encourage co-operation between, in particular, industrial enterprises and research institutes and universities, and between enterprises, preferably representing different links along the value chain or in clusters. International co-operation is generally favoured and five new Eureka projects were initiated in 2000/2001.

Results

An overall evaluation of the results reported in 2000 showed a significant output in terms of new or improved products, processes or services (80 reported); patents registered (24); the development of new or improved methods or models (150); the introduction of new technology (20 companies); new companies or business areas (10); scientific (refereed) publications (150); published presentations at international conferences (130); various non-scientific presentations (150) and notices in the mass media (90). The feedback from the broad range of participating enterprises indicates that the projects are viewed as generating highly useful results with a proven or anticipated potential to have a substantial impact on the commercial success of the enterprises. The public funding generally acts as a catalyst and is decisive to these achievements.

4.3. Department for ICT, Service and Manufacturing.

4.3.1. Description of the department

The department is responsible for the following R&D programmes:

- Maritime activities and offshore operations (2001 budget: MNOK 51.5);
- ICT (2001 budget: MNOK 87.6)
- Service, commerce and logistics (2001 budget: MNOK 66.1)
- Manufacturing and materials conversion (2001 budget: MNOK 77.1)

In addition, the department is responsible for the implementation of two multi-annual projects:

- IT for the disabled (2001 budget: MNOK 4)
- Risk and uncertainty research (2001 budget: MNOK 2.6)

The department also co-ordinates and promotes more integrated co-operation with SND, and is responsible for co-ordinating the Division's work with performance management system.

Personnel: A total 22 people (15.9 man-years of labour), of which 8 permanent staff (8 man-years of labour) and 14 hired (7.9 man-years of labour). The permanent staff comprises 1 director, 1 senior adviser, 2 advisers and 4 executive officers. Including the director, advisers and all the hired personnel, all members of the scientific staff have university degrees at the master's level. The other staff members, 4 executive officers, have a variety of IT, office management and technical skills.

4.3.2. The R&D Programme: Maritime and offshore operations (MAROFF)

Thematic research initiatives and target groups

The table illustrates the challenges and the corresponding themes of MAROFF will be running as from 2002:

Challenge	Theme ("demonstrator")
1. Increase value creation from Norwegian natural gas resources	1. Marine operations for "cheap" gas to consumer
2. Increase value creation from Norwegian seafood	2. High capacity production and distribution of seafood
3. Contribute to improved safety and environmental protection	3. Highly reliable sea transport
4. Re-vitalise Norwegian shipbuilding industry	4. The module-based ship
5. Develop and use the competence of the cluster more efficiently	5. Next generation networking company

The first two require participation along the entire supply chain and co-operation with other programmes which are, in fact, the prime "owners" of the challenges (the programme Oil and Natural Gas and certain BF programmes respectively). The remaining themes are of a more MAROFF "internal" nature, and their success is predicated on close co-operation across the

maritime industry. The last theme is conceived as being constituted partly as integrated parts of the other themes.

Links to former R&D programmes

MAROFF is the successor of the MARITIM programme, dedicated to the maritime sector or cluster (shipping, shipbuilding, ship equipment and maritime support services). However, MAROFF's range of activities has been extended to include maritime support services to the offshore oil and gas industry. This involves the well-diversified and highly specialised maritime activity known as "marine operations".

Budgets and the allocation of resources

MAROFF is inheriting a portfolio of projects from MARITIM, amounting to MNOK 26 or 70 per cent of the available public funding budget of MNOK 36 for 2002 (figure as of Aug. 2001). The grants for these projects were given priority in accordance with a different structure (MARITIM sub-programmes), so the portfolio profile has to be reconfigured to match the MAROFF structure. Four KMB projects started in 2001, adding up to MNOK 5 or 14 per cent of the total public grant in 2002. More KMBs are required to meet the demand for strategic and basic knowledge in the maritime cluster.

The table shows consolidated 2000 figures for the Research Council's maritime R&D (amounts in MNOK and percentages are of total projects cost unless stated otherwise):

- Total project cost MNOK 155
- Total grants MNOK 49 (31.7 per cent)
- Private part of grant MNOK 14 (General contribution from the shipping community)
- Public part of grant MNOK 35 (22.5 per cent. IE average: 36.6 per cent)
- Purchases from research inst. MNOK 22 (14.4 per cent. IE average: 29.2 per cent)
- Purchases from research inst. MNOK 22 (45.4 per cent. of the Research Council's remuneration. IE average: 79.8 per cent)

The average annual size of project grants in the current portfolio is MNOK 0.7 for 2001, increasing to MNOK 1.3 MNOK in 2002. The total cost of innovation projects varies from MNOK 3 up to MNOK 25.

Results

The results are highly diverse, ranging from better understanding of the shipping markets, the development of design methods and tools for ships, decision support tools for ship operation, concepts for transport systems and supply management control, information infrastructure standards and applications for shipbuilding, and e-business, to concept and prototype development for ships and equipment.

4.3.3. The R&D programme: Information and Communications Technology (ICT Programme)

Thematic research initiatives and target groups

As from 2002, the programme will focus on enabling technologies in three main technology domains:

- software technologies;
- communications technologies;
- micro technology and micro systems.

Respecting the trends of convergence and the increasingly multi-disciplinary nature of ICT applications, these technology domains will be treated as interrelated rather than as entirely separate areas. In addition, a number of truly cross-disciplinary themes such as user interfaces software and systems development processes, quality and safety aspects of systems are included.

The programme targets the ICT sector in the broadest sense, ranging from the manufacture of ICT products to ICT services, i.e. including the IT and electronics sector, telecommunications, software products and services, multimedia and net-based services. The programme will not directly address established service sectors, which are about to be transformed by ICT-based innovations. However, the programme will stimulate and support project partnerships where ICT products and services providers contribute to ICT-based innovations in other industries and service sectors.

Links to former R&D programmes

The new ICT programme will succeed a programme that focused more narrowly on traditional ICT industry sectors, and it will now encompass the entire ICT services sector. The project portfolio is expected to be dominated by industry-driven innovation projects, but with a significant (at least 20 per cent) share of enabling strategic projects (KMB projects) aimed at meeting future business needs for research and technology development in the ICT domain.

Budgets and the allocation of resources

The annual budget envelope for project grants from the Research Council amounts to some 10 million Euros (MNOK 87.6 in 2001). This budget is currently distributed among some 50 innovation projects, plus a number of smaller contracts to support feasibility studies and pre-projects of various kinds. It is expected that the new programme will also have a portfolio dominated by “innovation projects”, but that a significant share (at least 20 per cent) of the budget will be allocated to enabling strategic projects (KMB projects) to meet future business needs for Research and Technology development in ICT domains.

The total project volume of projects currently supported is about 4 times the amount of the project grants, demonstrating a strong industry commitment. The volume of RTD services acquired from institutes and universities under these contracts amount to approx. 70 per cent of the total project grants from the Research Council. In addition, some 20 PhD students receive financial support for their doctorate studies.

Results

The current portfolio shows good results in terms of technology and knowledge transfer. In a majority of projects, the R&D results contribute significantly to the implementation of new product prototypes, new methods or new production processes. The projects generally result in 15 to 20 registered patents on an annual basis.

4.3.4. The R&D programme: Services, Commerce and Logistics.

Thematic research initiatives and target groups

The target group for this programme will cover all enterprises and institutions that produce and/or supply services. These may be pure service providers or goods-producing enterprises for which the service content plays an important role. Prime target groups are:

- Private and public service providers, including consultants and providers of services within tourism, health and learning;
- Retailers and their partners in value chains;
- Logistics providers including transporters, integrated logistic chains and infrastructure providers.

Innovations made possible by the use of new technology play an important role.

Consequently, ICT enterprises and content providers are also part of the target group.

Four broad R&D themes are emphasised:

- Value creation in networks;
- New ways of conducting commerce and distributing goods;
- Logistics, including transport;
- Knowledge management.

As part of this, some narrower areas are also in focus:

- E-business and e-learning;
- Flexible/mobile ways of working – teamwork in geographically spread networks.

Links to former R&D programmes

In 2001, two programmes mainly cover the activities related to this programme:

- TYIN, covering knowledge intensive services with emphasise on net-based services, knowledge management and new ways of conducting commerce and distributing goods.
- LOGITRANS, covering logistics and transport.

Budgets and the allocation of resources

Most of the projects supported involve private enterprises in the driver's seat and focus R&D activities on their business interests (about 80 per cent). The rest are projects where the creation of new generic knowledge is the main goal, although it is influenced by participating enterprises to ensure it is attuned to the market.

Total cost	Research Council support	Participating enterprises' investment	Services purchased from R&D institutions	Support to participating enterprises
190	73	117	47	26

The figure above shows the amount (in MNOK) invested per year (2000 is used in the example) in the programme and how funding is shared between participating enterprises and R&D institutions. About 2/3 of the public support is spent in R&D institutions, thus creating new knowledge for the benefit of society-at-large.

Results

Results in the form of increased value added are generally visible only after several years. However, indications regarding such results as well as scientific results can be observed throughout the lifetime of a programme. In 2000, projects resulted in the establishment of six new enterprises and 13 new business areas in existing enterprises. In addition, development was completed on 61 new or modified services, products or processes. 22 students receiving financial supported under the programme were active in their doctoral studies on research topics related to projects in the programme.

4.3.5. The R&D programme: Manufacturing and materials industry – Manufacturing and material conversion (VARE-MAT)

Thematic research initiatives and target groups

The programme's ultimate goal is to use R&D to strengthen the competitiveness of Norwegian industry by boosting productivity and paving the way for the development of more market-oriented products.

In this context, the key challenges facing the manufacturing industry as a whole are:

- Manufacturing on demand and small series are replacing large series production;
- The application of new materials is increasing in new and existing products;
- More focus on environment-friendliness in products and manufacturing processes;
- More stringent requirements in respect of quality and costs;
- The focus is shifting from production costs alone to also include lifetime costs;
- Information technology is developing rapidly. Competitive application of IT on the production and integration of IT in manufactured products.

The long-term effects are to be ensured by:

- More long-term strategic research in the institutes that operate under the auspices of the manufacturing industry;
- Higher R&D levels in the enterprises that perform systematic R&D;
- More of the enterprises that currently perform little systematic R&D should be encouraged to adapt R&D as a strategic tool.

The programme is geared to the segment of the manufacturing sector comprising heavy engineering, metal goods, foundries, plastics, furniture and the textiles industry. The primary target group consists of enterprises in each of these areas that have the willingness and capability to adopt R&D as a strategic tool. Growth potential is essential for project priority.

The programme also focuses on education, pinpointed through the project "Productivity 2005" based on activities conducted at the Norwegian University of Science and Technology.

The key research area "Processing and applications of light metals" was established in 2001 in order to promote industrial development and contribute to substantial added value related to the downstream processing and new applications of light metals in Norway. The individual research projects are planned for a period of six years with a total budget in 2001 of MNOK 24, of which public funding accounts for MNOK 15 (62 per cent).

Links to former R&D programmes

VARE-MAT is the successor of the VARP programme, which was dedicated to the manufacturing industry with exception of enterprises working in the maritime, offshore and construction cluster. VARE-MAT includes all this and its ultimate focus is on the manufacturing industry in general. In addition, the programme includes industry dealing with applications of light metals, plastics and ceramics, former PROSMAT activities. The former programme P2005 is included in VARE-MAT.

Budgets and the allocation of resources

Time frame: 2001-2008

Research Council contribution: MNOK 77.1 (2001)

Industrial contribution: MNOK 200 (2001)

per nt KMB: 20 per cent

Industry contributes about 75 per cent of the budget (As a rule 20 per cent of this is cash) and the grants from the programme are used exclusively to buy R&D from universities and institutes.

R&D purchased: MNOK 110 (2001)

Results (2000)

Refereed publications: 36

New products: 68

Doctorates: 19

Dedicated results venues/activities: 232.

4.4. The Department of Innovation- and Technology-Networks – INNTEK

4.4.1. Description of the department

The department's three main tasks are to:

- encourage more enterprises to exploit R & D in their business development activities;
- improve co-operation between R & D institutions and industrial enterprises;
- commercialise investment in R & D by creating new R & D-based enterprises or licences.

The work is of an experimental nature and expert evaluations are conducted regularly to check the effect of the different programmes. The department focuses on networking and learning as working tools.

INNTEK is also responsible for IE's communication/information and budgetary/accounting activities. However, these two important staff areas are beyond the scope of this report.

The total budget volume of the project portfolio in 2001 amounts to about MNOK 283 of which MNOK 188 is public funding. Three ministries contribute to the public funding:

- | | |
|-------------------------------------------------------------------|------------|
| • The Ministry of Trade and Industry (NHD) | MNOK 122.2 |
| • The Ministry of Local Government and Regional Development (KRD) | MNOK 67.4 |
| • The Ministry of Education, Research and Church Affairs (KUF) | MNOK 6 |

Permanent personnel: 1 director, 1 programme co-ordinator, 3 advisers, 1 executive officers (6 man-years of labour)

Hired personnel: 3 programme co-ordinators, 5 advisors and two executive officers (8.5 man-years of labour).

The department is in charge of six programmes:

- MOBI - Mobilisation for R&D-related innovation
- Commercialisation/FORNY – the creation of research-based new businesses
- Value Creation 2010
- NIN - National Information Networks
- HOYKOM (Broadband communications in the public sector)
- The FAKTA Programme (Knowledge of Technology and Industrial Policy)

The first three programmes constitute the part of the innovation programmes which focus on the mobilisation of the enterprises to do research and on the commercialisation of research results as described in earlier chapters. As described in the following, the latter three programmes are of a different nature.

4.4.2. The MOBI Programme: Mobilisation for R&D-related innovation

Thematic research initiatives and target groups

The concept underlying MOBI is to ensure that more enterprises with limited R&D experience, usually SMEs, are offered long-term assistance to enhance their ability to innovate in collaboration with various R&D institutes and other relevant players. MOBI

activities operate at regional level. MOBI emphasises collaboration with relevant user-driven R&D innovation programmes and other public sector instruments, especially those under the auspices of SND. The programme operates in the interface between R&D and corporate development, technological and economic-administrative processes.

Links to former programmes

MOBI is based on the BRIDGE programme (Programme for Bridging the Gap between Industry and Research, 1996-2000/2001). The sub-programme portfolio in MOBI was initiated and developed under the BRIDGE programme.

- Sub-programme TEFT

TEFT (1999-2003) – Technology Transfer from Technological Institutes to SMEs. The objective is to enhance the competitiveness of SMEs by increasing their technological ability and capacity. TEFT is operated through 10 technology attachés operating in 16 counties, connecting SMEs with technology institutes. 2001 budget: MNOK 20.

Results - 2000:

Technology projects were initiated in 112 enterprises, 59 enterprises passed on to other public sector instruments, 55 projects were transferred to larger development projects, and 5 international technology projects were initiated. Close operational collaboration with other public sector instrument was achieved, especially those under the auspices of SND.

- Sub-programme SME Competence

SME Competence (1997-2001) is designed to help SMEs recruit well-qualified, relatively recent college graduates. The recruits devote one year to working on a defined project or development assignment based on the needs of the company in question. 2001 budget: MNOK 21.

Results –2000:

130 projects were initiated, involving 14 university colleges (18 university colleges were involved in 2001). Potential for closer links to SND's sector instruments.

- Sub-programme SME-College

The intention of SME-College (2001-2004) is to strengthen the contact and mobility between colleges and SMEs. The goal is to make the colleges more industry-oriented in their scientific, educational and external activities. 14 colleges and approximately 60 enterprises are involved in SME-College in 2001.

- Sub-programme REGINN

REGional INNnovation systems (1997-2001) . REGINN's primary purpose is to encourage regional R&D, along with other industrial players, to interact and engage in joint efforts to promote innovation in regional economies. A total of 150 enterprises have participated in REGINN projects. 2001 budget: MNOK 6.9.

Results - 2000:

18 regionally based projects in operation, 127 SMEs and 15 R&D institutions involved.

4.4.3. The Commercialisation/FORNY programme: Creation of research-based new businesses

Thematic research initiatives and target groups

Commercialisation/FORNY is based on the vast potential that exists for bringing to fruition research-based business ideas conceived at universities, colleges and research institutes.

The target groups are individuals, that is, management, employees and students at scientific and technical colleges, universities and R&D institutions, and organisations such as R&D institutions.

Commercialisation/FORNY is intended to help researchers and research managers to better recognise and assess opportunities for the commercialisation of research results. The R&D organisations co-operate with commercialisation units (i.e. science parks) to realise potential business opportunities through the establishment of new enterprises or licensing arrangements.

Links to former programmes

Commercialisation/FORNY is a continuation of FORNY which has been in operation since 1995.

Budgets and the allocation of resources

Commercialisation/FORNY is a joint effort between SND and the Research Council, operated by IE. The 2001 budget for Commercialisation/FORNY amounts to MNOK 45.5, of which MNOK 30 come from the Research Council, and the goal is to generate 300 potential business ideas, resulting in 50 commercialisations, and value creation worth more than MNOK 250.

Results

From 1995 through 2000, the FORNY programme's public funding came to MNOK 178. This resulted in the evaluation of approx. 1.500 potential business ideas and the creation of approx. 230 new enterprises/licences. The value creation resulting from these commercialisations (up to 1999) totalled MNOK 533, and is expected to be worth more than MNOK 750 by 2000 (the actual figures will be available in mid-September 2001).

4.4.4. The Programme Value Creation 2010

Thematic research initiatives and target groups

The main goals are to:

- Create and support development processes in enterprises by involving social scientists;
- Support and stimulate learning networks between enterprises;
- Develop new forms of co-operation between social partners and other players of significance in value creation processes;
- Promote social research and documentation in the fields of workplace relations, organisation and innovation.

Links to former programmes

VS 2010 builds on experience gained from former initiatives, in particular from BU 2000 (Enterprise Development 2000 - 1994-2000), and to some degree from REGINN (REGional INNnovation systems – 1997-2000).

Budgets and the allocation of resources

The programme is in its initial phase. After a small-scale start-up in 2000, this year's budget amounts to MNOK 24.8.

Results

Six combinations of research groups and enterprises are already involved, encompassing 60 – 80 researchers and about 200 enterprises.

4.4.5. The NIN Programme: National Information Networks (1996-2001)

Thematic research initiatives and target groups:

The basis of NIN is the concept of the information network, i.e. group of people and businesses that works together and exchanges information. This requires the support of a technical infrastructure, a communications network and a set of information services, i.e. information infrastructure.

The programme's principal aims are to:

- disseminate and explain the effects of using information networks in industry;
- demonstrate how society-at-large can benefit from the industrial and public-sector use of information networks;
- establish permanent information networks with participants from the public and private sectors.

The programme's main tasks and challenges are to:

- establish demonstrator networks and ensure their continuation after the end of the demonstrator period;
- identify information networks and making user groups aware of their usefulness;
- launch joint research and development activities.

A variety of areas are targeted for applications/demonstrators, including: Transport, maritime, building and construction, health, tourism, distance working and e-learning.

Budgets and the allocation of resources

Research Council contribution (1996-2001)	MNOK 149
Total project activities (more than)	MNOK 320

Results

The roster of projects supported comprises 210 participants, including enterprises, organisations, universities/schools and public sector agencies. Among the 130 enterprises, 40 per cent are SMEs with fewer than 100 employees.

By the end of 2000, 18 networks had been established. Seven more networks have received supported in 2001 and will be established by the end of the year.

The NIN programme will be closed at the end of 2001. A new programme is expected to pursue the central elements of NIN from next year in close collaboration with HOYKOM (see below).

4.4.6. The HOYKOM programme (Broadband communications in the public sector) (1999-2001)

The Ministry of Trade and Industry initiated HOYKOM, and the Research Council is operating the programme on behalf of the Ministry. Thus the budget falls outside the aggregate budget of the Research Council. The programme is part of a governmental action plan to promote broadband communications in Norway.

An extension and continuation of the programme is expected in the years to come, and central elements of the NIN programme will be incorporated.

Thematic research initiatives and target groups

HOYKOM is a programme to support the dissemination of broadband communication solutions, mainly in the public sector. The principal aims of the programme are to:

- develop new or improve existing public services to the private sector and consumers, using broadband information technology;
- enhance network-based co-operation and interaction between public sector organisations;
- raise the level of competence regarding the use of new technology in the public sector.

Budgets and the allocation of resources:

The programme awards grants to projects initiated by public sector agencies to cover up to 50 per cent of total project costs. By mid-2001, the programme had allocated about MNOK 60, representing a total portfolio of approximately MNOK 200. The projects may be pilot projects, investments in solutions and applications or dissemination, learning and guidance activities.

A secretariat outside the Research Council handles the application processes and the follow-up of projects in close co-operation with the Research Council's administration.

Results

Close to 100 projects have received support, and 35 have been completed. The programme has substantially stimulated the use of broadband communications in the public sector, especially in the rural areas. One important experience gleaned from the programme is the need to develop expertise in the public sector. Stimulating the demand for broadband communications is not so much a question of supporting the potential buyers with more money, but of the ability to integrate new technologies into the value chains and the way in which work is organised.

4.4.7. The FAKTA Programme - Knowledge of Technology and Industrial Policy

Thematic research initiatives and target groups

The FAKTA programme aims at the development of innovation policies. The rationale behind the programme is related to the advisory role of the Research Council and the need for a coherent, well-documented research and innovation policy.

The programme's objective is to improve the factual basis for taking decisions on Norway's industrial and technology policy based on an interactive understanding of innovation. One important goal of FAKTA is to develop knowledge that can facilitate strategies to get more enterprises to use R&D. Another ambition is to improve the level of professional expertise in the research communities.

The utility value of these efforts is mainly related to the decision-makers responsible for industrial and technology policies.

Links to former R&D programmes

The results of the FAKTA programme are important to the policy and strategy work done in the various other user-driven programmes in IE. FAKTA also co-operates with related programmes in other divisions of the Research Council.

A new programme, KUNI (The Knowledge Base for Industrial and Innovation Policies), is currently under preparation. KUNI is intended to strengthen the theoretical and empirical basis for industry and innovation policies. The programme will start in the autumn of 2002.

Budgets and the allocation of resources

FAKTA has an annual budget of MNOK 4. The programme started in 1997 and will finish in 2002. The overall budget amounts to MNOK 24. The project portfolio has comprised approx. 18 projects during the programme period.

Results

The main goals are to:

- publish 19 scientific articles and 29 reports during the programme period, in addition to 2 doctoral theses;
- improve the level of competence in innovation and technology policy in participating research institutions;
- ensure that users (i.e. policy makers) consider the programme to be very relevant at the end of the programme period;
- ensure that 50 per cent of the relevant public publications that contain references cite FAKTA projects;
- establish 22 lasting contacts with foreign institutions;
- establish at least 10 co-operative relationships between research institutions and relevant enterprises;
- publish four newsletters annually;
- arrange 12 seminars or workshops;
- be presented at at least 17 conferences in Norway and abroad.

4.5. International R&D co-operation

4.5.1. Norway's open economy

There is a far greater proportion of vertical trade in the value chain in Norway than in most countries. Vertical trade accounts for approximately 50 per cent of all trade, implying that about half of what Norway produces is sold abroad, and approximately half of what Norway consumes is imported. This indicates that Norway has a very open economy and is strongly dependent on events in other countries. Less than one per cent of all new technology is developed domestically. As a consequence, the Industry and Energy Division encourages Norwegian industry to increase and improve co-operative innovation in vertical chains that include industrial enterprises and research institutions abroad. Several special measures have been established to encourage joint R&D projects with industrial enterprises and R&D institutes abroad.

4.5.2. The integration of international R&D projects with national R&D programmes

The Division considers it important that Norwegian the R&D work performed under joint international projects be integrated into national programmes and priorities. As a consequence of this, it has been decided not to establish special programmes for international R&D or to set aside special money for this purpose. All projects seeking financial support from the Industry and Energy Division are channelled through the relevant "national" programmes for assessment. Accordingly, the same people who assess national project proposals also assess project proposals that constitute parts of joint international projects. These projects may be conducted under schemes such as Eureka, the International Energy Agency (IEA), or bilateral agreements. Furthermore, some high-priority geographical areas have been identified in the Far East (mainly decided through project owners' country strategies) and in the US. IE's customers are also free to create projects commensurate with their own innovation strategies in any geographical, industrial or technological area of the world and to compete on the basis of ordinary project criteria. However, IE has limited infrastructure available to support such activity.

4.5.3. The international project portfolio

As a result of the policy described above, the Industry and Energy Division does not really have a specific international project portfolio *per se*. The Division marks projects as "international" if the assessor is of the opinion that 10 per cent or more of the project work is taking place abroad. From this perspective, the portfolio statistics indicates that almost 50 per cent of all IE's projects have some kind of international linkage. This may range from a personal connection with a professor abroad, which is not formalised by any kind of written agreement, or a Norwegian post-doc student spending time at a foreign university, to a genuine foreign contribution with regard to work and funding. However, less than 20 per cent of the projects marked "international" are conducted within or in connection with a formal international framework such as Eureka, IEA, the EU framework Programme, the Nordic Industrial Fund or any of the Research Council's bilateral agreements. The rest of the projects are purely national. The Division's aim is to increase this percentage from 20 to 50 to reflect Norway's open economy.

4.5.4. Some comments about bilateral agreements

From time to time, the Research Council is invited to sign bilateral R&D co-operation agreements with government agencies and institutions abroad or to act on behalf of one of the Norwegian ministries in such arrangements. Such initiatives often come from abroad, from other public Norwegian entities or from private industry. However, the management and administration of bilateral R&D agreements are very costly in terms of both manpower and funding. Moreover, the results of these arrangements are often disappointing. Few concrete projects have been established, and the Research Council has been left with the administration of several “empty” agreements.

Based on this experience, the Industry and Energy Division’s policy is to take a very realistic approach when a new bilateral agreement is proposed. The policy is clearly that IE’s customers have to argue the benefit of such an agreement and the added value it can bring before IE will agree to sign. Furthermore, IE’s policy clearly points out that it is the customers who bear the responsibility for filling the agreements with content, while the Research Council can support them with well-established infrastructure such as Eureka on the European level. Thus IE’s policy differs from that of the Netherlands, for example, whose economy is 43 per cent open. That country is very active with regard to international R&D projects, which are dealt with through a separate agency with its own budget. The agency currently operates seven bilateral agreements and plans to establish three more this year.

4.5.5. Recent tendencies

The Industry and Energy Division has established specific measures to place more emphasis on international R&D co-operation and to increase the proportion of “real” international projects in its portfolio. First, IE asks all projects to argue why their particular application should be handled nationally and not as part of an international project. Second, IE has established a special budget item for pre-project work involving international R&D co-operation, e.g. work in connection with finding partners abroad, establishing a co-operation agreement and working out a joint project proposal for a joint project. It is the “national” programmes that assess these applications. Third, IE has set aside a special budget the “national” programmes can draw on for the initial project year as long as the project is registered as a Eureka project and complies with the Eureka criteria. This measure is an internal incentive to attract the programme boards to engage in Eureka projects.

The combination of specific budget incentives and continuing to have proposals assessed by the “national” programme teams has resulted in an increased number of “real” international projects and has definitely increased the involvement of the “national” programmes in international R&D work. This encourages more international R&D co-operation and ensures that Norway’s participation in international projects is integrated into the work taking place under the national programmes.

Finally, the Research Council signed a Memorandum of Understanding on maritime activities in Singapore. To support Norwegian activities in the region, IE is financing part of a technology attaché position in the Norwegian Trade Council. Furthermore, IE has developed strong infrastructure around agreements with expert groups, and organises meetings every half year to develop a common project portfolio. It has been decided to try to do this one thing

properly and learn from it, rather than spreading IE's interests and resources too thinly. Thus the learning goes two ways, as to how IE learns how to co-operate with the Trade Council in the market place in practical terms, and how to develop a cluster through a Memorandum of Understanding designed to bring mutual benefits to industrial enterprises in both the countries involved. Within the same framework, IE ran a technology seminar in Japan this spring, but once again it proved very time consuming and costly. Thus IE's key policy is that resources are required to run international activities, so before considering going into new markets, IE requires customers' clear assurance that this is to their benefit, and that they have the ability to stay in these markets for many years.

4.6. Programme and project management processes

4.6.1 Programme management

A Programme Board (see 3.2) is appointed for each programme. The two main tasks of the Programme Board are to

- develop and implement strategy and programme plans;
- develop a project portfolio that contributes significantly to the programme goals.

The Division Director, in agreement with the Programme Board, establishes a programme secretariat for the programme. The secretariat is headed by a Programme Co-ordinator who acts on behalf of the Research Council. The Programme Co-ordinator is responsible for carrying out the programme in accordance with the decisions of the Programme Board within the framework of the programme description, plan and budget and within the framework of other relevant guidelines (Doksy). The Programme Co-ordinator prepares all items for Programme Board meetings. Programme Boards make their own decisions regarding which projects to support, based on assessments and brief recommendations prepared by the Programme Co-ordinators.

4.6.2 Project selection

Projects are mainly sought through calls for proposals with fixed deadlines, with two calls for innovation projects and one for enabling strategic projects (KMB) each year. There are no deadlines for submitting proposals for support for establishing international projects.

In the proposal preparation phase, the programme secretariat is available to give advice and discuss project ideas. During the evaluation phase, dialogue with the applicant is now very limited due to the recent introduction of deadlines, and evaluations tend to be more and more based on the “face value” of the proposal alone. However, conditions may be attached, requiring that a project be changed as a requirement for funding it, and special conditions may be written into the standard contract.

Until recently, most of the proposals were evaluated by the programme secretariat, but it has now become mandatory to involve external experts in the assessment of proposals.

KMB projects are sent to referees for an evaluation of scientific quality, while panels consisting of external experts evaluate value creation. As regards innovation project proposals, external panels evaluate scientific quality and value creation. The programme secretariat then writes recommendations to the Programme Board based on the external evaluations.

All proposals have to be evaluated using the same computer-based system (Provis), which requires systematic scoring of value aspects. The value aspects correspond to the most important criteria for selecting projects. The value aspects are:

1. General project quality
2. Innovation level
3. Research level
4. International orientation

5. Financial value (business unit level)
6. Socio-economic effect
7. Risk
8. Other considerations
9. Additionality
10. Relevance
11. Overall appraisal value

Each value aspect is scored using the scale <7, 6,...,1>. Aspect 11 is an expression of the evaluator's overall impression of the proposal. There is no mathematical link between the score of aspect 11 and the scores for items 1 to 10. The scores 1-10 only serve as support for an independent overall decision.

Normally, the proposals given the highest overall appraisal value are selected for funding. However, departures can be made from this principle in order to meet certain paramount demands or to achieve the right composition of a programme's project portfolio.

Every four months, the programme secretariat receives a financial statement and very brief progress report from the contract partner. Funding is disbursed on the basis of the progress report. Programmes also require more extensive annual reports, including descriptions of the results achieved thus far. Normally, a programme will not intervene unless there is a verifiable deviation from the project plan. The programme secretariat sometimes contacts projects for more detailed follow-up.

4.6.3 Co-ordination processes

As described in Chapter 2, KMB projects address the Research Council's enabling technology and knowledge areas. Financial instruments employed by other divisions of the Research Council address the same areas. Each area of expertise has a small area-group which co-ordinates the proposals related to the area. The main purposes are to select the most important proposals for the development of the area, independent of which instrument or programme they belong to, and to avoid funding overlapping projects. This process may involve several divisions, mainly Industry and Energy and Science and Technology. These two units also have a common call for proposals in the areas of expertise.

To make sure that proposals are processed under the right programme, "brokerage events" are held to discuss the placement proposals with no obvious "home address". This process involves the relevant programmes, and may also involve other divisions.

To develop a common understanding of how to interpret the selection criteria and how to use the scale when scoring value aspects, "learning events" are held during the evaluation of the proposals. These events involve all the division's programme secretariats and are aimed at achieving a common level of scoring across programmes.

All programmes maintain close contact with the relevant industrial organisations for their target groups. Examples of processes that are typically co-ordinated include the mobilisation

of companies for R&D projects, information about project results and development, and the development of activity plans.

APPENDIX 1:

STRATEGY FOR INDUSTRIAL RESEARCH AND DEVELOPMENT

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Foreword

The Research Council of Norway has revised the strategy for industrial research and development adopted in 1996.

The accelerating pace of international forces of change, such as globalisation, expanding knowledge and expertise, the flow of information and the capacity to innovate, is serving to exacerbate the competitive situation, requiring public and private sectors alike to make extensive accommodations. As a result, it has been necessary to partially re-vamp the user-driven, strategic industrial research performed under the aegis of the Research Council of Norway.

The Research Council has attached importance to maintaining the most fundamental premise of its current industrial strategy, that is, its focus on users' needs and priorities, the main principle underlying user-driven research.

Based on the Research Council of Norway's overall strategy, "Research for the Future", this strategy also attempts to follow up proposals set forth recently in government studies on Norway's industrial and innovation policy.

The strategy discusses the main principles that underlie the taking of decisions. More detailed plans, as well as plans for implementation and follow up, will be discussed in sub-strategies and plans of action related to the Research Council's programme and project activities.

The new strategy addresses all Norwegian business and industry, including the service sector and primary industries, and thus embracing all the activities of the Research Council of Norway which might be of significance to Norway's economic development.

The strategy was adopted by the Board of the Research Council of Norway on 25 February 1998.

Halvor Stenstadvoid
Chairman of the Board

Christian Hambro
Managing Director

0 Summary

The strategy “Research for the Future”, adopted by the Research Council of Norway on 19 March 1996, states the following:

“A nation of knowledge, built on a firm foundation of science, research and innovation, is a vision of vital importance to Norway’s future if she is to safeguard the welfare and security of her people. A national research strategy must be designed to reflect this vision.”

This statement serves as a guidepost for the Research Council’s efforts to develop its strategy for industrial research and development. It points towards stepping up financial investments, clarifying priorities, improving organisational efficiency, expanding collaboration among research communities, and promoting interaction between research communities and business and industry.

Challenges facing Norway

The international forces of change are exerting increasing influence on the development of the manufacturing industry, the primary industries and the service sector. Greater openness between countries, fewer constraints on competition, waves of technological innovations, and the need to focus more intently on sustainable development call for high levels of knowledge, expertise and innovation on the part of industry. Few enterprises, if any, can count on their own efforts alone to master these challenges. For enterprises and the country alike, it is crucial to have viable research and development units that can provide a constructive framework for R&D coalitions. One of the main strategic tasks of the Research Council of Norway is to bridge the gap between research and industry, acting as a catalyst for the requisite interaction.

The welfare and security of the nation’s future depend on its collective ability to master new challenges. We are living in an era of opportunity, but it is also a critical period. In the opinion of the Research Council of Norway, the main task facing it in the decades ahead will be to realise the vision of Norway as a nation of knowledge, where science, research, development and innovation will collectively comprise the most important foundation of all.

Goals and priorities

The Research Council’s industrial strategy aims at promoting Norwegian industry’s capacity to innovate and to create value. Knowledge and expertise are key elements in this context. The Research Council’s industrial strategy is based on the premise that the value of knowledge

can be enhanced through close collaboration between business and industry and R&D communities. The Research Council's industrial strategy and approach emphasise the users' needs and priorities.

In the opinion of the Research Council:

- Norway's investments in industrial R&D must be stepped up. It is especially important for more small- and medium-sized enterprises (SMEs) to invest in R&D.
- The socio-economic dividends on aggregate public R&D programmes aimed at industry must be increased. This calls for several long-term efforts, including, for example, industrial strategy programmes.
- It is important for Norwegian research policy to concentrate on particular areas and on the setting of priorities. More emphasis should be attached to supporting and developing '*key areas*' in which Norway is or should be in the vanguard of international developments.
- Major, research-intensive enterprises should play a key part in creating added value in Norway, not least as partners for important educational and research communities at the national level. The Research Council intends to support and stimulate the development of this role.
- Internationalisation and keener competition are intensifying the need to organise innovation processes into value chains and clusters. The Research Council will follow this up by means of the way it organises its programmes and projects.
- There is room for improvement in the interaction between industry, universities, colleges and institutes in Norway. Accordingly, the Research Council will strive to forge stronger links between strategic industrial research and user-driven research.
- Innovation based on research and ideas that emerge from educational and research institutions has considerably greater potential than what has been realised thus far, so it will be supported.
- In collaboration with Norwegian business and industry, the Research Council will step up its activities in the international arena, whenever doing so will promote the creation of value and development of human resources on the domestic scene.
- Close, wide-ranging collaboration is needed between private-sector organisations and public-sector initiatives to implement and effect this strategy.
- Social science research and the humanities now play a more important role in industrial R&D than was previously the case. The Research Council intends to

strengthen the interdisciplinary aspect of industrial R&D.

1 Main trends and challenges

1.1 Why industrial research and development?

The latest economic growth theories identify knowledge and expertise as the two most significant factors affecting economic growth. It has been popularly contended that 70 per cent of economic growth is attributable to knowledge, organisation and technology.

The stimulus for growth lies in the positive effect knowledge has on wealth creation and consequently on the further development of our welfare society. When an enterprise or a research institute generates new knowledge and then applies it, the process not only improves the performance of the enterprise or the research community, it also raises the level of knowledge among all other parties involved, including customers, suppliers, etc. In other words, such knowledge has positive ramifications beyond the primary direct growth stimulus it provides.

In an open economic system based on extensive trade, private-sector R&D investment entails a transfer of knowledge. Generally speaking, enterprises tend to under-invest in knowledge, compared with what they would have invested, had they taken the perspective of society-at-large into consideration. The answer is to bring the public sector into the equation to provide partial funding for knowledge development and R&D. This furnishes an important economic rationale for the public sector, through the Research Council, to become deeply involved in industrial research and development in an effort to boost the overall socio-economic yield on investments.

Norwegian business and industry spent NOK 7.9 billion on R&D in 1995, representing 0.85 per cent of GDP, while the OECD average was 1.3 per cent. Although some of the differences from one country to the next are due to real differences in levels, some are also attributable to different industrial structures. Norway is home to industries both above and below the OECD average. In its primary strategy (“Research for the Future”), the Research Council of Norway proposes Norway’s industrial R&D spending be brought up to the OECD average during the year 2000. All in all, it would be a good idea to have more research and development-conscious companies in Norway.

1.2 International trends and challenges

These days, trade barriers are being dismantled all round the world. Markets are opening up and competition is growing keener. The

automation of production processes is continuing to progress, and more and more people are finding employment in the service sector. An ever-increasing proportion of the global population is sharing in the benefits of economic growth, resulting in a higher standard of living. Yet this is also having adverse effects on the earth's resources and the environment. International negotiations on agreements related to various environmental problems can lead to significant changes in the general economic framework applied to business and industry. As a result, we see that a number of technical innovation and dissemination processes linked to technology have become key to the resolution of global challenges. Such enabling technologies are closely linked to key areas such as energy, materials, biotechnology, transport and IT.

New forms of organisation are currently under development, transforming enterprises from closed hierarchical structures to more open systems through coalition building, networking, 'smart' organisations and the decentralisation of responsibility and authority. The value chain concept of viewing a process from a lifetime perspective, that is, from raw materials to the point of sale of goods or services, is gaining popularity. Network solutions and flatter organisational structures reduce costs, increase flexibility, accelerate adaptability and enhance the chances of benefiting from relevant spearhead expertise. Enterprises that work systematically to promote human resources and knowledge development in-house and through interaction with the environment around them will be the most likely to experience development and growth.

The supply and price of traditional factor inputs such as labour, capital and natural resources are becoming less important for the competitiveness of business and industry. Skilled employees with expertise and enthusiasm, proactive enterprises and dynamic corporate environments are becoming the main forces behind development. These forces thrive and develop best if pitted against and teamed up with strong academic communities.

Neither countries nor individual sectors of business and industry can remain unaffected by these conditions.

1.3 Challenges facing business and industry

The challenges facing business and industry may be summarised as follows:

- Enterprises must be prepared to face ever keener competition at home and abroad. This calls for greater efficiency, flexibility and adaptability.

- In terms of strategy and operations, it is becoming increasingly more important for enterprises to keep abreast of what is happening on the international arena.
- Enterprises are finding it increasingly important to develop knowledge and expertise in-house and through collaboration with others on the national and international levels.
- The need to steer social development in a more sustainable direction will pose serious challenges to business and industry as a result of changes in the market and the new requirements applied to products and production methods.

For enterprises, learning and the capacity to innovate will be important elements for the mastery of new trends and challenges. Research and development are crucial in this context. Industrial research and development are mainly the responsibility of the enterprises themselves. Business and industry must therefore have the opportunity to exercise considerable influence on the decisions and priorities made under the aegis of the Research Council. However, in most cases, innovations are derived from more than the knowledge possessed by the enterprises alone. They require enterprises to interact in different types of knowledge networks. The enterprises that acquire the knowledge they need, regardless of where it is found, and which are able to put it into use efficiently, have the best chances of being tomorrow's winners.

More emphasis should be placed on cross-trade interaction. The distinctions between the primary industries, industrial activities and the service sector are gradually being eliminated through various forms of integration and collaboration. This is nothing new. Links between the supply of raw materials, the food industry and retail stores have long traditions in both the agricultural and fisheries sectors. As far as agriculture is concerned, this has primarily been handled within the framework of national markets. In future, agriculture too will face stronger competition from abroad at every link in the value chain. For the fisheries, new technology, biological research, standards for greener resource management and more open world trade conditions will entail challenges and chances alike.

The public sector accounts for one-third of the value added in Norway, making it important to industrial wealth creation in a variety of ways. Accordingly, it is essential to further develop an efficient public sector, not least to serve as a marketing and development arena for the private-sector players involved in the production of goods and services.

The future growth of Norwegian business and industry will therefore depend on the most important participants in the innovation systems—enterprises, public agencies, universities and colleges, research institutes, research-funded agencies and the advisory service—to not only pursue their respective responsibilities, but also to learn to work together in coalitions.

Coalitions may be defined as groups of players that share common ambitions. They often possess different types of expertise or they may have the same type of expertise, but can join together to provide greater capacity. This is the wellspring of synergies and syntheses; each part contributes to the whole to create new and better results. Winning R&D coalitions are characterised by the fact that all parties benefit from their collaboration. Everyone must have something to contribute; everyone must have something to gain.

Experience has shown that collaboration is not always a shortcut to success. Collaboration must be planned, developed and often learned, at the same time as the enterprises in question must want to work together. In other words, expertise is needed in this area. Industrial social science research may have an important part to play in this context.

The most salient characteristic of collaboration is the ability to combine knowledge with business acumen and market insight.

Coalitions may be organised by trade or across traditional industrial dividing lines. The most important point is for them to embrace the relevant players based on their objectives and the tasks before them.

1.4 Norway must create winning R&D coalitions

The scientific backbone of Norway's R&D coalitions are the colleges and universities currently carrying out basic research and teaching that maintain international quality standards. In future, the recruitment of highly qualified personnel to teaching and research institutes will be critical to Norway's commercial success. Satisfactory recruitment poses a challenge not only to Norway's higher educational and research institutes, but also further upstream in the school system. Unless recruitment is improved at every link in the chain, both the R&D system and business and industry will face grave problems in the near future. Women's perspectives and opinions are particularly important to this research. It is therefore important that more women be encouraged to take part in research in Norway.

It is not possible for a small country such as Norway to excel in a large number of scientific fields at the international level. Most fields must be

maintained at satisfactory levels through close contact with industry and the most prominent foreign knowledge providers.

Norway has also developed a large, powerful institute sector specialising in technical, biological, natural science and social science research. Recent decades have witnessed the emergence of a considerable number of regional research institutes and regional colleges. In addition, the country has a number of industry-specific institutes, as well as many private, public and semi-public knowledge enterprises that conduct studies and undertake consultancy work.

It is natural that the nation's areas of international-level expertise in R&D are related to the areas in which Norwegian business and industry excel, or should excel, in the face of international competition. These areas are often related to industrial clusters, that is, groups of enterprises that complement each other, mutually reinforcing each others' positions, partly through cross-deliveries of goods, services and personnel, and partly through rivalry and the constructive dynamics that can entail.

It is natural to point to the maritime sector, the energy sector, materials and the fisheries industry as examples of promising industrial clusters. As Norway's financial income grows, financial services might evolve into a new industrial cluster. Experience has shown that it is in the areas that overlap, for example, the interface between IT and the maritime sector, between energy, materials and environmental technology, and between the maritime sector and marketing, where it is possible to achieve bursts of development. However, this requires an adequate overview of and insight into the global markets, as well as access to them.

The primary objective of Norway's industrial research is to promote national wealth creation. This is essential if the country is to maintain employment and further develop its welfare system. According to the Research Council, stronger R&D coalitions, preferably with international participation, would provide an added boost in this context.

R&D coalitions would result in:

- a joining of forces, sharing of risk, and project enhancement,
- the stimulation of knowledge, creativity and motivation for following up more long-term objectives,
- access to knowledge that could give rise to dissemination dividends and new R&D coalitions,
- a more rapid pace of innovation, quality improvement and greater strategic awareness.

The latest studies regarding the industrial policy of tomorrow have all underscored the importance of pursuing an industry policy based on human resources. The Research Council's industrial R&D strategy occupies a central position in this landscape, including the most important arguments presented in this paper.

1.5 The Research Council of Norway as catalyst

Based on these intentions, the Research Council considers it important to ensure that the resources made available are largely spent on identifying, establishing and operating projects based on R&D coalitions.

The Research Council's mission in this context is to act as a catalyst. This means that the Research Council's efforts will be of a more strategic nature and that the Council will stand out as a highly qualified, attractive partner.

The role of catalyst entails:

- *A process-oriented approach and a proactive role encompassing coalition building, matchmaker activities and the systematic matching of suppliers with those in need of R&D services.*
- *Financial support for projects and collateral preliminary assessments, follow up and post-evaluation.*
- *Advice on research and technology policy to promote satisfactory general conditions for business and industry's own research and innovation activities.*

2 Main strategic principles

2.1 Vision and main goals

On the threshold of the new millennium, the world is facing growing environmental challenges and major technological innovations and breakthroughs. In the years ahead, Norway's creation of wealth, and thus its national welfare, will increasingly rest on the question of how the country manages to compete and maintain a position at the forefront of the adaptations this demands.

The vision underlying Norway's industrial research policy is to help Norway become a nation with the capacity to acquire and implement new technology and knowledge to increase wealth creation within the framework of sustainable development.

As a link in its overall strategy, the Research Council of Norway has elected to identify four main thematic target areas, one of which is industrial research and development.

The goals of industrial research are to:

- *Help lay the foundation for internationally competitive, sustainable industry in which knowledge, human resources, networking and learning are important inputs.*
- *Encourage business and industry to undertake bold R&D investments to strengthen long-term efforts that could have major socio-economic consequences.*
- *Encourage more enterprises to make their own systematic development efforts and, in this context, to get involved in R&D so that the number of research and development-oriented enterprises increases.*
- *Develop a knowledge sector (universities, colleges and institutes) which has the human resources, quality and capacity required to meet the needs of today and tomorrow, and which encourages Norwegian and foreign enterprises to take an interest in investing in Norway and in establishing business activities here.*

Through continual efforts to improve its programme and project portfolio, the Research Council aspires to safeguard long-term and more short-term considerations alike. This also implies the setting of priorities and, to some extent, a focusing of the portfolio. Among other things, the Research Council will try to channel its efforts towards areas that meet one, or preferably more than one, of the following conditions:

- Rapid technological development and considerable innovation potential;
- Strong dynamics and a rapid pace of revitalisation in the markets in question;
- Strong Norwegian knowledge and expertise;
- Considerable national significance linked, for example, to the exploitation of natural resources or to important environmental issues.

From this overall perspective, including the vision, main objectives and priorities, R&D coalitions are an important method of working. For the same reason, the role of catalyst must permeate all the Research Council's work. Playing the part of catalyst poses demanding challenges to the Research Council in terms of its strategic expertise and ability to ensure professional follow up at the operative level. Like enterprises, the

Research Council must operate efficiently, demonstrate flexibility, have the ability to adapt, and keep abreast of international developments.

Achieving the Research Council's objectives through industrial research presupposes a good understanding of the basis for wealth creation and growth. Industrial social science research and the humanities are important in this context. One key objective of the research performed in these fields is to produce knowledge about the factors that affect wealth creation and affluence trends. Among the most important of these factors are the emergence of the expertise-based society, internationalisation/globalisation, and the conditions laid down by government authorities, as well as cultural and value-related changes. For industrial research, studies of how players interact in networks, clusters and innovation systems will be of particular interest in the years ahead.

2.2 User-driven research – the first main pillar of Norway's industrial R&D

User-driven, strategic industrial research is one of the most important tools available to the Research Council's industrial R&D programme.

The Research Council's other tools, including action programmes, free basic research and allocations for infrastructure and fellowships/grants, all play a part in industrial R&D.

The term 'users' refers to enterprises in the primary industries, the manufacturing industry, the service sector or government administration.

The users recognise opportunities

The Research Council's industrial strategy and approach attach importance to users' priorities and needs. The basic premise underpinning user-driven research is that enterprises wishing to engage in R&D should have a decisive influence on the direction, control, management and implementation of the programmes and projects. The idea behind the concept of user-driven research is that it is the enterprises themselves that are most familiar with the needs of the market, meaning they are the ones which best recognise opportunities for success and growth. At the same time, it is essential that the relevant research communities at universities, colleges and institutes be actively included in the planning and performance of R&D.

It is possible to earn a good return on R&D investments by ensuring that participating enterprises have developed satisfactory strategies for

initiating and implementing R&D projects, not least for the subsequent application/commercialisation of successful R&D results.

The effects of user-driven research on research communities

User-driven research is vital for reinforcing contact and collaboration between industry and teaching and research institutes. The quality of industry's own research is enhanced as R&D institutions gain impetus and expertise. Ultimately, this translates into a cross-pollination of learning processes. From the viewpoint of society at large, one important motivation for user-driven R&D is that it helps protect and further develop Norway's national R&D resources.

Organisation

To date, the Research Council has organised its programme activities into industrial sector programmes, thematic efforts and, in a few cases, into value chain programmes. In future, the Research Council will attach more importance to programmes related to value chains and industrial clusters.

The main advantages of organising user-driven programme activities on the basis of cluster and value chain criteria are that:

- *Enterprises are encouraged to work across traditional divisions between industries and fields of endeavour, thus expanding the extent of their knowledge and innovation base.*
- *The end-client's needs and wishes are revealed by looking at the overall perspective.*
- *Organising activities on the basis of programmes and projects is consistent with dynamic organisational development trends whereby the producers, market and knowledge providers are all integrated into binding collaboration to meet international competition.*

The evaluation made of user-driven research indicates that the processes involved in selecting programmes must be improved and that quality assurance procedures should be introduced. The programmes must be planned and designed to make them as goal-oriented and efficient as possible.

The Research Council intends to:

- *Ally itself with business and industry to develop more and better ideas for projects that have considerable potential for wealth creation, thereby ensuring that public*

and private sector investments in R&D result in optimal returns.

- *Increase the number of programmes and projects organised around value chains and clusters.*
- *Ensure that as many projects as possible are based on collaboration between industry, universities, institutes and colleges.*
- *Introduce better systems for improving and assuring the quality of the processes related to the initiation of programmes.*

2.3 Strategic industrial strategic research – the second main pillar of industrial R&D

The Research Council's strategic efforts in important fields of knowledge should be bolder and more long-term.

By virtue of the fact that they bear the primary responsibility for basic research and researcher training, the universities and technical colleges constitute the core of the research system, and are an important link to international knowledge production. Norway's regional colleges are expected to play an increasingly important role in the regional knowledge and innovation system. It would be prudent for the university and college sector to become more involved in the R&D tasks facing business and industry.

A strong tertiary education system is a prerequisite for improving society's capacity to innovate. While individual researchers and groups often have long-term goals for their research, institutions have not been equally concerned about strategic long-term research planning. However, there is a growing appreciation for the necessity of ensuring a holistic, long-term perspective in the development of the universities as research institutions. Long-term planning, with emphasis on the international dimension, would promote collaboration and a division of responsibilities.

The technical-industrial institute sector constitutes a key component of the infrastructure which, through applied R&D, is intended to contribute to Norway's economic development. Today, the institutes actively collaborate with the public and private sectors, working on the international contract research market. The research institutes are intended to carry out research on the users' terms and conditions in a different, more direct way than the universities. The institutes also bear a clear national responsibility for reinforcing technology-based innovation.

If research is to contribute actively to increasing the creation of wealth, it is necessary to develop strategies which impart a clear understanding of the roles involved, present clear professional profiles and lead to closer collaboration between research institutions and business and industry.

2.3.1 Strategic focus on basic technology

New technology will promote the evolution of new growth industries and strengthen existing industrial activities in terms of technical solutions, production technology and processes, energy efficiency and environmental considerations. Basic technologies (generic), such as information and communications technology, biotechnology and materials technology, will play a crucial role in this context. Many ethical challenges arise in relation to the application of biotechnology in particular, and systems must be found to deal with them so that the potential consequences can be assessed in each individual case. In addition, the segment of Norway's industrial structure currently linked to the petroleum sector could be internationalised and exert a stronger influence on technological development trends that apply to Mainland industry and the maritime sector. The field of mathematics is developing methods and algorithms related to simulations and models. These tools are being used to further basic research in most general subjects, as well as for industrial research applications.

University and institute research must be reinforced in such fields of technology by devoting long-term efforts to R&D collaboration between research institutes and universities, where the objective is to earn a position at the forefront of international developments.

The Research Council intends to:

- *Increase its focus on strategic industrial research, including scientific equipment. This will help ensure better utilisation of the potential represented by the universities and institutes, improving the return on earlier investments.*
- *Encourage the universities to develop their own industrial research strategies based on stronger specialisation and a better division of responsibilities at the national level, and featuring stronger, more formalised collaboration with the best universities abroad.*
- *Increase basic allocations to the institutes to encourage more extensive collaboration with the universities, more international collaboration, a continued high level of human resources mobility and a more clearly defined contract research profile in respect of enterprises with little R&D expertise.*

2.4 *Time frames and focus*

According to the Research Council, it is important to emphasise long-term projects that have socio-economic dividends.

Devoting more attention to long-term research calls for the Research Council to better co-ordinate the main instruments at hand (user-driven projects, action-oriented programmes, strategic institute and university programmes, and basic allocations to institutes) than what is the case today. Investments and the setting of priorities in strategic industrial research will eventually become an important pillar on which user-driven research will rest. Accordingly, it is necessary to focus more intently on cultivating and supporting research communities with a high level of expertise. Such research communities must be encouraged to work together closely with business and industry, and to establish collaboration between universities and research institutes as well as with respected international R&D communities. It is also essential to find better ways of dealing with ideas and concepts developed by individuals associated with the research communities. One consequence of this is that the Research Council will initiate more comprehensive, long-term strategic industrial programmes to develop/establish a few “*key areas*”. Within user-driven research, these “*key areas*” can be strengthened by initiating strategic programmes in the same research communities, and by encouraging the establishment of joint endeavours between universities, research institutes and industrial R&D units.

These “*key areas*” should be fields in which Norway aspires to earn a position in the vanguard of international developments.

Among the potential selection criteria for the choice of “*key areas*” are:

- The area’s significance for future wealth creation and social development in Norway.
- The position and status of the research communities in question in an international context (that of both business and industry and the R&D institutions).
- Natural advantages that put Norway in a special position in the field of research in question.
- Future growth areas in which Norway has or can acquire basic expertise that can lay the foundation for the business and industry of tomorrow.

The Research Council intends to:

- *Collaborate with enterprises with R&D expertise to promote more long-term time frames and improve the socio-economic returns on user-driven research.*

- *Collaborate with business and industry and with research and teaching institutions to develop “key areas” of industrial research.*

2.5 Government authorities as users of industrial social science research

Knowledge about innovation and other conditions that may affect the competitiveness of business and industry straddles the spheres of responsibility of several government ministries. The ministries act as users, *inter alia*, by funding industrial research that supports the ministry’s/agencies own policy-making and administrative activities. This type of research becomes increasingly important when attention is paid to potential socio-economic gains. Part of the research funding is channelled directly from the ministry to the research institute, and part through programmes under the auspices of the Research Council. The Research Council has an important role to play in co-ordinating trans-sector industrial research.

Important topics for trans-sector research include the effects of R&D investments on economic growth; the impact of globalisation and internationalisation on competitiveness; and the connection between regional and rural policy and economic development. The research is first and foremost based on the social sciences, placing technological development in a social and economic framework.

The Research Council intends to:

- *Co-operate with ministries on strategies for industrial R&D within and across sectors.*
- *Initiate and further empirical research on new growth theory and research on correlations between industrial and technology policy and other policy areas, including financial, trade, labour market, regional and educational policy.*

Research Council activities to ensure in-depth and in-breadth perspectives

2.6.1 Enterprises with substantial R&D expertise

Enterprises with substantial proprietary R&D expertise are well equipped to take advantage of external expertise. This is true of large enterprises and enterprises operating in the SME sector. In such cases, Research Council participation will involve ensuring that Research Council funds trigger R&D activities that would not otherwise take place, or that they reinforce such research, in addition to helping ensure that strategic

expertise communities in Norway take part in the development dynamics represented by such enterprises.

Larger scale, long-term projects entailing a considerable boost in terms of technical development and featuring high potential returns will be given more priority than what has been the case thus far. It will be necessary to bring Norwegian, or possibly foreign, institutes and universities into the picture. Collaboration with other Norwegian or foreign enterprises will also be viewed as positive.

The Research Council will also support projects involving the transfer of expertise from enterprises with substantial R&D expertise to enterprises with little R&D expertise.

The Research Council intends to:

- *Support long-term R&D projects that entail high risk, but hold the promise of considerable corporate and socio-economic returns.*
- *Ensure that the educational institutions and research institutions play a larger part in the projects.*

2.6.2 Enterprises with little R&D expertise

Small- and medium-sized enterprises (SMEs) are a major force in Norway's business and industry due to the number of employees they have and the percentage of the workforce they employ.

These enterprises often have little R&D expertise and, in the short term, they will often require help with known technology, strategic expertise and organisational development. As a rule, they also have limited access to qualified personnel and capital, meaning they cannot afford to take the same risks as larger enterprises. The Research Council must therefore make a close examination of the capacity this type of enterprise has to carry out R&D projects.

The Research Council will devote more attention to this group of enterprises, working actively to recruit more proactive small- and medium-sized enterprises to make systematic R&D efforts.

The Research Council intends to:

- *Support development projects in enterprises with little R&D expertise, especially through coalitions with knowledge communities.*

- *Collaborate with the Norwegian Industrial and Regional Development Fund (SND) to encourage enterprises to identify their expertise requirements and to develop strategies to achieve their objectives.*
- *Actively help convey technology, knowledge and highly skilled labour to this type of enterprise.*

3 Thematic challenges

3.1 A smoothly functioning innovation system is a prerequisite for the creation of more wealth

Recent years have seen the emergence of growing interest in innovation systems as a locomotive for economic development.

Innovation is more than merely an economic mechanism or a technical process. It is also a social phenomenon. An individual society's history, culture, educational system, political and institutional organisation and industrial structure have a major impact on its ability to engender and accept innovation.

This discussion revolves around the general framework and the working conditions that apply to the players that collectively comprise the foundation for industry's capacity to innovate in any given region, within a nation or between nations. More specifically, the innovation system includes large enterprises of different types, various kinds of SMEs, special-interest organisations, R&D institutions, financial institutions and government programmes. More innovation will require closer contact and collaboration between business and industry and R&D communities.

Innovation policy straddles sectoral divisions. It is extremely challenging to co-ordinate industrial policy, regional policy, trade policy, educational policy, labour market policy and research policy. The Research Council would like to play an active role in this context, for example, by promoting and contributing to the development of satisfactory collaboration mechanisms.

The expertise built up by the R&D communities at the regional and national levels must be made relevant and accessible to business and industry.

Small- and medium-sized Norwegian enterprises in need of development assistance must be put into contact with the country's regional R&D

communities. Regional colleges have an important role to play in this context.

It is assumed that a reinforcement of the regional knowledge system would not undermine the development of the major national educational and research institutions, and that a smoothly functioning network can be established among the various parties involved.

The Research Council intends to:

- *Undertake the responsibility for gathering key players for the purpose of creating uniform, smoothly functioning innovation systems.*
- *Endeavour to develop R&D coalitions in which regional colleges and regional hubs of expertise are joined by business and industry.*

3.2 Familiar technology and research results must be applied

One of the main challenges facing Norwegian research policy is the gap between what we know and our ability to apply that knowledge.

The application of R&D results must be reinforced in the Research Council's many projects. This also applies to projects under the auspices of the EU and EUREKA, where the results of international research need to be applied in Norway. EU-Research Info and EU-Innovation are important instruments in this regard.

Norwegian research communities have traditionally maintained good, firm contacts with respected international research communities. The Research Council would like to see the opportunities inherent in such contacts exploited more effectively. With support from the Research Council, Norwegian researchers abroad (on sabbatical or leave of absence) will be put in a better position to convey international R&D results to Norwegian business and industry and other relevant user groups.

The Research Council intends to:

- *Support processes that transfer knowledge and R&D results from abroad to Norwegian business and industry and research communities.*
- *Organise the Research Council's projects to encourage more widespread dissemination of the R&D results.*
- *Improve the technology transfer measures directed at enterprises with little/very limited R&D expertise.*

3.3 Recruitment and mobility – A dynamic aspect of economic development

Knowledge transfer is a process that takes place between people. Accordingly, the exchange of staff between R&D institutions and business and industry must be stimulated to improve the dissemination of knowledge, to expand the capacity to innovate and, ultimately, to create more wealth.

Several countries have established successful mobility and recruitment measures involving the placement of highly educated individuals in business and industry to improve the level of expertise, the capacity to innovate and competitiveness.

Such a policy will be examined in Norway as well. The means employed must be adapted to the various target groups in business and industry.

The Research Council intends to:

- *Further develop mobility and recruitment schemes based on an ongoing assessment aimed at raising the level of expertise in business and industry, especially in SMEs.*
- *Increase the number of doctoral grants provided under Research Council programmes to facilitate mobility and recruitment goals.*
- *Underscore the importance of implementing measures to increase the recruitment of women to technical subjects within the ordinary school system and at colleges and universities.*

3.4 Information and communication technology (ICT) – The ‘central nervous system’ of business and industry

Information and communication technology (ICT) may exert the most widespread influence on society of all the forces of change at play today. Networks based on ICT are developing vertically and horizontally; networks of which all of us, enterprises and individuals alike, are part. One common characteristic of these networks is that they are becoming more and more open, and are no longer subject to geographical restrictions. This fact, in itself, promotes efficiency, restructuring and innovation in the private and public sectors alike. ICT is in the process of changing from being a useful tool to becoming a necessary part of the infrastructure required by the private and the public sector.

One serious challenge will be to optimise ICT trends to acquire the requisite technical and administrative competitiveness and to boost the

capacity to innovate. The existence of strong, national ICT expertise is vital in this regard. One of the Research Council's priorities is to help develop this expertise. This will be of the utmost importance since goods and services are becoming increasingly interwoven in this field.

The technological and behavioural trends whereby digital technology has become the basis for communication and data processing have caused the traditional IT industry to become increasingly integrated into the telecoms industry. This leads to restructuring and new trade patterns. Public telecom monopolies have been dissolved in Norway, as in the rest of Europe. A new platform must be found for national research policy responsibility, most of which used to be shouldered by state monopolies. In Norway, the Research Council is prepared to accept a growing share of this responsibility.

In the opinion of the Research Council, with a high level of ICT expertise in general and a competitive ICT industry, Norway will further improve its chances of reaping gains on the technological and market progress being achieved by Norwegian business and industry as a whole.

The Research Council intends to:

- *Encourage more R&D in the field of ICT.*
- *Shoulder part of the responsibility to ensuring a national expertise base and infrastructure that reinforce the factor most critical to ICT's success: access to qualified human resources.*
- *Learn more about the ICT-man interface, and about the impact of technology on social and cultural change.*

3.5 Embryonic business and industry

Innovation and the establishment of new commercial activities based on results achieved by educational and research institutes are an important part of Norway's economic development.

The creation of new commercial activities is a demanding process, and the Research Council is prepared to help make it easier.

The general attitude to entrepreneurial activities, from primary school through the secondary and tertiary levels, must be steered in a more positive direction. In this context, it is important to forge stronger links between schools and business and industry.

The Research Council intends to:

- *Stimulate innovative activities based on efforts made at universities, colleges and research institutes.*
- *Work to promote more positive attitudes to entrepreneurial activities and innovation in the educational system, identifying any factors running counter to the desired development trends.*

3.6 International collaboration – new opportunities and challenges

One consequence of globalisation is that Norwegian business and industry and Norwegian research institutes are collaborating with foreign partners. This is both necessary and desirable.

It is the Research Council's opinion that international R&D collaboration will enhance the competitiveness of business and industry, thus enhancing the position of commercial enterprises in Norway.

The Research Council's overriding criterion for all participation in international collaboration is the probability that the project will create wealth and promote knowledge development in Norway. In this respect, wealth creation embraces both tangible and intangible assets.

One interesting model for international collaboration would involve the participation of business and industry and R&D communities from Norway and abroad. Such a collaboration constellation could have other positive ramifications as well, and promote the flow of knowledge to Norwegian business and industry and to the universities and research institutes.

The Research Council would also be willing to support other collaboration constellations. The common denominator for all international co-operative projects is that they must be evaluated individually and fulfil the Research Council's overriding criterion regarding wealth creation in Norway.

It is important that co-operation agreements be signed in advance between leading R&D institutes in Norway and those in relevant collaborating countries, in order to lay the best possible foundation for such international collaboration, which may involve exchanges of students and researchers, and co-operation at the post-graduate and post-doctoral levels.

In the natural sciences and technical subjects, there are long, well-developed traditions of international collaboration. In addition, collaboration is a prerequisite for the development of high-quality national R&D communities. It also promotes cultural understanding and the establishment of international networks that can open doors to industrial collaboration.

In some cases, market access to Third World countries is contingent on collaboration between the authorities and business and industry. The establishment of bilateral research agreements at government level can sometimes support efforts made by business and industry.

As far as industrially-oriented R&D collaboration is concerned, Europe will continue to be Norway's most important market. This means that Norway's efforts will continue to focus on the EU's framework programme and EUREKA. However, it is important that participation in EU activities and EUREKA support and strengthen Norway's main national priority. The Research Council's international activities will also give priority to relations with the USA and Asia.

The Research Council intends to:

- *Support more international R&D collaboration projects in areas of interest to Norwegian business and industry and which result in wealth creation in Norway.*
- *Encourage more co-operation between educational institutions and research institutes in Norway and abroad.*

3.7 Information and communications about the role of the Research Council – A factor critical to success

To succeed, the Research Council must provide adequate information about its industrial research and development efforts, and about the results achieved. This will not only help business and industry to submit more and better R&D projects, but also make the Research Council more familiar to the funding authorities, ministries, parliament and the general public.

One important tool in this respect is to document what the Research Council achieves through industrial research. More attention should be devoted to evaluations of completed programmes/projects, for example in the media, than what is the case today. In other countries, the media maintain an entirely different level of focus on research and development. It will be a challenge to modify the attitude that prevails in Norway.

Generally speaking, it will be necessary to facilitate a better general understanding of the importance of R&D for Norway's progress as a national of knowledge.

The Research Council intends to:

- *Draw up an information strategy designed to promote more understanding of, and to underscore the importance of, industrial research and development from the point of view of society at large.*

4 Relations with other institutions

4.1 Collaboration with the industrial organisations – vital to promoting innovation

The strength of the industrial organisations lies in their close relations with the enterprises, and in the fact that they can influence the authorities. These organisations are important for the Research Council's efforts to step up industrial research in Norway.

Collaboration with the industrial organisations will emphasise the importance of research and innovation in enterprises, research institutions and the public sector.

In some industries, collaboration is handled through joint research projects and by industry-specific research institutes. Stepping up R&D efforts would result in more joint projects that target specific industries or value chains. To maintain this type of commitment, it is necessary to draw up binding financial schemes based on combined funding from the industries themselves and the Research Council.

The Research Council intends to:

- *Work with industrial organisations to reinforce the efforts to interest companies in carrying out systematic R&D work.*

4.2 Co-ordination and interaction – essential for effective measures and advisory services

The Research Council, the State Regional and Industrial Development Fund and the State Bank for Agriculture are the main funding sources for innovation in business and industry. These bodies have a variety of effective means available to achieve their objectives. The challenge lies in using these means prudently to provide uniform, goal-oriented services to business and industry. In addition, there a public advisory

service system that consists of important agencies such as the National Institute of Technology (TI), the North Norway Institute of Technology and Innovation (VINN) and the Corporate Advisory Service.

One major challenge facing the Research Council will be to collaborate with these players to ensure that R&D, human resources development, training and continued and further education are seen in a broader perspective to serve the best interest of the enterprises.

The means at hand include a number of individual, separate measures that address SMEs with little research expertise. Business and industry have pointed out that such programmes often seem to lack overall public co-ordination. The Research Council and SND have decided to initiate a collaboration measure entitled “SME-Innovation” to meet this challenge. Once integrated into SND’s regional offices, “SME-Innovation” will provide information and advice about all the opportunities available under the auspices of SND and the Research Council.

For SND, this will open up opportunities to further reinforce the benefits it can provide to the Fund’s customers and its communication with those customers. For the Research Council, the measure will open up a new distribution system for the Council’s programmes and services, thus also opening fresh avenues of approach to potential new customers.

The Norwegian Trade Council has an important role to play in the efforts to market and assist Norwegian business and industry on international markets.

The Research Council intends to:

- *Join forces with the main public R&D-oriented sources of funding to co-ordinate and inform the public about available R&D resources.*
- *Establish SME-Innovation at all SND’s regional offices to promote the Research Council’s industrial policy programmes.*
- *Further develop its collaboration with the Norwegian Trade Council.*

APPENDIX 2:

The Enabling technology and knowledge areas of the Research Council

The enabling technology and knowledge areas are fora for cooperation between research groups and industry. These areas are intended to enable all the divisions of the Research Council to make joint effort to meet the future requirements of industry for knowledge.

Biotechnology

Biotechnology includes gene technology, methods in molecular biology, fermentation technology, separation technology, biopolymer chemistry and physics, cell biology and immunology. Biotechnological methods have given us new insight into basic life processes. This has resulted in the development of a comprehensive set of tools that enable us to perform a wide range of accurate analyses of biological material. Used as production tools, biotechnological methods also open up the possibility of making better and more diversified use of raw materials. This technology thus has both a wide field of applications in medicine and health research and great potential for the creation of new industrial activity. Functional genome research is a core issue. This topic demands competence in bio-informatic system technology and database construction. Efforts are being put into competence development in analytical aspects of biotechnology, with a view to exploiting the results of the major genome projects and while at the same time further developing analytical and diagnostic systems. The high level of Norwegian expertise in immunology and cellular signal transduction will also be developed further.

Materials technology

Materials technology comprises the knowledge, methods and techniques related to production, processing, fabrication and recycling of materials, combined with basic understanding of their functions and applications. Competence in materials technology is of decisive importance for progress in most other fields of technology, and is thus of vital importance for the development of new products.

In the area of structural materials there is great potential for Norway in lightweight materials, and R & D challenges are specially related to the processing and use of light metals, plastics and plastic composites. As far as functional materials (materials with special physical or chemical properties) are concerned, materials of uses in energy applications (solar energy, hydrogen, natural gas) present us with the most important challenges, while in the field of nanomaterials (materials that can be formed into structures at atomic or molecular levels), a high level of basic competence needs to be built up for subsequent use by Norwegian industry. In fundamental and interdisciplinary materials research, which is the basis for all of the above-mentioned areas of R & D, experimental methods, simulation and modelling are central topics.

Information and communication technology (ICT)

ICT refers to a broad set of technologies that are utilised in the acquisition, storage, processing, presentation and transfer of data and information. The field can be roughly divided into three core areas of technology. Microtechnology and microsystems form the material basis of ICT products and services. Communications technology is the basis for the development of new network infrastructures that will enable new network-based services to emerge. A third core area comprises software technology and information systems.

The objectives for the ICT field of competence is to guarantee that Norway possesses ICT competence of top international quality within specific areas in which the potential for exploiting such specialised competence in industrial development will be significant. Because Norway is dependent on having a wide range of high-quality ICT competence in order to be able to exploit the results of ICT research and ICT-based innovations at the international level, there is also a need to strengthen research in central topics and problems within the three core areas of technology of this field.

Energy and Petroleum

The energy and petroleum sector play a vital role in Norway's economy and industry. We must ensure that a long-term view of research needs is taken, in order to acquire a competent knowledge platform upon which industry (energy companies, oil companies, the supply industry) and the public sector can draw.

The energy part of this area comprises disciplines and areas of technology in the production, transport, purchase and sale, and use of energy as well as equipment manufacturing. It also covers related areas of the social sciences. Petroleum is defined as the exploration and mapping of resources, upstream oil and gas production and processing and transport. On the energy side efforts are being put into environmentally friendly utilisation of natural gas, the utilisation of hydrogen as an energy bearer, energy systems and reductions in end-user consumption, and the development of renewable sources of energy. On the petroleum side, work is being done on geophysics, reservoir characteristics and reservoir control, and on developing a technology whereby most well-stream processing takes place near the reservoir while final processing can be done ashore. Emphasis is also being placed on the development of reducing the costs of reservoir and exploration technology.

Productivity, marketing and competence management

Productivity is the utilisation of relevant knowledge and manes to obtain maximum added value in a company with minimal consumption of resources. Marketing covers advertising, pricing, availability, information gathering, processing and exchange, communication with customers and competitors, and forms of delivery. Competence management deals with the understanding, development and utilisation of knowledge and competence. This is central area for much of industry, not least the service sector. Research within this area is aimed at increasing industrial profitability by enabling companies, either individually or as members of networks, to develop and adopt new

competence. The area of productivity emphasis challenges related to market-driven innovation, organisational renewal, and technological productivity increases, while marketing focuses on how tendencies such as globalisation and a steadily accelerating pace of technological development affect economic, social and knowledge-oriented relationships with the market, and how companies deal with the trends and consequences of these, internally and in interaction with the market. The area of competence management focuses on knowledge and added value, “smart” products, and the utilisation of technology to create new forms of work and organisation.

Process technology

Process technology is defined as technology for transport, transfer and the chemical, physical or thermal transformation of mass and energy. Basic chemistry/biochemistry, biology and physics are important bases of knowledge for this field of competence. Norwegian process industry turns water, biological resources, minerals, oil and gas into a wide range of products with innumerable applications - from health products and cosmetics to car parts and foodstuffs. The process industry is responsible for almost 30% of Norway’s total exports (including oil and gas). The process industry will require access to high-level competence across a wide spectrum of disciplines, and the aim is to maintain a high international level of competence in areas of strategic importance for process development, for the bulk production process industry, fine and special chemicals manufacturing and the food industry. Critical areas of knowledge include catalysis and reactor technology, and research in generic areas such as cybernetics, fluid mechanics and process system techniques will secure the future of this industry.

Marine technology

Marine technology is the scientific and engineering basis of designing, building and operating vessels, structures and devices on and below the surface of the sea. Norwegian research groups in marine technology enjoy a strong international position. A high degree of competence in marine technology is of importance for the development of three of Norway’s most important industrial clusters: marine transport and maritime activities (maritime), offshore petroleum production (oil and gas) and the exploitation of marine biological resources (seafood). Important research challenges of relevance to several industrial clusters include the design and product development processes, sea loads and responses, marine cybernetics, logistics, operating techniques and safety.

Construction and environmental technology

Central disciplines here include construction techniques, geotechnology and engineering geology, architecture, building technology and processes, hydropower development, building management and mapping and surveying. Participants in this value chain range from the building owner with his advisers to the construction company, craftsmen and suppliers of materials, components and equipment. A well-operating physical infrastructure is an essential part of a society with a high standard of living, and research challenges facing this area are related to this aspect. Challenges worthy of mention

include sustainable building methods, development of building and construction processes, modelling of structures, use of materials, energy- and resource-efficient technologies, tunnelling technology and underground structures, coastal engineering, fjord crossings and arctic technology.

APPENDIX 3:

Industry and Energy Division

Programme Catalogue 2001

The Research Council of Norway

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Foreword

This document contains brief descriptions of the user-driven research programmes under the auspices of the Industry and Energy Division (IE) of the Research Council of Norway.

The Industry and Energy Division is the Research Council's primary executive unit for user-oriented downstream technical and industrial research.

The paramount goal of this industrial research is to promote wealth creation through R&D-based economic development. Such efforts are intended to strengthen long-term wealth creation in society in general, safeguard jobs, ensure the prudent utilisation of resources and protect the environment, while boosting the level of knowledge intensiveness in Norwegian business and industry.

The Research Council intends to:

- promote industrial research in the sectors that will make significant contributions to Norway's national wealth creation;
- increase the number of enterprises performing systematic R&D;
- help pro-active small- and medium-size enterprises (SMEs) reach a higher level of technology;
- identify, implement and follow up R&D programmes and projects with a potential for R&D-based innovation and wealth creation;
- strengthen the collaboration between the Norwegian Industrial and Regional Development Fund (SND) and the Research Council as a platform for increasing R&D-based economic development;
- promote the development of a research institute sector with ample capacity and a high scientific and professional level adapted to the needs of industry and government, and thus promoting wealth creation in society in general;
- encourage mobility among researchers from institutes and universities to the industrial sector, particularly to industries that are not traditionally research intensive and to SMEs.

IE is a partner for those companies and collaborating R&D communities intent on identifying projects that have the potential for substantial wealth creation in Norway, and where R&D efforts might serve as a catalyst and/or amplify effects.

The user-driven programmes are strategic in that they involve the participation of highly qualified researchers and companies in resource-intensive projects scheduled to last for three to five years. In addition, user-driven projects are used as a means to find out about new opportunities proposed by the enterprises themselves. Applications for support are received with deadlines February 1, May 1 and October 1.

Title of programme: **Power exchange and distribution monopolies – EFFEKT**
<http://www.forskningradet.no/program/effekt/>

Programme co-ordinator: **Hans Otto Haaland. Telephone (+47) 220 37297**
email: hoh@forskningradet.no

Time frame: **1996-2001**

Research Council contribution: **MNOK 165**

The programme focuses on Norway's public sector investments in user-driven R&D related to the power supply. While it mainly covers electricity, the programme also deals with other forms of energy insofar as they are relevant to the supply of electrical power.

The programme has three main target areas:

Power exchange, effective distribution monopolies, and safety and the outdoor environment.

Within the framework of sustainable development, the programme is designed to increase the returns Norwegian business and industry earn in the electrical power sector.

The programme is intended to result in environmentally acceptable new systems and technical solutions which:

- improve the yield on Norway's exchange of electrical power with other countries by reducing relative investments, boosting transmission capacity between Norway and other countries and increasing power plant output, while enhancing the systemic dividends inherent in the overall system;
- improve the operational and development-related efficiency of domestic grid monopolies;
- promote wealth creation in the power supply industry by improving competitiveness with a view to increasing the export of the sector's goods and services. (Including the supply of electric power, consultancy services and products such as turbines, transmission facilities and the like).

The programme's target group is the Norwegian energy industry, the power supply industry and the public sector.

Title of programme: **Efficient, renewable energy technologies – NYTEK**
<http://www.forskningsradet.no/program/nytek>
Programme co-ordinator: **Fritjof Salvesen, KanEnergi AS**
Telephone (+47) 671 53853 Fax: (+47) 671 50250
email: fritjof.salvesen@kanenergi.no
Time frame: **1995 - 2001**
Research Council contribution: **MNOK 29,8 (2001)**

The NYTEK programme focuses on research and development (R&D) aimed at efficient and renewable energy technologies, covering development efforts up to and including the field testing of a prototype.

In this context, the concept ‘renewable energy’ refers to the traditional renewable new energy sources: solar, bio, wind, geothermal and wave energy. Other renewable energy sources such as ocean currents and salt gradients, in addition to small scale hydropower (<10 MW), may also fall under the purview of NYTEK. The programme is related to utilisation and conversion, meaning that biomass-based production will not necessarily qualify.

In recent years, the international market for renewable energy has been expanding rapidly in Europe as well as globally, with sales typically rising by 25 per cent annually. Norway’s supply industry should target these markets, and it should be possible to increase Norwegian participation in this area by establishing new businesses and/or expanding the scope of existing industry.

The programme will focus on areas that feature commercial opportunities for products made by Norwegian companies. The goals of the programme are to:

- Develop products and systems which, preferably within a five-year period, pave the way for profitable Norwegian business activities related to efficient, renewable new sources of energy;
- Lay the foundation for future public and private sector activities related to the development and use of efficient, renewable energy technologies;
- Ensure a satisfactory level of expertise in selected areas at key research centres.

The highest priority will be assigned to the development of competitive products designed to improve energy efficiency and enhance the utilisation of renewable sources of energy. Approximately 70 per cent of the project funding is allocated to this, and contracts are to be signed with companies. Special importance is attached to projects that carry a high risk, but offer the potential of substantial wealth creation for Norway. The exploitation of bioenergy constitutes the greatest single market potential for Norwegian energy suppliers in the short term, and high priority will be attached to the development of competitive products and systems that can rapidly be launched on the Norwegian market. NYTEK co-operates with the Norwegian Water Resources and Energy Administration (NVE) and the Norwegian Industrial and Regional Development Fund (SND).

Approximately 30 per cent of the project funding is spent on more basic R&D to promote new economic development in Norway. This covers the development of expertise in fields in which users include one or more co-funding companies or public agencies. These projects often also include studies related to doctoral degrees.

Importance is attached to the internationalisation of Norwegian companies. Accordingly, support will be provided for pre-projects aimed at drawing up applications for

relevant EU research programmes. Participation in international collaboration requiring national funding, e.g. IEA and EUREKA, is considered on the basis of the same criteria as those applied to other projects. This emphasises the necessity of the multi-user approach, as NYTEK can cover a maximum of 60 per cent of the costs.

Title of programme: **NATURAL GAS - goods, services and processes**
<http://www.forskningsradet.no/program/naturgass>
Programme co-ordinator: **Trygve U. Riis. Telephone (+47) 220 37347**
email: tur@forskningsradet.no
Time frame: **1996-2001**
Research Council contribution: **MNOK 86**

The programme's ultimate goal is two-pronged:

- 1) To promote the development of profitable products and services based on the use of natural gas;
- 2) To promote the development of new and existing gas-related processes and new applications for natural gas in connection with processes.

Goal 1) primarily refers to projects that use natural gas directly in a distributed system featuring numerous, relatively small-scale users. This form of activity is most common on the export market, and is thus a continuation of an earlier programme entitled "Gas research - goods and services" (GAVOT). There has, during the programme period, been a larger focus on R&D related to increased utilization of natural gas in Norway.

Goal 2) primarily refers to the process industry and related activities that aim at promoting wealth creation based on the application of natural gas in processes in Norway.

In addition to the original main targets, there is today a higher focus on R&D activities which can contribute to increased utilization of natural gas in Norway.

The prime target group for GAVOT is equipment suppliers, as well as companies which help promote the use of natural gas in Norway in other ways. Important participants currently include Ulstein Bergen, Kværner, Kongsberg Offshore, Framo Purification, Umoe, Ulstein Bergen, and Fremo. Among the relevant research institutions, the most important participants are NTNU, SINTEF, MARINTEK, and CMR..

Chemical conversion mainly targets the major Norwegian petrochemical companies Statoil and Norsk Hydro. Other possibilities include Borealis, Dyno Industrier and Kværner Engineering. The development of processes to convert natural gas could boost Norway's domestic consumption of natural gas appreciably, and result in considerable wealth creation in Norway based on this resource. NTNU, the University of Oslo and SINTEF are the main research institutions involved.

Priority will be given to projects in which it is clear that Research Council participation will engender R&D activity. Further, it is important that the programme helps mitigate the risk involved, as technological R&D will normally entail some risk. The Research Council will therefore give priority to projects that carry a high risk but have the potential to yield a good dividend, and entail clear socio-economic benefits in addition to company-specific benefits.

Programme title: **Offshore 2010**
<http://www.sol.no/forskningsradet/program/offshore>
Programme co-ordinator: **Aud Alming, Telephone: (+47)220 37286**
email: aalm@forskningsradet.no
Programme period: **1999-2010**
Research Council funding: **MNOK 30,8 in 2001**

Technology is evolving at a rapid pace in the petroleum sector. New development solutions will focus on subsea production at great water depths, wellstream transport across vast distances, downhole operations, development in ecologically vulnerable areas, etc. Less energy-intensive, more environment-friendly solutions will be the focus of attention. One of the main challenges will be to arrive at technical solutions for new development concepts that call for less initial investment, cost less for maintenance and eliminate damaging pollution. A large part of the technological development in the petroleum sector is taking place in small and medium-sized enterprises (SMEs) and technology centres. Efficient industrialisation of the technology being developed will have a strong impact on employment and further progress in the industry. One challenge will be to get these companies take a systematic approach to R&D efforts in their fields of speciality in order to maintain their competitiveness.

Offshore 2010's main objectives are to:

- promote the development of new technology and expertise in downhole and subsea processing as well as multiphase transport;
- facilitate innovation and commercialisation in small and medium-sized enterprises (SMEs).

The research programme is designed to help develop technology, processes and products that will allow wellstream treatment as close to source as possible, opening the possibility of multiphase pipeline transport over vast distances and allowing final processing to take place onshore when such a solution would be optimal in terms of costs. The programme is intended to put Norway at the forefront of international developments in selected target areas.

Important R&D tasks:

- Facilitate the cost-efficient, safe and environment-friendly production of oil and gas at water depths down to 3000 m;
- Achieve multiphase transport through pipelines over distances of more than 300 km;
- Make downhole separation and the reinjection of water technologically and processually justifiable and operationally profitable;
- Develop subsea separation, pressure boosting and injection equipment for water depths down to 3000 m;
- Develop sophisticated monitoring and control systems for multibranch wells that will optimise productivity and cut well maintenance costs by 50 per cent;
- Reduce the volume of hazardous pollution from oil and gas production by 50 per cent, and contribute to reaching the national targets for CO₂ and NO_x emissions.

Title of programme: **The development and application of new knowledge to promote sustainable development in the Norwegian process and materials industry – PROSMAT 2000**
<http://www.forskningsradet.no/program/prosmat>

Programme co-ordinator: **Astrid B. Brenna. Telephone (+47) 220 37311**
email: astrid.brenna@forskningsradet.no

Time frame: **1996-2001**

Research Council contribution: **MNOK 617**

A large proportion of the products delivered to the Norwegian process industry currently consist of sophisticated materials and other high-tech products. Traditional raw materials such as metals, paper and plastic are no longer bulk commodities, but tailor-made products featuring special properties adapted to customers' needs. One of Norway's national goals is to develop industries that further process and refine more raw materials in Norway, and this programme was designed to support that goal. In this context, human resources are the manufacturing industry's most important tool. Building new knowledge into the products and increasing the share of custom-made and customer-specific products represent the manufacturing industry's best chance for improving its competitiveness and profitability.

The programme has the following objectives:

- NOK 10 billion more in R&D-based sales by 2005;
- NOK 1.5-2 billion in cost savings by 2005;
- At least 80 researchers associated with the programme should have completed doctorates by 2001;
- 70 per cent of these doctoral students should accept employment in the private sector.

The main challenges facing the process and materials industry are to:

- develop new products with a higher degree of refinement;
- develop new, improved processes to manufacture products more efficiently and of higher quality than competitors' products;
- ensure environmentally correct production;
- establish and further develop collaboration between companies and research communities in different fields and industries.

To meet these challenges, the programme will give priority to the following types of projects:

- Innovation projects;
- Basic research involving multi-company collaboration and aimed at developing the products and processes of today and tomorrow;
- Collaborative projects straddling several disciplines or different industries, or organised along a value chain or in a cluster;
- Environmentally motivated projects.

The projects will involve close collaboration between companies and Norwegian universities, colleges and research institutes. This should promote effective interaction between basic, targeted and market-driven research and ensure the quality and relevance of the research done in Norway, as well as the recruitment of the skilled labour required by the manufacturing industry.

The programme's target group includes companies in the following industries: wood processing, light metals, ferroalloys, petrochemicals, pharmaceuticals, fine and special chemicals, ceramics, and the rest of the chemical and metallurgical process industries.

Title of programme: **Economic Development from Medical Research - MEDKAP**
Programme co-ordinator: **Arthur Aamodt. Telephone (+47)220 37084**
email: aam@forskningsradet.no
Time frame: **2000 – 2005**
Research Council contribution: **MNOK 98**

On 1 January 2000, the Research Council of Norway established a new research programme aimed primarily at *promoting wealth creation by increasing the commercialisation of the results of medical research*. The programme is a joint effort on the part of the Industry and Energy Division (IE) and the Medicine and Health Division (MH). It represents a continuation and integration of the IE programme *The capitalisation of biotechnology* (KAPBIO) and the MH programme *Innovative business ideas based on medical research*. In 2001 the programme has four closing dates for applications.

The programme mainly targets individual researchers and small groups of researchers working in medical/technical fields at universities, colleges or hospitals, or in the institute sector. The programme can also grant support to researchers working in industrial enterprises to develop product ideas in fields that would not be natural to exploit or commercialise through the enterprise by which the researcher is employed.

The programme will focus on four types of activities:

- Funding for all or part of the R&D work needed to develop and verify a particular scientific or technical concept;
- Evaluating the market and patent-related basis for the project, and finance market surveys and initial patent protection (priority patent);
- Assessing opportunities for other sources of funding and helping establish contact between the parties, if need be;
- Providing expertise for the commercialisation of ideas, either by establishing new enterprises or by implementing the idea in an existing enterprise, and helping finance the initial phases, if need be.

Programme management will be proactive and flexible, at the same time as the requirements for proprietary or independent funding will be limited. The intention is to encourage an in-depth dialogue between the programme management and potential applicants, so that both parties have a complete understanding of the assumptions, opportunities and limitations inherent in the projects selected. The dialogues will generally be handled by programme-specific research managers with scientific and industrial experience.

A six-member joint programme committee has been set up, supplemented by observers from the Ministry of Trade and Industry (NHD) and the Ministry of Health and Social Affairs (SHD). The programme co-ordinator is employed by the Research Council of Norway, Medicine and Health Division. For more detailed information about the programme, please contact:

Professor Tore Jahnsen (Chairman of the Programme Committee), University of Oslo, Tel. (+47) 222 00137, tore.jahnsen@basalmed.uio.no, Director Thorfinn Ege, BioMedical Consulting AS, Tel. (+47) 328 53636, torfege@online.no, Professor Anders Sundan, NTNU, T. 73 59 86 67, anders.sundan@medisin.ntnu.no, Adviser Wenche M. Olsen, Forskningsparken A/S, Oslo, Tel. (+47) 229 58986, wmolsen@fposlo.no.

Title of programme: **Programme for the building and construction industry 1996 - 2001 (the BA programme)**
Programme co-ordinator: **Jørn Lindstad. Telephone: (+47) 220 37334**
email: jli@forskningsradet.no
Time frame: **1996-2001**
Research Council contribution: **MNOK 250**

The building and construction programme (BA) targets an industry with annual sales of about NOK 130 billion. The building and construction industry serves a vast market both in Norway and abroad. The R&D tasks are numerous, and cover a wide range – from the production of building supplies to engineering and design.

As described in “The building and construction industry’s strategy for innovation, R&D and human resources development”, the goal of the programme is to help Norway develop:

- a building and construction industry that can compete on the international arena
 - higher profitability through more innovation
 - specialisation and more value added, *inter alia*, through more long-term customer/supplier relationships
- a building and construction industry adapted to users and customers
 - raise the total utility value of buildings and construction projects for the end users
 - promote more innovation and interaction in the building process
 - improve predictability and devote more attention to environmental and administrative tasks
 - contractors that set stringent requirements
- an attractive industry for the recruitment of the best employees
 - more interest in technological development
 - more innovation and human resources development

For the industry, the greatest benefit will be higher productivity in terms of both implementation and professionalism. The results will be evident when construction projects receive fewer complaints and offer higher quality, benefiting the end user.

Apart from the purely technological aspects, important R&D tasks include raising the level of expertise in the university and institute sector, in addition to building up expertise within companies to a level at least as high as that of foreign competitors.

Title of programme: **The IT industry and the graphics industry – PROGIT**
http://www.forskningsradet.no/program/progit
Programme co-ordinator: **Jan E. Marthinsen. Telephone (+47) 334 59003**
email: jan@jemcon.no
Time frame: **1996-2001**
Research Council contribution: **Approximately MNOK 450**

The programme is aimed at industrially-oriented companies with products based on information and communications technology (ICT): manufacturers of electronic products and components, computer and telecommunications equipment, software and the IT systems industry. The segment of the ICT industry that generally supplies *services* (for example, telecom and network services, IT operations services, consultancy and development support for projects, the sale and maintenance of IT equipment) basically falls outside the scope of the programme. Notwithstanding, the programme is open to projects and players that are in the grey zone between industrial and service-oriented ICT activities. For the graphics industry, the main emphasis will be on projects related to the use of ICT in graphic products and production processes.

PROGIT's goal is to promote growth and profitability in Norway's IT and graphics industry. Particularly high priority will be given to R&D projects that will promote the manufacturing industry's opportunities to expand in export markets. The projects may be geared towards product innovation or towards achieving more cost-efficient and quality-assured production and product development processes.

PROGIT focuses on technologies and fields of great importance to many companies. These technology-oriented efforts cover topics such as *Sensor technology. Compact electronics, software development – process improvement, and communications technology*. More independent efforts will be possible in certain areas in which the industrial and human resources situation suggest that good results can be achieved. The programme – and the target areas – comprise the following types of projects:

- *Company projects* based on the company's corporate business strategy. The projects should help raise the level of ambition and encourage people to take a more long-term view of the company's R&D efforts.
- *Collaborative projects* directed towards the R&D needs of a larger group of companies, and performed under the supervision of the collaborating companies.
- *Doctoral projects* related to R&D projects under the auspices of industry or to R&D needs identified by one or more companies ("industrial doctorates").
- *Pre-projects* to study and improve target areas, as preliminary studies for projects under the auspices of a company (with or without support from PROGIT for the main project), and in preparation for international R&D collaboration (such as, for example, EUREKA projects, or the preparation of applications for relevant EU programmes).

Title of programme: **Programme for services/infostructure – TYIN**
<http://www.forskningsradet.no/program/tyin>
Programme co-ordinator: **Helge Klitzing. Telephone (+47) 2203 7442**
email: hkl@forskningsradet.no
Time frame: **1996-2001**
Research Council contribution: **MNOK 45 – 60 per year**

The main pattern for wealth creation and employment in Norway has shifted significantly – from emphasising the primary industries, manufacturing and the production of goods, to emphasising the provision of public and private sector services. Today, services account for nearly 80 per cent of all employees and approximately 60 per cent of the gross domestic product. This trend will continue. TYIN is one of the instruments the authorities have for reinforcing this sector.

There is a clear correlation between services and infostructure. Good infostructure will play an important role in respect of the service industry's development opportunities. In itself, good infostructure will also pave the way for entirely new service products and new marketing and sales channels. However, the programme will also address issues that are independent of the bond between infostructure and services.

TYIN's primary objective is two-pronged:

- *To increase the creation of wealth, productivity and quality in service enterprises;*
- *Thereby, as well as through the creation of new services and trade patterns, to contribute to the creation of more wealth in business and industry in general and in the public sector.*

The sector is extremely broad, so efforts must have focal points. TYIN's target groups are:

- A. Knowledge-intensive business services – KIFT.¹
- B. Value chains aimed at distribution and retail trade.²
- C. New services based on infostructure and the establishment of infostructure for such services.

Within this the programme focuses three areas:

1. *Learning, organization and co-operation*
2. *New ways of doing commerce and distribution*
3. *Netbased services*

The projects that will receive support can be divided into three categories: pre-projects, doctoral projects³ and main projects⁴. The projects will have three levels:

- Strategic level: research **on services** as well as on common problems.
- Industry level: research and industrial studies **in collaboration with** relevant industries on industry-specific problems.

¹ The services depend on professional expertise; they produce a product which is, in itself, a primary source of information or knowledge for customers; they are used by customers to produce their own goods and/or services, and they engage in other professional activities as customers.

² Vertical chains from manufacturer to consumer.

³ These should preferably be linked to one of the main projects.

⁴ Ordinarily, the party to a contract is a company that may represent a group of companies.

- Corporate level: studies of wealth creation **for** and **together with** individual companies or groups of companies in vertical or horizontal collaboration.

Title of programme: **Programme for logistics, IT applications, transport
–LOGITRANS**

Programme co-ordinator: **Torstein L Garnaas.T. 221 28370, Fax: 221 28397
email: tlg.forskningsradet@tf.no**

Time frame: **1997-2001**

Research Council contribution: **Approximately MNOK 75**

The main goal of *LOGITRANS* is to promote wealth creation through more efficient, environment-friendly logistics/transport, *inter alia*, by using more IT-based solutions to solve problems involving logistics and the transport of people and goods.

Each year, the Research Council channels MNOK 15 to the programme, most of which comes from the Ministry of Transport and Communications. Projects are to be based on collaboration between industry, public agencies which are, as a whole, expected to invest comparable resources, and relevant R&D communities. Through close contact with users, the goal is to perform result-oriented research, development and demonstration work in six target areas:

- *Environment-friendly, efficient logistics and transport solutions*
- *Combined transport systems and hubs/terminals*
- *IT-based solutions for passengers and travellers –The Citizen's Network*
- *Infrastructure and general terms and conditions*
- *Horizontal (common) IT-related topics*
- *Human resources development and the dissemination of knowledge.*

Industrial logistics projects have already been started, and include important, export-oriented industries and individual companies at the national and regional levels. Development projects have been started for the service industry, for example, transport/logistics companies. Network building and benchmarking are of great importance to such projects.

A project entitled City Logistics is scheduled to begin under the auspices of this programme in 1998.

Environmental considerations will be playing a larger part in transport and logistics solutions in the years ahead, so the programme aims to initiate projects based on company-related (micro) and national (macro) needs. Opportunities and requirements for the development of more powerful corridors for the movement of goods, based on multi-modal solutions (road, sea, rail) to Europe and domestically will be examined; computers, modelling/method tools, as well as structural and behavioural factors will be vital.

The application of information technology is a crucial element in the various target areas. The main focus will initially be on the development of information networks (infrastructure requirements), services/equipment and questions related to the use of same. Among other things, activities have been initiated involving the use of dynamic data in road traffic and professional drivers' role and working situation with a view to the introduction of new information technology.

The *LOGITRANS* programme will be part of Norway's participation in the EU's framework programme.

The programme is intended to facilitate the completion of four doctorates.

Title of programme: **Maritime activities (MARITIM)**
www.forskningsradet.no/program/maritim/index.htm
Programme co-ordinator: **Paul F. Sørensen. Telephone (+47) 220 37301**
email: pfs@forskningsradet.no
Time frame: **1998-2002**
Research Council contribution: **MNOK 240**

The framework for the overall social and industrial goals is outlined in Report No. 28 to the Storting (1996/97) *Where ships can float.....* The following quotation comes from the report:

“One goal is to ensure that the greatest possible share of wealth creation and employment in Norwegian maritime activities takes place in and from Norway. The development of new knowledge and new products is engendered through close co-operation between the various parts of the maritime community. The Government’s approach is that maritime industries are important as a whole. The Government is of the opinion that maritime research ensures the viability of the Norwegian maritime community. Importance will be attached to spending the research funding on projects that will serve the whole environment insofar as possible.”

The MARITIM programme was started in 1996, partly as a consequence of the Report to the Storting (White Paper), and partly as a result of the compelling challenges the Research Council received from industrial trade organisations to gather maritime R&D activities into *one* cluster programme.

Objectives:

- Profitability and competitiveness
- Expertise, recruitment and education
- Safety and the environment
- Internationalisation

Utility value:

Closer collaboration and a stronger cluster effect, combined with new knowledge and expertise, new products and services for a global market, a higher level of safety and environmental awareness – a Norway acting as a prominent hub of international expertise.

Important R&D tasks:

The programme is divided into four R&D areas involving time-limited thematic efforts (sub-programmes), as illustrated below in italics:

- **Sea transport and logistics:** *Short sea shipping (1995 - 98) and Sea transport/logistics (Plan for 1999 - 2002)*
- **Ship operations:** *Ship operations and ship technology (1998 - 2002), Programme for the maritime environment (1998 - 2002)*
- **Shipbuilding and ship technology:** Product development, paving the way for production, production technology, organisation and interaction (1998 - 2002)
- **Ships’ equipment and equipment technology:** The cost-effective supplier, lifetime deliveries and products of the future (1998 - 2002).

Title of programme: **R&D programme for the manufacturing industry – VARP**
<http://program.forskningsradet.no/varp>

Programme co-ordinator: **Sven Samuelsen. Telephone (+47) 220 37443**
email: ssa@forskningsradet.no

Time frame: **1996-2001**

Research Council contribution: **MNOK 33,7 (2001)**

The programme's ultimate goal is to use R&D to strengthen the competitiveness of Norwegian industry by boosting productivity and paving the way for the development of more market-oriented products.

In this context, the key challenges the manufacturing industry as a whole will have to tackle are:

- Manufacturing on demand and small series are replaced large series production;
- The application of new materials is increasing in new and existing products;
- More focus on environment-friendliness in products and manufacturing processes;
- More stringent requirements in respect of quality and costs;
- The focus is shifting from production costs alone to also include lifetime costs;
- Information technology is developing rapidly.

The long-term effects are to be ensured by:

- More long-term strategic research in the institutes that operate under the auspices of the manufacturing industry;
- Higher R&D levels in the companies that perform systematic R&D;
- More of the companies that currently perform little systematic R&D should be encouraged to adapt R&D as a strategic tool.

The central R&D tasks will generally represent a balance between common industrial activities and industry-specific activities. For the manufacturing industry as a whole, important fields of R&D will include:

- * Product development and design, * Materials technology, * Production technology,
- * Productivity

The programme is geared to the segment of the manufacturing sector comprised of the heavy engineering, metal goods, foundries, plastics, furniture and the textiles industry. The primary target group consists of companies in each of these areas that have the willingness and capability to adopt R&D as a strategic tool. The priority given a project will be commensurate with its growth potential.

The results will also be of interest to companies outside the manufacturing industry. R&D institutes, educational institutions and trade associations will be key players in the implementation of the programme.

Title of programme: **Productivity 2005 (P-2005)**
<http://www.p2005.ntnu.no> Programme co-ordinator:
Sven Samuelsen. Telephone (+47) 220 37443
email: ssa@forskningsradet.no

Time frame: **1997 - 2005** Research Council contribution: **MNOK 17,9 (2001)**

The manufacturing industry is the dominant industrial sector in Norway. Competition is keen in national and international arenas, and only those companies that can demonstrate the capacity to adapt and restructure can expect to succeed. Many people expect strategic alliances between companies and research and educational institutions to be a prerequisite for competitiveness in the next millennium. This means that expertise will be a key factor in improving the productivity of Norwegian manufacturers.

Productivity 2005 aims at implementing a national campaign to enhance the competitiveness of the manufacturing industry through active reinforcement of NTNU's educational programme and Norwegian research expertise. This involves the development of spearhead expertise and interdisciplinary expertise in technology, management and organisation.

During the period in question, six strategic programmes will be implemented in collaboration with at least 10 cornerstone companies. The programme should result in the production of 36 doctorates. New user-driven projects will be developed at the national and international levels.

P2005 is a long-term programme aimed at the development of expertise. Its greatest potential lies in innovation in the overlap between technology, management and organisation, and in the establishment of alliances between industry and academia, both nationally and internationally.

The most important R&D tasks are related to the implementation of strategic projects through close collaboration between industry and research, the production of doctorates, the development of international networks and a number of independent project focusing on productivity.

Title of programme: **Environmental Technology Programme-NORMIL 2000**
<http://forskingsradet.wbno.no>

Programme co-ordinator: **Tor-Petter Johnsen. Telephone (+47) 220 37426**
email: tpj@forskingsradet.no

Time frame: **1996-2001**

Research Council contribution: **MNOK 7,4 (2001)**

This programme is intended to strengthen the environmental technology industry, promoting wealth creation and export revenues in this sector.

The programme's more operationalised secondary objectives include the promotion of:

- commercially profitable environmental technology products and services in existing and new markets;
- collaboration on the development of complete systems solutions;
- new technological solutions to environmental challenges that have priority at the national and/or international levels;
- the efforts of the manufacturing industry and the research institutes with regard to long-term human resources development.

To be commercially viable, environment-related industrial activities must be based on domestic and international environmental problems. Both the authorities and the manufacturing industry contribute to the creation of new activities and the priorities assigned to the relevant product areas, and the order of the priorities is subject to constant flux. The emphasis on the user-driven approach and human resources development call for efforts to be focused on three types of problems:

- Technology projects (product development, testing)
- Systems projects (total, turnkey solutions)
- Strategic projects (future environmental challenges, the need for knowledge).

The programme is primarily directed at business and industry and research institutes, although some strategic projects will require the involvement of the environmental authorities. This programme defines the industrial environment sector as that segment of business and industry which supplies products and services primarily intended to mitigate or avert environmental problems.

The programme will also accept applications from other industries, provided the project in question is primarily environmental in its motivation.

The programme is scheduled to run for five years. It will be closely co-ordinated with other relevant Research Council activities.

Title of programme: **Technology for reducing greenhouse gas emissions - KLIMATEK**
<http://www.cmr.no/klimatek>

Programme co-ordinator: **Hans Roar Sørheim, Christian Michelsen Research**
Telephone (+47) 555 74214
email: hans-roar.sorheim@cmr.no

Time frame: **1997 - 2001** Research Council contribution: **MNOK 40 (2001)**

In association with Report No. 41 to the Storting relating to the Norwegian policy on climatic change and the emission of nitrogen oxides (NO_x), Norway's ministries of the Environment, Trade and Industry, and Petroleum and Energy devised KLIMATEK, a programme designed to focus on the testing of technology that can reduce emissions of CO₂ and other greenhouse gases. The programme started in 1997.

The primary objective of KLIMATEK is to:

- Promote more use of technology to reduce emissions of greenhouse gases.

The programme's secondary objectives have been defined as being to:

- Trigger an average of one full-scale project in the petroleum and/or process industry per year;
- Trigger two to four pilot and demonstration projects in the petroleum and/or process industry per year;
- Trigger a limited number (<6) of pilot and demonstration projects in other sectors;
- Initiate research projects that feature a high degree of innovation and have a strong potential for reducing emissions.

KLIMATEK focuses on projects with the potential to cause appreciable reductions in Norway's emissions of greenhouse gases. Demonstrations of emission-reducing technologies under realistic conditions are considered to be an important means of promoting commercial use. One criterion for the success of the programme is that the total potential emissions reductions that can be accomplished using technology from KLIMATEK must be at least 10 million tonnes of CO₂ equivalents.

Important R&D tasks:

- Technology for the combustion of fossil fuels, which also contributes to cost-efficient reductions in CO₂ emissions;
- Technology for scrubbing waste gases and storing CO₂;
- Technology for more efficient energy consumption/energy recovery;
- New processes in the industrial, waste management and agricultural sectors that reduce emissions of greenhouse gases;
- Technology/solutions that facilitate reductions in emissions from the transport sector;
- System analyses.

From 2001 there will be a certain focus on research concerning gas-fired power generation with CO₂ sequestration.

Title of programme:	BRIDGE – Programme for bridging the gap between industry and research http://www.forskningsradet.no/bro
Programme co-ordinator:	Marit C. Synnevåg. Telephone (+47) 220 37231 email: mcs@forskningsradet.no
Time frame:	1996 – 2001
Research Council contribution:	MNOK 490

The fundamental concept underlying BRIDGE is to bridge the gap between industry and R&D institutions by encouraging specific collaboration projects. The current activities of BRIDGE are often located in the grey zone between corporate development, R&D, and technological and financial/ administrative processes. The activities are based on the assumption that the mobilisation of the R&D communities is one important factor for promoting more innovation in these companies. One important aspect is to promote more smoothly functioning innovation systems and learning environments, where companies, public sector agencies and programmes, the Authorities, R&D communities and other experts can work together more closely at both the national and regional levels. BRIDGE also focuses on mobilizing/new companies to R&D by strengthening their ability and capacity to innovate more systematically.

Primary objective

The programme shall promote long-term relationships and collaborative projects between companies with little R&D activity especially SMEs, and R&D institutions in an effort to create more innovative, competitive companies. Ultimately, the success of the programme depends on the success of the companies. BRIDGE will in the future place greater emphasis on the needs and expectations of the SMEs.

The BRIDGE's - current portfolio

- **TEFT** - technology transfer from technological research institutes to SMEs
- **REGINN** – regional innovation
- **SME-Competence** – the recruitment of highly skilled staff to SMEs
- **SME-College** – strengthening relations between regional colleges and industry

Target groups

- companies with little R&D activity and little R&D experience
- R&D institutions - represented by universities, colleges and research institutes
- innovation systems, other parts of the public sector – especially The Norwegian Industrial and Regional Development Fund (SND), other public sector and local authorities.

The Programme portfolio - the BRIDGE-projects

TEFT (1999-2003) (technology transfer from technological research institutes to SMEs) The project's total budget is MNOK 119. The objective is to enhance the competetiveness in the cooperating SMEs through increasing the technological ability and –capacity.

TEFT will maintain the focus on technology while devoting more attention to the ‘soft’ side of technology transfer. Considerable emphasis will be attached to the ties between TEFT and other relevant user driven R&D- programmes in order to offer companies more comprehensive, long-term development trends. TEFT consists of 12 technology attachés operating in all counties connecting SMEs with technological research institutes, for the purpose of performing co-projects. There are primarily technological communities are involved in TEFT as of 2000; SINTEF, Rogaland Research, Christian Michelsen Research, NORUT and MATFORSK (Norwegian Food Research Institute).

SME Competence (1997-2001)⁵ is a project designed to help SMEs recruit well-qualified, relatively recent graduates. The recruits devote one year working on a defined project or development assignment based on the needs of the company in question, in order to promote the innovation processes and possibly expanding collaboration between regional colleges and the company. The recruits are backed by professional support, generally an academic supervisor. SME Competence is designed to encourage the establishment of more lasting, formalised and mutual collaboration between SMEs and the educational institutions involved. In 2001 18 regional colleges are participating.

SME College (2001-2004) focus on stimulating regional colleges external activities and their role in regional innovation. The projects are formed by the colleges themselves and are comprehensive. It is highly important stimulating to creativity and new forms of cooperation. This will support and accelerate the outward contact that many regional colleges are already having. In 2001 are 14 projects sat on foot.

REGINN – projects for regional innovation 1997-2001 will contribute to the development of stronger links in regional innovation systems. REGINNs primary purpose is to encourage regional R&D centres, along with other industrial players, to engage in more interaction and joint efforts to promote innovation within regional industry. Branches and clusters of utterly importance for the regions will be supported. In 2001 are 10 projects economically supported. REGINNs innovation projects are being supplied by research projects concerning various aspects of regional innovation. This is done in co-operation with the FAKTA-programme.

A learning scheme for BRIDGE

To ensure more systematic documentation, reinforce the basis of knowledge, improve learning and dialogue among the programme’s players and sources of funding, a learning scheme has been developed. The basic idea is developing meeting places and learning arenas internally in the projects, and between the BRIDGE-board and the projects. Special analyses of the projects, year reports, evaluations and contemporary research projects are all components within the learning scheme.

For further information on the BRIDGE programme, we refer to our Internet address:

www.forskningsradet.no/bro

⁵ The Research Council has already suggested further support for a new period - 2002-2005.

Title of programme: **FORNY – Research-based innovation and commercialisation**
Programme co-ordinator: **Torkil Bjørnson Telephone (+47) 220 37000**
torkil.bjornson@forskningsradet.no
Time frame: **2000-2003**
Research Council contribution: **MNOK 139**

FORNY is being set up as a separate programme as from 2000. It is a joint venture between the Norwegian Industrial and Regional Development Fund (SND) and the Research Council. The Ministry of Trade and Industry and the Ministry of Local Government and Regional Development are providing funding. FORNY was initially a project under the Programme for Technology Transfer in 1995 and was subsequently continued under the BRIDGE Programme.

FORNY is based on the vast potential which exists for bringing to fruition research-based business ideas conceived at universities, colleges and research institutes.

Target groups: Individuals, that is, employees and students at scientific and technical colleges and universities, organisations such as R&D institutions, and commercialisation units such as science parks.

- FORNY is intended to promote wealth creation based on research results obtained in Norway, and thereby to enhance the knowledge and technology component in Norwegian business and industry. Thus FORNY will help create more competitive enterprises by promoting innovation at the national and regional levels. The goal is to make FORNY available nation-wide.
- FORNY is intended to help researchers and research managers to better recognise and assess opportunities for the commercialisation of research results. This should mean that those who conceive ideas and those who own the rights to the ideas benefit from any commercial success that might be achieved on the basis of the idea in question. FORNY is designed to increase the number of researcher-generated ideas that lend themselves to commercialisation and entail a satisfactory wealth creation potential.
- FORNY will help commercialisation units become more professional advisers in relation to evaluating commercial potential and further processing ideas with an attractive innovation potential. FORNY will contribute to the effective realisation of potential business opportunities through the establishment of new companies or licensing arrangements.
- FORNY will help promote more and closer collaboration with other Research Council programmes/projects, with SND activities and with other relevant innovation players (e.g. SIVA, the Start Fund), to ensure that those involved in commercialisation processes receive effective and far more comprehensive assistance.

FORNY will enhance R&D facilities' potential for conceiving commercial ideas, partly by using funds earmarked for the R&D institutions to encourage ideas, and partly by using funds earmarked for the commercialisation units to evaluate and possibly develop ideas commercially, up until other private or public sector players can take over and continue this work. The funding available through FORNY falls into three categories: Infrastructure funding, Project funding and Incentive funding. Agreements for infrastructure funding will be

signed with R&D institutions, while agreements involving project and incentive funding will be signed with commercialisation units. In addition, the commercialisation units and R&D institutions will sign separate commercialisation agreements with each other.

Title of programme: **Facts of importance to industrial and technology policy – FAKTA**
<http://www.forskningsradet.no/program/fakta>

Programme co-ordinator: **Tor-Jørgen Thoresen. Telephone (+47) 613 30575**
email: tjt@forskningsradet.no

Time frame: **1997-2002**

Research Council contribution: **MNOK 25**

By virtue of its role as research strategy adviser to the authorities, the Research Council is to collect and collocate facts of importance to Norway's industrial and research policy. This advisory role must be viewed in relation to the realisation of the objective regarding a uniform, well-documented research policy. This task also means that the Research Council will give the Government and ministries advice about ranking the priority of Norwegian research projects. This advisory responsibility means that the Research Council puts the research needs of tomorrow on the agenda and recommends which research policy tasks require concerted national efforts, and how such co-ordination can be accomplished.

The programme's objective is to improve the factual basis for taking decisions on Norway's industrial and technology policy based on an interactive understanding of innovation. The programme is intended to provide more and better background information for political decisions and for planning at different levels of government and at the Research Council.

One important goal of FAKTA is to develop knowledge that can facilitate strategies to get more enterprises to use R&D systematically as a means to promote growth and add value. Another ambition is to improve the level of professional expertise in the research communities that participate in the programme to build interest in and expertise related to industrial and technology policy in the long term.

The utility value of these efforts is mainly related to the decision-makers responsible for the general conditions that will apply to industrial and technology policy and for the instruments available to ministries, public sector programmes, employee and employer organisations and the like, so that these bodies will have a better factual basis for the formulation of policy.

Important R&D tasks:

- Profitability, growth and the development of expertise as a result of R&D and innovation;
- Entrepreneurial efforts and intrapreneurial efforts;
- Corporate demographics and case studies.

Title of programme: **National Information Network – NIN**
 Programme co-ordinator: **Odd Helge Longva. Telephone (+47) 220 37325**
 Time frame: **1996-2001**
 Research Council contribution: **MNOK 149**

*An **information network** is a group of people and businesses that works together and exchanges information. This requires the support of a technical infrastructure, a **communications network** and a set of information services, i.e. an **information infrastructure**.*

Principal aims

- *To have disseminated and explained the effects of using information networks in industry.*
- *To have demonstrated how society benefits by the industrial and public-sector use of information networks.*
- *To have established permanent information networks with participants from the public and private sectors.*

Specific aims

- *To have established 25 information networks in at least 15 priority areas, of which at least one third should involve network-based interaction between participants from the public and private sectors.*
- *To have identified and described at least 50 reference networks in Norway and abroad, in about 20 different areas, in order to put Norwegian industry into contact with leading international users of information networks.*
- *To have helped raise levels of competence and restructuring ability in Norwegian industry by means of well-designed joint organizational solutions.*
- *To have demonstrated positive social results, e.g. in rural development, employment, the environment, the integration of the disabled as a result of teleworking etc.*
- *To have taken research and development initiatives in issues related to the establishment, operation and connection of networks and activities based on networks.*
- *To have encouraged innovation by disseminating the potential for new services and products in information networks.*

The main tasks and challenges to solve in order to meet these aims are:

- Establish demonstrator networks to show user groups the usefulness of information networks and what they can be used for, while ensuring that the networks will continue under their own power after the end of the demonstrator period.
- Identify information networks and making user groups aware of their usefulness.
- Launch joint research and development activities on the potential and limitations related to setting up and operating networks, such as new methods of organizing and interacting, technology, infrastructure, infostructure, legislation and regulations.

Target groups include users, network operators, information providers, information processors, network operators, and regulatory authorities.

Areas targeted for applications/demonstrators are:

- | | | |
|----------------------------|---------------------|-----------------------------|
| * Transport | * Maritime | * Building and construction |
| * Health | * Tourism | * Electronic commerce |
| * Distance working | * Geodata | * Corporate information |
| * Regional networks | * e-learning | |

Areas in bold are given priority.

Co-ordination with the relevant ministries will be handled by The Co-ordinating Committee for NIN, SU.

Program name: **Value Creation 2010**
Enterprise Development Through Broad Participation
<http://program.forskningsradet.no/vs2010>

Programme coordinator: **Håkon Finne, tel.: +47 73 59 25 54**
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Programme period: **2001-2010**

Research Council contribution: **approx. 15 mill. NOK (2001)**

Competitive advantage is increasingly related to application and development of human resources, competence, relations and other intangible assets. Global competition more and more occurs through innovation and renewal of products, processes and organization, changes that to a large extent need to emerge from existing activities if enterprises are to survive. Competence development through external supply is important but at the same time the enterprises need a strategy for learning and innovation through renewal from within.

By coupling an enterprise-internal participative approach, based in social partnership, to external research resources, the programme will create learning strategies and interactive innovation processes for the benefit of enterprises and research. A linking of many enterprises, research and educational institutions, public support agencies and organizations of trade and industry in *development coalitions* will give greater impact on regional and other processes of increasing value creation.

The main objective of VS 2010 is to contribute to increased value creation, employment and entrepreneurship through development of enterprises from within in an organized co-operation with external actors. This is to be based in development activities in the individual enterprise through the strengthening of national and local co-operative relations based in social partnership and the co-ordination of agencies and their resources.

The programme is a collaboration between LO (Norwegian Confederation of Trade Unions), NHO (Confederation of Norwegian Business and Industry), SND (Norwegian Industrial and Regional Development Fund) and the Research Council's divisions of Industry and energy and Culture and society. It expands on experiences from the programme Enterprise Development 2000.

Important challenges:

- Develop existing enterprises from within through broad participation
- Promote an active commitment of social partners to enterprise development
- Propagate and adapt participation and other organisational measures to other industries and sectors
- Increase the enterprises' use of research and development
- Strengthen Norwegian institutions of organizational research and education
- Promote the participation of enterprises in networks and other development coalitions
- International challenges

The programme is industry independent and addresses larger coalitions as described above.