Midway Evaluation of the Norwegian Centres of Excellence

A report submitted by an International Evaluation Committee

Evaluation report

The Research Council of Norway
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Executive summary

The Norwegian Centres of Excellence scheme is designed to stimulate Norwegian research groups to set up centres devoted to long-term basic research. The intention is to raise the quality of Norwegian research and bring more researchers and research groups up to a high international standard. Following an application and evaluation process thirteen Norwegian Centres of Excellence were selected and started their activity in 2002 and 2003. The CoE scheme requires that each of these centres be subjected to a midway evaluation under the auspices of the Research Council of Norway after 3 ½ years, as calculated from 1 January 2003.

The purpose of the midway evaluation is to assess the scientific quality and performance of the individual centres in absolute terms and relative to the centres' original research plans. The evaluation will provide data to support the Research Council's decision as to whether the individual centre is to continue for an entire 10-year period, or will be wound up after 5 years.

The midway evaluation has been carried out in accordance with the terms of reference and procedure established by the Research Council of Norway, and involves the preparation of an extensive background material, including self-evaluations prepared by the centres and their host institutions, an assessment of each centre by three international experts, and an overall evaluation made by an interdisciplinary, International Evaluation Committee set up by the Research Council. The Evaluation Committee has based its judgement on the written background material background material, the experts' assessments and hearings with each centre and host institution. The present report sums up the considerations and conclusions of the International Evaluation Committee.

The Norwegian Research Council (NFR) is to be congratulated for having initiated the program of Norwegian Centres of Excellence. From a 3.5 year perspective the CoE program has been very successful, and most centres have established a dynamic research program. Through the formation of a CoE, the centres have become attractive partners for national and international collaboration, and they have in general been able to markedly further enhance their funding from universities, foundations and/or the industry. They have also been able to increase their postdoctoral and PhD training and attract international senior scientists as staff members and visiting scientists. The international visibility and status of Norwegian science has been markedly improved.

Our overall ranking of the different CoEs were based on their research achievements, the research plans for the next five year period, and the organization and leadership of the CoE. The different CoEs were evaluated and ranked, using the description of terms defined by NFR. Most centres were evaluate as exceptionally good, whereas a few were ranked somewhat lower, primarily due to concerns regarding the organization of the CoEs

The overall impression of the evaluation committee is that the CoEs have had a very positive effect on the research environment in which they have been formed. They have generally created collaboration and interaction across disciplines, departmental and faculty borders. Important characteristics of the most successful centres are:

- Scientific vision and clear strategic focus
- Willingness and ability to exploit cross fertilization between different disciplines

- Strong and dynamic leadership in terms of both intellectual/scientific direction and team management.
- Ability to attract the very best scientists at all levels from all parts of the world

These characteristics promote scientific excellence and international visibility.

A particular concern at this stage is the urgent need for planning by the host institutions for the CoEs at the end of their term. This is vital for the recruitment of new, and maintaining existing staff and high profile activities at the different CoEs during their last period. Such plans need to be developed in interaction between the CoEs and the university or other organisation at which the CoEs are based. We note that some universities consider it important to take advantage of the development at the CoEs, provided that they continue to do cutting edge research. They plan to continue the best aspect of the CoE efforts in other forms after the ten year period is ended, although concrete plans are not yet formed. In contrast, the representatives for the University of Oslo expressed the view that their CoEs would have to be closed, and they had no possibilities to provide further support after the ten year life of the CoE.

1. Introduction

The Norwegian Centres of Excellence scheme is designed to stimulate Norwegian research groups to set up centres devoted to long-term basic research. The intention is to raise the quality of Norwegian research and bring more researchers and research groups up to a high international standard. The scheme is open to long term basic research without immediate application or social relevance, as well as to research with such relevance. The centres may receive funding for a maximum of ten years. The CoE scheme is administered by the Research Council of Norway and funded by the yield on the Fund for Research and Innovation.

After a call for proposals in 2001, followed by an application and evaluation process divided into two phases, thirteen Centres of Excellence were selected and started their activity in 2002 and 2003. The Norwegian Centres of Excellence scheme requires that each of the centres be subjected to a midway evaluation under the auspices of the Research Council of Norway after 3 ½ years, as calculated from 1 January 2003.

The purpose of the midway evaluation is to assess the scientific quality and performance of the individual centres in absolute terms and relative to the centres' original research plans. The evaluation will provide data to support the Research Council's decision as to whether the individual centre is to continue for an entire 10-year period, or will be wound up after 5 years.

2. Terms of reference of the midway evaluation

The terms of reference of the midway evaluation of the centres were announced by the Research Council on the web 18 August 2005, and provide:

- the framework for the evaluation
- the conditions and basis for the evaluation assignment
- background material for the evaluation
- mandate for the International Evaluation Committee.

The document giving the terms of reference is presented in Attachment 1.

3. The Evaluation Process

The midway evaluation has been carried out in accordance with a scheme announced by the Research Council on the web in January 2006, and is based on the following documents and background material:

- A self-evaluation and fact sheet providing information on each centre in a standardised form, both prepared by the centre. The self-evaluation should give an analysis of the research performed, scientific achievements, publication records, researcher training and recruitment and organisational aspects including governance, national and international collaboration and important industrial, social or cultural dividends, if relevant.

- An assessment prepared by the host institutions summing up the experience gained from hosting a CoE, both scientifically and from an administrative point of view.
- A plan presented by the centre and host institution providing a project description for the second five year period
- An assessment made independently by three international experts judging the scientific achievements of each centre
- An overall evaluation of each centre made by an interdisciplinary, international Evaluation Committee set up by the Research Council. The Committee is not supposed to address the question of prolongation or winding up of individual centres in its final report
- A list of the documents, which have served as background material for the Evaluation Committee, is shown in Attachment 2.

Based on the report from the International Evaluation Committee, including the background material described in Attachment 2, the Executive Board of the Research Council of Norway will make the final decision on prolongation.

4. The International Evaluation Committee

The interdisciplinary International Evaluation Committee was appointed by the Research Council of Norway 3 July 2006 (Attachment 3). The members are:

Professor Sten Grillner (Chair)	The Nobel Institute for Neurophysiology, Karolinska Institutet, Stockholm, Sweden
Professor Cecilia Albin	Department of Peace and Conflict Research, Uppsala University, Uppsala Sweden
Professor Elena Anagnostopoulou	Department of Philology, University of Crete, Rethymno, Greece
Professor Bertil Nilsson	Department of Religious Studies and Theology, Göteborg University, Göteborg, Sweden
Professor Preben Terndrup Pedersen	Department of Mechanical Engineering, Technical University of Denmark, Lyngby, Denmark
Professor Randolph Richards	Institute of Aquaculture, University of Stirling, Stirling, UK
Professor Colette Rolland	Centre de Recherche en Informatique, Université Paris Panthéon Sorbonne, Paris, France
Professor Gerold Wefer	Marum, Bremen University, Bremen, Germany
Professor Majorie Wilson	Earth Sciences, School of Earth and Environment, The University of Leeds, Leeds, UK

In accordance with the procedure adopted for the evaluation process, the International Evaluation Committee received the background material for the evaluation prior to a meeting of the Committee in Oslo from 23 to 25 October 2006. During this meeting the Committee conducted hearings with representatives of the centres and their host institutions. The programme for the Committee's meeting is given in Attachment 3.

5. Evaluation of the centres

5.1 International Centre for Geohazards (ICG), Norwegian Geotechnical Institute, Oslo

The goal of the CoE has been to establish an environment for scientific and technological research on geohazards with the objective of reducing loss of life and damage to infrastructure and environment. The centre is hosted within the Norwegian Geotechnical Institute (NGI) and is a consortium of two private foundations (NGI and NORSAR), one government organisation (NGU) and two universities (University of Oslo (UiO) and Norwegian University of Science and Technology, Trondheim (NTNU). Structurally it operates as a "distributed centre" with a central office in Oslo (hosted within NGI) and satellite offices within each of the other partner organisations. This appears to work well, providing access to a wide range of laboratory and other infrastructure resources. The ICG is one of only two Centres of Excellence located in a non-university setting. The centre does not have its own Administrative Officer but is fully supported by the Administration Division of NGI. Most of the PhD students from UiO work in the ICG central office.

Research achievements at the time of evaluation

The ICG has undoubtedly achieved a worldwide reputation as one of the leading international centres in geohazards research in its specialised field of landslides and rock avalanches. To some degree this reflects positively on the international standing of the host organisation, NGI. In this respect the ICG is close to achieving its original vision that "*within 5 years (it will) be the world authority and premier research group on geo-related natural hazards onland and offshore*".

Whilst the centre's output of publications appear to be extremely good (averaging ~ 4 papers per year per researcher) it is clear that a significant proportion of the output is in the form of conference proceedings. In many respects this reflects the roots of the host organisation (NGI); this approach to publication is quite normal in the fields of engineering geology and geotechnics. Additionally a number of the publications listed appear to reflect the work of ICG researchers before the CoE was initiated.

The milestones outlined in the original proposal lack explicit metrics against which the outcome of the first three years of research can be evaluated quantitatively. In general terms the programme of capacity building, research and its application appear to be on schedule. One aspect of the programme relating to tsunamis has actually been significantly expanded, reflecting the 2004 December 2004 disaster in Indonesia.

The IGC is rapidly expanding the range of its international partners, which include both developed (e.g. Japan, Switzerland, Hong Kong, Netherlands, USA, Germany, Spain, UK) and developing (e.g. Nicaragua, El Salvador, India, Thailand) countries. Almost 50% of the staff is of overseas origin. The successful partnership with US organisations in an NSF-funded "offshore natural hazards" project ($ 2.4 million) may be regarded as a benchmark. There is also evidence of a high success rate in the EU 6th Framework Programme, attesting to the setting up of successful partnerships within Europe.

Researcher training appears to be of a very high standard, particularly that delivered through the University of Oslo. Some 20 PhD students and 31 researchers were in post in 2006. Two Masters degree programmes have been established: *Environmental Geology and Geohzards* at UiO and *Geotechnics and Geohazards* at NTNU. These are going well and likely to attract increasing numbers of both home and overseas students.

In general the centre has done well in attracting good foreign researchers, doctoral students, post-doctoral and senior researchers.

The centre appears to have established good industrial links, particularly with the Norwegian offshore oil and gas industry. Some of its research outputs have extremely important implications for civil protection authorities worldwide.

Organisational and administrative aspects

The leader of the CoE appears to have done an exceptionally good job in building up the centre. The organisation of the centre and its management structure are well planned and should be highlighted as a model for future Centres of Excellence. The organisational structure with a Director, Deputy Director and Board of Governors who oversee the work of theme coordinators and project managers is highly appropriate. The model adopted is a matrix form of management which is common in industry but much less so in the university sector. The leadership appears to be very strong which enhances both the national and international profile of the centre. The Board of Directors also acts as the Scientific Advisory Board. This appears to have worked well during the start-up phase but is perhaps less appropriate as the centre moves into a more mature phase of operations. The centre leaders recognise this in their self-evaluation report.

The relationships with the host and partner organisations appear to be incredibly harmonious – far exceeding expectations. This is evidenced by the commitment that the ICG will continue beyond 2012 when its Research Council funding ceases. The ICG has contributed significantly to the strategic goals of NGI.

It is difficult to evaluate the standard of the premises and equipment without actually seeing them. These appear to be as be excellent. Through its partner organisations the ICG has access to state-of-the-art experimental facilities.

The issue of gender equality has been appropriately considered in the staffing of the centre. However, the fields of engineering geology and geotechnics do not typically attract many women. The fact that the Director of the host organisation, NGI, Dr Lacasse, is female sends out a good message. The centre appears to be doing very well (30% of researchers at ICG are female) in their recruitment of female scientists.

Research plans for the future five-year-period

During the first phase of activity the research emphasis has been on the basic understanding of geohazards and developing appropriate methods for the assessment of hazard and risk. In the second phase activities are planned to shift towards the development of methodologies to assist decision-makers in dealing with geohazard management. This will require the involvement of more staff whose basic training is within the field of social sciences and social policy. The ongoing research plan is ambitious but realistic within the likely funding limitations. It builds soundly on the activities of the first 5 years, aiming to intensify its public outreach programmes. The proposal for the second phase of activity includes development of a database of landslide hazards along with web-based tools for the evaluation of the impact of major landslides. These

activities could substantially raise the international profile of Norway and Norwegian scientists as a "*force for good*".

As far as it is possible to judge based on the information provided, the research approach and methods appear to be appropriate. The ICG has been very smart in building strategic alliances with international partners to provide access to large-scale international facilities which do not exist in Norway (e.g. Cambridge University- centrifuge testing; University of Minnesota – flume tanks; Geotechnical Engineering office in Hong Kong - full scale model slopes).

The centre already has international leadership in its specialist field of geohazards research relating to landslides. It also has the critical mass to make fundamental research contributions in this field. There is some question as to whether it has sufficient staff with appropriate experience of social sciences as it moves into more policy-related areas of research; this needs to be addressed. There are tremendous opportunities for Norway to take international leadership in the development of tools for hazard mapping and risk analysis (in the context of landslides and rock avalanches); these tools should be developed for application on local, regional, national and continent-wide scales. Clearly there are resource implications here; it would be a pity if the focus became entirely national.

Based on the achievements of the ICG so far it seems clear that they have appropriate training and recruitment policies. These will need some further consideration as they start to change direction in the second 5 years of operation and need to bring in expertise in the field of social sciences/social policy. International collaboration is excellent and is set to expand.

The centre is in a position to attract good researchers from abroad. Currently 50% of the research personnel come from overseas. Within the limitations of the available funding this is probably an appropriate balance. As the prestige of the centre grows more international scientists will wish to come there to work. A balance needs to be maintained between quality and quantity.

Based on the available evidence the organisation of the centre will continue to translate into a high level of efficiency and good relations with the host institution and partners. Clearly if initiatives such as the Masters training programmes are to be expanded further then additional resources will need to be found

Summary and Recommendations
The performance of the CoE, thus far, appears to have been ***exceptionally good****. More consideration perhaps needs to be given to the exchange of staff with other centres of excellence in geohazards research worldwide. The centre should aim to organise and host more international workshops and conference symposia to raise its international profile (though there clearly are budget limitations); they are already doing some good work in this respect.*

Publication in high ISI journals is one of the metrics by which research success is conventionally judged and this should be given greater priority in the future.

5.2 Centre for the Biology of Memory (CBM), Norwegian University of Science and Technology, Trondheim

The centre for the biology of memory is chaired by professor Edvard Moser (born 1962) and his co-director professor May-Britt Moser (born 1963). The structure of this Norwegian Centre is somewhat unusual in that except for the two directors, the remaining principal investigators are recruited from Europe and North America. They are international leaders in different areas within

the field of the centre: professor Carol Barnes, University of Arizona, who has served as chairmen of the American Society for Neuroscience, professor Bruce McNaughton, pioneer in memory research, professor Randolf Menzel, expert on invertebrate memory coding, Free University of Berlin, professor Richard Morris, University of Edinburgh and pioneer in International Memory Research and currently president of the Federation of European Neuroscience Society, dr Ole Paulsen, University of Oxford, dr Alessandro Treves, associate professor at the International School for Advanced Studies, Trieste, specialist in modelling of neural processes and professor Memo Witter, University Medical Centre, Amsterdam.

The Mosers have succeeded in forming an exceptionally strong research environment by creating a centre with international expertise in the focus area of Mosers´ own research.

Research achievements at the time of evaluation

The centre had in its original application a very attractive and focused problem oriented research program. During this first period it has by all standards been exceptionally successful. The focus of interest is the ability of the brain to form memory traces of the surrounding space. This is required for us to be able to remember locations in space and be able to move in a reproducible way in the environment. We can also associate locations with different events and recall these episodes, what is usually called episodic memory. It has long been known that one part of the brain, hippocampus, plays a prominent role for the formation of new episodic memories and that lesions of this area lead to an inability to form new memory traces of episodes, whereas all old memories are retained. Although much information has been gathered about the activity pattern of neurons in hippocampus, related to space - the coding remained enigmatic.

The Mosers and their collaborators have now shown that a formation of the spatial map resides in an input area to hippocampus, the medial entorhinal cortex. They have found that neurons in this area form a regular organisation with grids of neighbouring cells having a common spacing and orientation, and furthermore that the grid can be very detailed in one layer and much broader in deeper areas. In this way the surrounding space can be coded with different levels of granularity. These cells have been referred to as grid cells and represent a novel discovery that has become widely recognised. The Mosers have received the Alden Spencer Award from Columbia – a very prestigious award - Professor Eric Kandel, a Nobel laureate and memory researcher, recognised their contribution as a major break through for memory research. Edvard Moser has also been invited to give a presidential lecture at the Society for Neuroscience in 2005. The Mosers have been invited to apply for a new Kavli institute in the field of neuroscience – the other two Kavli institutes are at Columbia (Kandel) and Yale. The centre has clearly been at the forefront of development in this field during the last few years and has produced outstanding research as also recognised by the external reviewers.

The centre has a remarkable series of high profile articles published in Nature, Science, Neuron and Proceedings of the National Academy of Science. The articles of the centre have a very high impact and the quality is exceptionally high and the quantity clearly satisfactory.

The centre has worked according to the original plan with milestones but has during these few years made the discovery of the grid cells – a major new finding – that was not conceived of at the time of application. The international collaboration within the centre has clearly been a very important aspect both with regard to methodology and concepts.

The training aspects of both PhD and post docs are clearly of very good quality and the centre is now an attractor for foreign PhD and postdoctoral students.

Organisational and administrative aspects
The centre is run by the two directors in what appears a very efficient way and reports to a board appointed by the president of the Norwegian University of Science and Technology. An advisory board of another set of leading researchers in the area of the centre has been appointed. They have made an insightful report from a visit in June 2005, which is very positive, but also makes recommendations to further expand the centre by for instance hiring new faculty and also the need for additional space.

The relationship between the centre, the host institution and the partners appear to function in an excellent way and the interaction between the partners has clearly enriched the overall research environment. To further expand the neuroscience program of the university, the centre has been moved from the psychology section to the medical faculty. Within the university the centre has associated other neuroscience groups to the centre, like that of Mustaparta, which will further enhance the research environment in Trondheim. The two directors have thus made an excellent contribution, both as coordinators of the centre and as researchers.

There is clearly a need of more space for the centre and further faculty.

Research plan for the future five-year period
Given the extraordinary performance of the centre during the first year of its existence there are reasons to believe that the plans outlined in the proposal can be realised. The Mosers and their colleagues have established themselves as one of the leading research centres in memory research, which is one of the 'hottest' areas of brain research. Their overall plan is ambitious but realistic. Through the collaboration with leading research groups in North America they have got access to all necessary advanced techniques. It was most likely a very important decision by the Mosers to invite foreign collaborators with cutting edge methodology to be part of the centre.

The centre perspective with regard to training is very appropriate as well as to gender equality.

Conclusion
In conclusion, the centre has had a major impact and developed into a major international centre for studies of the biology of memory. The ranking is ***exceptionally good****.*

5.3 Centre for the Quantification of Quality of Service (Q2S), Norwegian University of Science and Technology, Trondheim

The centre focus is on quantifiable aspects of Quality of Services in packet based networks. The revised plan for the next five year period organizes research around three areas: network media handling, Q2S mechanisms for dynamic networks and Quality assessment. The research on the first area encompasses activities in improving media services and targets new network services. The Q2S mechanisms for dynamic networks will focus on generic mechanism for resource allocation, dependability and security services. The third area on Q2S assessment is mainly on measurements. The centre aims to carry out research in these areas with a multi-disciplinary emphasis on quantifiable aspects of Q2S .

Research Achievements at the time of evaluation
Q2S quantification in the context of heterogeneous, multi layered networks is an extremely important problem. It is of interest for academia, industry and society. It has an impact on how to design, deploy, service and use IT based systems. The centre has an expansive and ambitious research and educational agenda. It is clear from the publications that the centre professors and researchers are having a significant impact on research problems in the areas of interest. The

thirteen projects of the first three year period have contributed to the creation of strong groups that are working well to train high quality graduate students. However, the engineering impact of the work has not come out yet, in a clear and sustainable manner. How might the fundamental work of the centre impact local, European and global industry needs to be addressed in the next step. The international visibility has to be raised.

The publication record is good. The growth of productivity since the start up phase is significant. Starting for example, with one journal paper and 8 papers at international conferences in 2003 the centre reached 8 journal papers and 44 conference papers in 2005. It is evident that the centre's researchers are active in presenting refereed papers at conferences well representing the breadth of the centre. Some are high quality conferences. A cursory examination of published papers seem to show that their impact is in a combination of theory with models and measures. This aspect is unique and has the potential for a sustained influence across the board.

The centre has had a reasonable level of international collaboration judging by (a) the participation at international conferences, (b) the centre researchers visiting peer institutions and (c) the external researchers visiting the centre. A significant increase in international visitors is encouraged to significantly increase the visibility of the centre and facilitation cross-pollination.

Judging by the quality of the publications and the number of co-authored papers with Ph.D. students, the researcher training performance of the centre is good. An area of expansion would be to provide strong industry experience and via student internships and joint Q2S centric-projects with industry. While this appears to be happening, to a certain extent it does not stand out in the self assessments.

The recruitment of Ph.D. students and postdocs has been slow initially but has been increasing significantly over years. From looking to the publications, it can be guessed that students are of high quality. The centre has been attracting visitors mainly from Europe. This is an area however, which could be pursued somewhat more aggressively by the centre's leaders in order to create a greater international visibility for the centre and its researchers.

The impact on industry so far is through the various organizations collaborating with the centre. It is in the right path but somewhat modest. This is an area where it can not be expected that significant changes will appear during the initial phase of operation. It takes time to open up these opportunities. Given time and a sustained effort by the centre leadership to showcase the centre's successes, visible societal and industrial impact can occur. We shall encourage the centre to address this issue during the next term.

The research plan is in line with the initial one and keeps the same projected goals. To avoid some form of balkanization due to too many small projects, it could be recommended to increase the integration and cross-fertilization between the different thrusts. Defining some overarching projects to bring together the various areas can also help. This is somehow appearing in the revised plan and shall be encouraged.

Organizational and administrative aspects

The centre has a management structure of its own which seems to work efficiently. An advisory board has been created this year and should play in the next future an important role as far as the research strategy is concerned.

The host institution assessment shows that the centre and the host have a constructive working relationship. The host institution expresses that the centre's research has led to a significant

mutual enrichment. They have set a reciprocal information exchange to deal with daily operations, which work well. Based on the report, equipment and premises seem to be satisfactory.

Dr. Peder Emstad is managing the centre activities and budget in a very efficient manner. To the entire satisfaction of his staff and colleagues.

Gender equality is being well addressed at the level of doctoral students with 28 % of female which is good compared to the standard. However, the centre is less successful with the postdocs and failed to bring any female professor. Clearly, it would be advisable to bring women into the leadership of the centre. Besides, inviting distinguished international women faculty could help both locally and in publicizing the activities of the centre.

Research Plans for the future five-year-period

The overall focus and objectives remain the same; However the re-focus on three main research areas is appropriate and reflects the lessons learnt during the first three years. This should facilitate the development of synergies and collaboration among the areas so that the outstanding Q2S issues such as performance, timeliness, security and dependability are addressed in a cohesive manner. The plan is ambitious and yet realistic. It shows some healthy overlap and plans to work together which are an essential condition for success.

The existing and proposed equipment and areas addressed provides significant experimental opportunities. The plans to further combine theory and experiment are in the right direction. There is a request for more space in case of an expansion of activities particularly within the 7th IST framework.

With a concentration on three key areas and more interrelations among areas, the centre shall be in position to consolidate its successes and impact both science and engineering aspects of Q2S. The centre is led by a cohesive group of leaders and one can expect that it will continue to grow both in stature and visibility internationally.

The centre has a policy to recruit PhD candidates, mostly in Norway and networks through which it can recruit postdocs and visiting professors. With the increase of visibility in mind, the expert committee encourages the young researchers to get more involved in demonstrating their engineering impact of their work and present their results to the international audience of their peers.

The centre is aware of the gender issue and plan to recruit female PhD and postdocs to ensure the best gender equality. There is no commitment on the method to achieve this goal. The committee do encourage inviting leading international women researchers and professors to visit the centre for seminars, workshops, sabbaticals and the like. Bringing the gender perspective in the leadership is also encouraged.

The plan remains modest in terms of international collaboration. Keeping in mind the need for an expanded visibility of the centre and its results the committee would encourage the development of International/European projects involving multiple partners. The centre is well placed to attract researchers from abroad and should use this opportunity.

The centre plans to appoint a scientific advisory board, which can play an important role to help in adjusting the research plan to current circumstances. The good relationship with the host organization shall continue to maintain formal and informal dialog.

Conclusion
Overall, there is no major institutional or structural weakness in the centre or its plan. The centre is undertaking original research on a very important subject and publishing in quality conferences and journals. The centre is led by a cohesive group of leaders; it is well managed and attracts good doctoral students. This is an important and valuable investment for Norway to make. It is bringing benefits in advanced scholarship, training and visibility that would not have happened otherwise. The investment is worth continuing and should bear more fruits in the second phase.
Strengths:

- The topic of the centre's research is exceptionally important
- The quality and expertise of the leaders is very good
- The thrust of the accomplishments - a novel confluence of analytical, simulation and real measurements- is a major and unique basis on which to build sustained contributions
- The publication record is very good but could be better quantified.

Weaknesses:

- International collaborative projects. The development of such projects could serve to showcase the impact of the centre, highlight some of its major achievements and could serve as a trigger for industry interest
- International students and visitors. Enhancing the number and diversity of international students, postdocs and visitors can bring many rewards particularly in terms of visibility and networking. Women are too few.
- Integration of research areas. As set in the revised plan a stronger integration of the three main areas of research into the mainstream topic is recommended.

In order to strengthen the centre productivity the following is recommended:

- *to set a scientific advisory board that can help in setting the right scientific direction for the centre*
- *to refocus the research on some key topics in order to avoid dispersion of efforts*
- *to increase international collaboration and set international projects to raise the international visibility of the centre*
- *to demonstrate the engineering impact of the centre through Q2S centric projects with industry.*

The overall ranking is ***good to very good.***

5.4 Centre for Ships and Ocean Structures (CeSOS), Norwegian University of Science and Technology, Trondheim

The Aim of CeSOS
The objective of the centre is to establish new fundamental knowledge about the behaviour of ships and ocean structures at sea, taking the random nature of the ocean environment and the possibility for automatic control of vehicles into account by integrating research on:

- Marine hydrodynamics (Group Leader: Prof. Odd Faltinsen)
- Marine structures (Group Leader: Prof. Torgeir Moan), and
- Automatic control (Group Leader: Prof. Thor Inge Fossen)

The main focus is on the development of basic, generic knowledge within these fields. However, the research institutes MARINTEK and SINTEF Fisheries and Aquaculture, which perform contract research, are associated with the centre and internationally leading Norwegian

companies in the marine industry are sponsors. The contact to industry opens an avenue for disseminating the generated knowledge into practical application.

Research achievements at the time of evaluation
The scientific performance of key researchers employed by CeSOS is of very high quality. The group has world leading expertise in the above-mentioned areas. Key personnel are recruited from the very highest level of the international scientific community, where they have received continuous recognition, as testified by the appointments in top level congresses such as the International Ship and offshore Structures Congress (ISSC), International Towing Tank Conference (ITTC), PRADS, OMAE etc.

The research of the centre focuses on applied and pre-normative research. It mainly addresses scientific and methodological problems, rather than industrial or commercial development. This basic research is at the forefront of developments within maritime research.

During the first period, the publications from CeSOS have been very impressive. The number of papers appearing in international journals has increased to a very high level and the publications are of a high standard, both in quality and scope. The results are new and innovative. They appear in the leading international journals within this field. These publications have lead to new understanding, which has affected national and international research in the field.

CeSOS has reached its original milestones. The collaboration of the centre with top level national and international research organisations has strengthened the research performed at the centre and contributed to integrate the research results from the centre into the international community. The research appears well integrated with MARINTEK, authorities, maritime industries and international cooperation partners

The centre has established a good basis for the training of researchers and participate actively in the EU sponsored Marie Curie training program. Due to the excellent reputation of the leading researchers and the general position of Norwegian Marine Technology, the centre has been able to attract international researchers, doctoral students, postdocs and senior researchers. As of 2005 foreigners outnumber Norwegians at CeSOS. However, the self evaluation report states that foreigners who gain a PhD or do research in marine technology in Norway prefer to stay and work in Norway, and that 4 out of 5 foreign postdoctoral or PhD candidates completing their assignment at CeSOS gain employment in Norway. This fact enhances the possibilities of important industrial or social dividends to the Norwegian society. The research activities are obviously of relevance to society, as they all to some extent are associated with the structural safety of marine structures with a strong connection with the safety of life at sea and the protection of the marine environment

In general the research performed by CeSOS must have a high impact on Norwegian society. The group is largely responsible for the strong position of Norway in research and education within basic research for rational design of marine structures.

Organisational and administrative aspects
CeSOS appears to have a strong and efficient leadership. The head of the centre, Professor Torgeir Moan, is an internationally recognised researcher within Marine Technology and the success of the centre demonstrates his managerial skills. Also other prominent figures have been engaged at the forefront of research for many years. This ensures the efficiency and the quality of the research.

Another factor in the success of the group is the close cooperation with NTNU and MARINTEK and the superb laboratories available for CeSOS, providing a unique physical research environment.

Equal opportunities for men and women have been addressed in the recruitment policy of the centre, however, with somewhat limited success. In 2005 women made up 7 % of the research years and 21 % of the PhD years.

Research plans for the next five-year-period
The plan for future research is well balanced and constitutes a logical, integrated continuation of the research carried out so far. Improving existing mathematical models and developing new models is the main task in the next period. The final outcome should be an improvement in the reliability of marine structures. This presents the mainstream of international research at present. Its significance for scientific progress is therefore quite high. The plan is ambitious but realistic.

The research output of the centre has steadily increased over the years and will probably become even more dominant on the international research arena during the next five year period.

This position will help the centre attract highly qualified PhD candidates, postdocs and senior research staff.

Over the next five-year-period the centre faces a challenge presented by the retirement of two-thirds of the management group. CeSOS director, and head of Structural Mechanics Prof. Torgeir Moan and head of Hydrodynamics Prof. Odd Faltinsen were both born in 1944. The retirement of these two outstanding researchers at the end of the coming period of support could have a negative effect on the centre's continued research profile, and expertise within their areas could be lost. This problem should be addressed over the coming years as the research strategies at CeSOS, as is true for most other successful research units, depend on individuals. Also, both national and international research collaborations depend on individuals. The risk, however, appears manageable. The two senior researchers have produced a large number of doctoral candidates and recruitment of the next generation of key staff is probably not an issue.

Conclusion
*In conclusion the overall impression of the performance at CeSOS is **exceptionally good**. The centre has an international front position within the research community for Marine Technology; the researchers are very productive and have undertaken original research. The research results are being published in the leading international journals in the field, and in addition the research contributes to maintaining Norway's strong position within marine structures.*

5.5 The Centre for the Study of Civil War (CSCW), International Peace Research Institute, Oslo

The Centre for the Study of Civil War (CSCW) is hosted within the International Peace Research Institute (PRIO), Oslo, with which it has many close links. Its overall objective is to advance knowledge - through multi-disciplinary, multi-method research - on "why civil wars break out; how they are sustained; and what it takes to end them and build a lasting civil peace" (CSCW Self-evaluation for the Midway Evaluation of the Norwegian CoEs, p. 1). The last-mentioned focus was not in the Centre's original research plan for the CoEs scheme, but has been added recently. It reflects the real-world shift to problems of establishing a durable peace in the aftermath of war and preventing relapses into violence.

The CSCW leadership includes its director, Professor Scott Gates (born 1957), and the leaders of the seven thematic research groups into which the Centre's work is organized. The structure, leadership and focus of these groups have also changed somewhat compared to the original plan and are at present the following: Transnational and International Dimensions of Civil War (headed by Kristian Berg Harpviken); Religion and Civil War (headed by Jon Elster); Environmental Factors in Civil War (headed by Nils Petter Gleditsch); Human Rights, Governance, and Conflict (headed by newly appointed Sabine Carey); Conflict and Economic Performance (headed by Karl Ove Moene); Values and Violence (headed by Ola Listhaug); and Civil Peace (headed by Kaare Strom). Apart from the leaders the Centre has some eight researchers, 20 associate researchers, and 14 doctoral students.

During its first few years of existence, the CSCW has without question developed a very dynamic and productive research environment and established itself as an internationally leading institution for the study of civil war.

Research achievements at the time of evaluation

The Centre's research has been at the forefront of developments in its field. During its first few years, the Centre has made cutting-edge contributions to knowledge on the causes, nature (types), dynamics, and impact of civil war, in particular through strength in quantitative methods and the creation of new datasets. Among the Centre's top achievements is its publication record, which is exceptional by any standards. Original research has been published on e.g. rational choice models of civil war, quantitative assessments of resources as a cause of civil war, and quantitative and qualitative analyses of institutional arrangements contributing to or inhibiting civil war. The production of peer reviewed articles in major international journals has been particularly large (122 in the period 2002-2006). To this should be added a significant number of newly created and adapted datasets on armed conflict, which are made widely available to other researchers.

Success in securing additional external research funding for the Centre (32% of total accountable income in the period 2002-2006, according to CSCW figures) reflects the quality of its work.

The Centre regards its staff and recruitment policy as a major strategy in achieving excellence. Attracting both senior and junior researchers from abroad has been an important component. Stating difficulties in matching salaries and other rewards offered in other countries, notably the US, the Centre has focused on recruiting senior researchers with a pre-existing affiliation to Norway to its core staff. Several world class scientists have received associate status. Another component of the strategy has been the focus on in-house doctoral and post-graduate training, so as to create a pool of young scholars from which to recruit. As for the coming years, the Centre states the intention to focus more on in-house recruitment.

While the in-house team is strong in its own right, collaboration with Scandinavian and international institutions is an essential component adding a great deal to the Centre's work. The number of significant international collaborations increased from six in 2002-03 to ten in 2006. They involve a wide variety of activities and partners; e.g. dataset creation with Uppsala University, doctoral student exchange with the University of California at San Diego, and a number of research projects with international institutions, universities and research institutes.

The record points to the research training within the Centre being of a high standard. Four Ph.D. students, and many more MA students, completed their training at the Centre during the initial period. Their record of publishing in major journals is unusual and impressive.

The Centre's research is clearly of great societal importance and relevance, and there are certainly opportunities for dividends. Exploiting these to the full does not seem to have been prioritised, in the way that purely academic research and scholarly publishing have been.

Organisational and administrative aspects

The Centre's form of governance and organization has clearly permitted research of very high quality and high productivity. Strong and focused intellectual leadership, and the structure of division into research groups, are likely to have contributed to this. Generally, relations between the host institution and the Centre appear to have worked very well. The activities of the two units have clearly been mutually enriching and advantageous, with the Centre contributing significantly to the overall research environment. PRIO states the Centre's role in increasing collaboration with leading world scholars, and exposing its researchers to the highest international standards, as being a particularly important contribution.

Both PRIO and the CSCW report on the difficulties experienced by the host institution in providing enough administrative services for the Centre, given its size and many foreign staff members. There is also a self-recognized problem with adequate IT support for datasets and communication, which is now being tackled. The Centre, along with its host institution, moved into new larger premises recently.

Has the question of gender equality been adequately taken into account in the Centre's recruitment policy? The policy of recruitment to staff positions appears to date not to have directly targeted women, at least not in a manner that has noticeably redressed the obvious gender imbalance. The Centre is clearly male dominated, and to date all male in the lead research positions. The approach has rather been to target good women candidates for the Centre's research training program, in the hope of thereby redressing the gender imbalance in the longer term. In the coming five-year period, one of the seven research groups will be led by a woman.

Research plans for the future five-year-period

The original research plan continues in essence along the same route in the second five-year period. It remains both ambitious and, judging in part by the Centre's past achievements, realistic. Some changes include an added overall Centre focus on researching the problems of building a "lasting civil peace" and, at the research group level, new foci on religious motives in civil war and on civil peace. There will be increased emphasis on the disaggregated study of civil war, and on making research results accessible to policy experts and academics. On the administrative side, the Centre indicates that an Executive Council is currently being established, to coordinate the activities of the research groups and support activities cutting across these groups.

Among the additional Centre objectives for the second period are staff and recruitment issues: to recruit more full-time researchers, and especially younger ones trained by the Centre itself. As for gender, a focus will also be on recruiting and promoting more women. The host institution has created a gender balance committee to oversee recruitment practices. Given the scarcity of women researchers in the field particularly at the senior

level, the Centre may wish to complement in-house recruitment with additional tools such as targeted advertising and some form of 'head-hunting'.

International collaboration has been a strong dimension of the Centre's work from the outset, and is set to continue to be so. New collaborative initiatives are included in the plans for the second period. The effective and mutually rewarding relations between the host institution and the Centre are bound to continue in the second period as well. In the final years, its research activities are to evolve gradually into PRIO projects, thus following up on the plan to continue select CSCW work within PRIO after the Centre's closing in 2012.

In sum, judging by its past record and future plans, there is every reason to expect that the CSCW will continue to perform at the top level. There is still some room for improvement, however, in the second five-year period. Firstly, non-quantitative research and publications should receive more emphasis and visibility, to help complement the well-known limitations of quantitative work. Greater cross-fertilization between qualitative and quantitative work would also be desirable. Secondly, more effort should be invested in making the Centre's research findings accessible to and useful for practitioners. This appears as an essential core task for a Centre working in an area of such tremendous importance to society.

Conclusion
*The Committee's overall rating of CSCW is **exceptionally good**, and its strong international reputation is well deserved The Centre, backed by PRIO, has put Norway on the map as the place for internationally leading research on civil war. The excellence has been achieved in a relatively short period of time, partly by adopting a sharp focus (in this case reflecting the Centre leadership's main strength in quantitative research) and by engaging already accomplished senior scholars in the field, while at the same time caring to train well the next generation of scholars. The existence of detailed plans already at this stage for how to build upon the CSCW's achievements after the end of the Centre's ten-year life, so that these are not lost, is much welcomed.*

5.6 Bjerknes Centre for Climate Research (BCCR), University of Bergen

The aim of the Bjerknes Centre is to continue to develop into a climate research centre of international standing with its emphasis on the ocean and polar areas. The Centre integrates scientists from three university departments: from the University Research Foundation, from the Nansen Centre, and from the Institute of Marine Research, and receives between 15 and 20 million NOK per year from the research council of Norway. The Centre has three encompassing research areas:
1. Enhancing our understanding of the nature, causes and likelihood of rapid climate change, and the role of ocean circulation in abrupt climate changes,
2. Understanding and predicting climate variability in the North Atlantic-Arctic region, and
3. Understanding key processes that drive climate changes in the past, present and future - both natural climate changes and those that originate from human influences.

Research achievements at the time of evaluation
The Bjerknes Centre for Climate Research (CoE BCCR) is, without question, at the forefront of climate research. It is on the way to become one of the leading centres worldwide and has already an excellent reputation at the national and international levels. The cooperation among various disciplines, along with the sea-going and modelling groups, is considered as an exemplary

positive characteristic. The focus of their work is in the ocean, particularly the polar regions. The Nordic Seas are extremely important regions, connecting the Arctic with lower latitudes and representing an important area for water-mass conversion, with distinct implications for the meridional overturning circulation (MOC) in the Atlantic.

In their first 40 months 266 peer-reviewed papers were published. These include several studies that appeared in the respected journals *Science* and *Nature.* Considering the relatively short time span since its inception, the publication record of the Centre is considered as outstanding.

The aspired milestones in all three research areas were achieved. There have been no significant changes in the research program.

Many international relationships are evident in research as well as in the area of graduate training. The extensive participation of the Centre in EU-funded projects is impressive (presently more than 10 EU projects).

Researchers at the Centre are involved in European training programs, for example, the EU-funded graduate school PROPER. A joint program with the University of Washington has been initiated to offer summer school programs and joint workshops as well as promoting the exchange of scientists. In addition to these two cases, there are many other examples of cooperation with top institutes, particularly in Europe, the USA and China. In general, the centre is capable of attracting excellent foreign researchers, doctoral students and post-docs.

Scientific results regarding climate interactions cannot be translated into industrial products, but they represent the basis for long-term decisions relating to the reduction of green-house gases and provide science based knowledge for societal planning.

Organizational and administrative aspects

From the records there is no evidence of problems among the Centre, the host institution and other partners. The working groups are spread over the city of Bergen. Location in one building would allow much better integration of different disciplines. There is no evidence in the records of how the Centre should continue to operate after the year 2012. Efforts should be initiated now to consider how this very effective working group can continue to operate after this point in time.

The Centre is efficiently run. The head of the Centre, Prof. Eystein Janssen, has done an excellent job. He is well known as a good organizer, as he has shown through the initiation and carrying out of several EU projects. Furthermore, he is a highly respected paleoclimate researcher with a superior international reputation. Based on the success and admirable development in the first three-and-a-half years, it is assumed that the management is also excellent. The Centre is very well equipped and this allows them to produce reliable, internationally accepted results.

The aspect of gender equality is adequately addressed. As in other centres, there is a proportion of around 50% women PhD students and 40% women scientists. The problem exists in the area of filling the professorial positions with a larger proportion of women. This seems to be especially difficult in the area of physics. This is a problem experienced by practically all such scientific centres in the world.

Research plans for the future five-year period

Basically the research plan begun in 2002 will be continued. There is no need to adjust or change the topics because they are very current and cover such a wide spectrum that they can only be carried out over an extended period. The program is on the leading edge of international research.

The methods applied are state-of-the-art, and the available equipment is appropriate and necessary. This was mainly brought up to its present high standard by investments during the first funding phase.

The research plan for the next five years can be expected, with a high degree of certainty, to reap continued innovative results that will enable the Centre to more strongly establish its position as a leading climate research institute.

During the initial funding period new initiatives in training were developed, particularly in cooperation with other European partners and through its cooperation with the University of Washington. This powerful international start-up will make Bergen even more attractive and draw young scientists from around the world. A fellowship program for financing young post-docs could be an excellent tool for attracting promising new young scientists. All institutes experience the problem of having few women in leading positions. The Centre is aware of this problem and they will present a plan to improve this situation in 2006. This will include a mentoring system to improve the gender balance.

The level of international collaboration is excellent, both in quantity and quality. The IPY projects for the Arctic and Antarctic in the time frame from 2007 to 2010 will provide another very good opportunity in this respect. In past years as well as in the future, research programs and mobility programs have played and will continue to play a large role, as will the new initiatives of the European Science Foundation, "Eurocores".

Because of these international cooperative projects and attractive research projects, the Centre will continue to be in a position to attract quality researchers from around the world.

The organization of the Centre is excellent, particularly the cooperative work among the Institute, the Centre, and other partners. It can therefore be assumed that a continued smooth flow of activity and sustained support by the host institution will be maintained.

Conclusion
*In summary, the Bjerknes Centre for Climate Research has produced outstanding research results and is on the forefront of developments in their field. Therefore it has met the expectations laid down in the Norwegian CoE-Scheme. Overall Recommendation****: Exceptionally Good***

5.7 Centre for Medieval Studies (CMS), University of Bergen

The general starting-point for the first application for a Centre for Medieval Studies in Bergen was that the europeanisation of the peripheries in Northern and Eastern Europe ought to be studied interdisciplinarily by questions concerning how the cultural influences (in the broad sense) from the central and earlier Christianised parts were handled in the peripheries. However, it was stated that neither the centre nor the periphery should be considered as homogenous or static. Indeed, the adaptation process was going to be studied specifically, and one should not forget the contributions from the periphery to the centre.

This fundamental approach has been the guiding-star for the studies, which have been carried out within the four main areas of research at the CMS. Thus, one has followed the intentions in the research plan, which formed the basis for the formation of the CMS. The approach, which marks a new onset compared with a lot of earlier research where the europeanisation of Scandinavia mainly or even exclusively has been looked upon as a process of receiving, has shown itself to be fruitful

during the first period of research, since it has led to outstanding results which imply that the CMS is at forefront in its field.

The overall aim would be carried into effect by four projects, which were specified in a convincing way in the application. The application focused on central, desirable and practicable tasks of research in the light of the earlier research tradition, internationally and nationally with regard to empirical as well as more theoretical studies. The four projects have later on been specified in the documents, which form the basis for the midway evaluation. However, the projects are not hermetically sealed entities but interact and partly overlap each other, something which has appeared to be fruitful for the results as well as stimulating for the scholars which have had the advantage of being employees or guests in the Bergensian villa where the CMS is located. By hosting the employees under one and the same roof the CMS has created an inspiring research milieu also for the senior scholars and the PhD candidates from abroad who stay there for longer or shorter periods. So, also in this way the collaboration has been strengthened, which has contributed to the results.

Research Achievements at the Time of Evaluation
Since the research has been carried through in accordance with the plans for the four projects, it is reasonable to evaluate each of them separately to start with, keeping in mind, though, that in reality they are parts of a greater whole and that the research has been done in cooperation between those who have made contributions to the results.

Project no 1 deals with the arrival of writing and aims at investigating to what extent people learnt to read and write as well as which consequences literacy had for the periphery. The first aspect is about the relation between oral and written, the second one between Latin and vernacular. The third aspect deals with the communication that became possible thanks to hand written books, the fourth the impact of written documents on ecclesiastical and royal administration and the fifth aims at presenting a theoretical framework on the basis of the empirical studies and, thus, creating refined analytical tools for the future study of communication.

All the five parts have been dealt with, although the theoretical reflections on an overall level seem to have been pushed a little into the background. This project has resulted in a considerable number of publications, especially when one takes into consideration the short time during which the CMS has existed and the long time it takes to get books and articles published. Everything that was mentioned from the start has not been implemented in details, but in many ways the centre is well on the way. So, one should stress the fact that much research has been published and much else has been finished which has not yet been printed. Without lessening other scholars' contributions within this project one is inclined to emphasize the finished comprehensive doctoral thesis on polemic literature, which also is a good example at showing the successful work done by the professors to lead a PhD candidate to complete his degree with an important dissertation also from an international point of view. Another two doctoral theses from this project will be completed during the coming year and have already resulted in "preparatory" articles, which are in print. Here should also be mentioned that the research done by a postdoc fellow as well as the results of the cooperation within the so called Reykholt network represent substantial contributions to the research in the field in question. A workshop has been held in Bergen concerning fragments of parchment, and the results are in print.

Project no 2, dealing with the religious change and the Church's role in medieval society, has two points of focus chronologically: a) the Early Middle Ages and b) the Late Middle Ages. It consists of three parts which concern 1) the Christianisation, 2) Christian belief and practice and 3) the relations between the local church and the papacy. The first part has mainly been elucidated in publications, which depart from archaeological excavations and in articles dealing with different aspects of the

cult of saints. Also the gender perspective has been treated more specifically in one article. The results also concern aspects of Christian belief and practice which is also the case in the studies dealing with penitentiary letters to the papal court from the Late Middle Ages; here new material from the Vatican Archives has been used. Furthermore, one volume is about to be finished which will be a sort of bringing up to date the opinions about the Christianisation in the seven countries which form the periphery according to the project´s definition. The publications taken together testify to the fact that a big and active network has been built up around the Christianisation problems with scholars in particular from the Nordic countries but also from Poland, the Czech Republic and Hungary. These have met in different conferences and workshops. A desideratum for the future would perhaps be to see something more about the influences, which are supposed to have gone from the periphery to the centre.

The third project which deals with state formation and political culture is divided into three parts, namely 1) the formation of kingdoms and principalities during the Early Middle Ages, 2) their further development and 3) the interstate unions during the Late Middle Ages. The project has not yet led to any printed book dealing with the main questions but such a one is said to be finished in the end of 2006. However, a number of articles have been published which also are about other parts of the CMS's research work. The articles are mainly dealing with the two first mentioned aspects - the third one has been treated only occasionally. Within this project a doctoral thesis has almost been finished.

Finally the project which deals with the construction of the past: It contains four aspects, and research has been done mainly concerning two of them and then in comparison between the peripheries and the centre, i.e. medieval historiography and the relation between secular and ecclesiastical culture respectively. A comprehensive volume with contributions from a number of internationally renowned scholars has led to a new understanding as to how local Christian myths have originated in liturgical writings. Apart from a number of articles two doctoral theses have been finished within this project, one of them to be defended in the beginning of 2007. Another two are in progress. A number of workshops and big conferences have been held, and the CMS has also for a shorter time had a visiting professor, whose speciality is historiography.

Organisational and administrative aspects

The organisation and the development of the CMS seem on the whole to have been successful during this first period. The complications which have been pointed out in the self evaluation and have been stressed also by the experts seem not to have affected the research in any considerably negative way so far. On the contrary one should emphasize the praiseworthy fact that the four employed professors have done so much basic research of their own, since they at the same time have been training PhD candidates, planning conferences, building up of networks and so forth and also have had other administrative tasks.

The relationship between the CMS and the University of Bergen is and has been very good. From the side of the university one is very pleased with the CMS, its work and its results. Some minor problems of administrative character have been pointed out but they have been solved in mutual agreement. The centre is led by one director but in practice – according to the self evaluation - by the four ones in cooperation who are in charge of each project respectively, and from 2005 with a more precise dividing up of some administrative tasks. In the self evaluation there is a remark concerning the guest scholars that they have tended to stay not so long as were desirable, but one can hardly blame the CMS and for this.

Research plan for the future five-year period
The research programme for the coming five years does not include any fundamental changes, and in the light of the results, which so far have been presented, there is no reason why it should be radically changed. However, there are some partly new aspects of the fundamental issues, which have originated from the research during the first period. Furthermore, the themes, which have not yet been so thoroughly dealt with will be given more attention. Thus, the plans for the future on an overall level can be regarded as very good. Some of this work has already started partly by a postdoc's project, partly by doctoral theses, which are going to be completed during the next years. What is mentioned in the plan, including the new perspectives, have ambitious and realistic goals and seems to have good prospects of being fruitful. For instance, one may mention that the theoretical reflections on the overall level about the fundamental questions will be deepened. As means for this development the networks already established will be elaborated further. Partly this will be realized in close contact with the Nordic Centre for Medieval Studies (NCMS), which started in September 2005. Among others this cooperation will vouch for that the research at the CMS also in the future will be of the best quality and at the forefront. The plan contains not only a thorough account for the coming themes of research but also how the goals are going to be reached by the employment of PhD candidates and postdocs. One may hope that the necessary limitations of the possibilities to do primary research, which pertains to the four professors because of their administrative duties will diminish during the coming period with the help of the new employees, especially senior scholars. To conclude with, one can honestly say that it is a very well laid-out plan with regard to interesting and ambitious scholarly projects. There is an outspoken aim to employ also junior scholars and in that connection see to it that both sexes are represented. Also conferences, workshops and seminars in cooperation with other institutions and seats of learning as well as exchange of scholars have been planned or outlined in a reasonable perspective of time. Likewise are the plans for future publications well thought-out, which includes also popularisation of the results through different types of media.

Conclusions
The CMS's projects have reached their original goals in all relevant respects, i.e. not only with regard to the number of publications and their high quality but also concerning international, national and interdisciplinary collaboration, the ability to train PhD candidates and to be a basis also for postdoc fellows and senior scholars from Norway and from abroad. Noting of the same kind exists anywhere else in the Nordic countries, which means that the University of Bergen has been put on the map as an important centre with regard to European medieval research. So far one can easily agree with the experts' opinions that the CMS should be regarded as "very good" or "exceptionally good". On the other hand, the overall impression which the evaluation process as a whole has given is that the CMS is in the need of clarifying the relations with the Faculty of Arts when it comes to compensation for those who have been employed by the CMS, which particularly has to do with the ability of teaching on ground level or even higher levels. Furthermore, the leadership has to be taken into consideration as the current director will retire soon, and there appears to be no succession planning in place. As a priority the new director will need to improve the relationship between the faculty and the CMS to ensure a joint future within the university system following the end of research funding for the CMS. It may be possible to establish joint posts between the faculty and the centre in the interim to support this process. This issue should be addressed as a matter of urgency. Because of our serious concerns about the future development of the centre we feel that the grading of ***good to very good*** *is the most appropriate at this time.*

5.8 Centre for Integrated Petroleum Research (CIPR), University of Bergen

The main objective of CIPR is to establish an internationally renowned, cross-disciplinary research unit in petroleum science in which the results of basic research will produce

technological improvements to ensure the best possible exploitation of hydrocarbon resources on the (Norwegian) continental shelf. CIPR aims to establish a globally recognised track record of innovative, high-quality, reservoir research, focusing on maximising oil recovery. The centre also aims to create multi-disciplinary education programmes at Masters and PhD level to meet the current and future needs of the (Norwegian) hydrocarbon industry. Research in this field is essential to ensure the continued competitiveness of the Norwegian hydrocarbon industry. A unique aspect of this CoE is its close association with the national hydrocarbon industry and the fact that many of its staff have previously worked in the industry.

Petroleum-related activities on the Norwegian continental shelf account for 30 % of national revenue. This is the most important industrial sector of the Norwegian economy. Norway is the world's 6th largest oil producer and the 3rd largest oil exporting country; it is the most important supplier of natural gas to Europe, along with Russia and Algeria. A large number of the Norwegian oil fields are in the mature stages of production and there is an urgent and important need to extend their operational lives. CIPR was established to maximise the recovery of (Norwegian) oil. This is a difficult and complex problem, which is challenging the hydrocarbon industry worldwide. The market for this research is highly competitive.

Research Achievements at the Time of Evaluation

There is evidence that substantial progress has been made in the first three years of operation of CIPR. It is not clear if the results can truly be classified as outstanding, nor the extent to which this research has had an international influence. The increasing number of international collaborators is reassuring in this respect. Nevertheless many of the main activities still have a strongly Norwegian industry focus.

The centre has identified some of the key problems associated with understanding hydrocarbon reservoirs; the eventual solution to these problems will have an important impact on oil recovery from the Norwegian shelf and worldwide. However such solutions may be a long way down the line.

In the period 2003-2005 there appears to have been a high-level of scientific productivity with over 170 articles published in good quality international scientific journals and 62 articles in conference proceedings. However from the list of publications it is not clear that all of these outputs are actually the direct products of CIPR research activities. Additionally some of the work must have undoubtedly been done before the start up of CIPR.

The centre appears to be well on target to achieve (and in some cases exceed) the targets it originally set for its first 5 years of activity. Some new opportunities for additional funding from industry and the PETROMAKS programme have enabled it to expand its activities in some areas. The true extent of both the national and international collaboration mentioned in the CIPR report is difficult to judge. An impression is given of a very strong focus towards collaboration with Norwegian companies (e.g. Norsk Hydro and Statoil). Many international partners were mentioned in the presentation given by the centre to the Committee; these include some of the leading petroleum research groups internationally. It appears that PhD students spend up to 6 months working in the laboratories of these international groups; unfortunately reciprocal visits are much fewer.

In the report it is claimed that annual workshops will be held to communicate results to a wide group of national and international stakeholders. Only one workshop seems to have taken place (in 2004). This aspect of the centre's outreach activities needs to be substantially strengthened in order to raise its profile both nationally and internationally.

There appear to be a significant number of PhD and Master's students working within the centre. Indeed CIPR claims to be one of the largest researcher training institutions in the world in petroleum technology. It is not possible to verify this claim. The CIPR report highlights the difficulty in graduate recruitment when the oil price is high and the companies are hiring people at MSc level on high salaries. The centre appears to be producing well-trained graduates who are highly sought after by the local hydrocarbon industry. It is not clear from the report to what extent their training programmes are relevant to the needs of the international petroleum industry. The first cohort of PhD students has only just graduated. Given the relatively small involvement in the centre from permanent university staff there may be some concern that the student/supervisor ratio may be too high.

The University has introduced courses in Petroleum Technology at undergraduate level which will feed into the Masters program from 2006. This of course implies that the majority of students are recruited locally.

There are only a limited number (currently 5 + 2 who have long-standing careers in Norway) of foreign researchers currently employed within the centre; most of the staff are Norwegian. No information is provided on the nationality of the doctoral students. It is difficult to evaluate the quality of the foreign researchers explicitly as no detailed CVs are provided. There is no clear evidence presented in the report of a pro-active international recruitment strategy.

During the period 2003-2006 15 PhD and 30 MS students are reported to have graduated. For the PhD students this implies good completion rates.

It has clearly taken a long time (3 years) to build capacity within the centre. Unfortunately, the direct involvement of University staff in the CoE has been significantly less than anticipated. It should be a major target to improve this situation.

The existence of CIPR has clearly strengthened the profile of its host, the University of Bergen, both nationally and internationally. The centre works in close collaboration with the Norwegian hydrocarbon industry and there are some emerging international partnerships. However it is not clear by what means technology transfer actually occurs from CIPR to the hydrocarbon industry. Is this simply by the provision of trained personnel? In this field of research it could be expected that patented technologies might be involved. It is not clear how Intellectual Property rights are protected.

Norsk Hydro has recently selected the University of Bergen as their university partner in Geology, Geophysics and Reservoir Engineering; Chevron are currently evaluating CIPR/UoB as one of their key university partners.
In 2004 the research programme was rearranged into 3 main themes: (1) Fluid flow and faults; (2) Enhanced oil recovery and flow assurance; (3) Reservoir modelling and characterisation. This gives the work of the centre better structure and focus.

Organisational and administrative aspects
The centre has a Board and a Scientific Advisory Committee (SAC); both are appointed by the University of Bergen. The SAC includes high-level representatives from the international hydrocarbon industry. At an operational level the structure appears more loosely organised, although there are theme and project leaders and both Administrative and Management Groups. The organisational structure appears to be relatively flat with project leaders having the main responsibility for coordination and planning. This appears to work well. The researchers within

CIPR are employed by a University of Bergen company; Unifob Petroleum. The head of the centre appears to have done an excellent job, providing strong leadership.

The activities of CIPR are synchronised with University of Bergen strategy, the research strategy of the Norwegian oil companies and Norwegian government priorities within petroleum research/education. This may have a negative impact on the internationalisation of the centre.

Superficially the relationship between the centre and the host institution (University of Bergen) appears to have functioned smoothly, and has the centre's research has definitely led to an enrichment of the overall research environment. However, appear to be some governance issues which need to be sorted out. The presence of CIPR has certainly been of benefit to the University.

The University of Bergen facilitated the start-up of the CoE by extensively refurbishing office and laboratory space. As the centre has grown it is clear that more space is needed, particularly for offices. The University appears to be responding as well as it can to meet this need. The premises appear to be of a high standard based on the limited information provided.

There is little mention in the report of any measures taken to ensure a good gender balance within CIPR. At present relatively few of the staff are female. Whilst the hydrocarbon industry used to be strongly male-dominated this is no longer true, particularly in Norway.

Research plans for the future five-year-period

The original research plan for the first 5 years of activity had very ambitious goals, which will require long-term research activity to realise. Nevertheless if it achieves even 50% of these goals it should have made significant research advances in the field of multi-phase fluid flow. The second five-year plan mostly continues along the same lines, although it is a little better focused. The goal of reaching international leadership status seems a little distant, although the centre clearly appears to be quite strong. The CIPR management will need to put a lot more effort into international outreach and recruitment at post-doctoral/senior researcher level to achieve their ambitions of world leadership in the field.

There is no doubt that the centre will produce some innovative results – indeed it is already doing so. As far as internationalisation is concerned, things appear to be on an upward trajectory. Nevertheless much more could and should be done in terms of international outreach e.g. workshops, conferences, networks, recruitment strategies.

There is insufficient detail provided in the report to evaluate if the quality of the researcher training programme is adequate. The introduction of undergraduate programmes in Petroleum Sciences should ensure a local supply of Masters and PhD students. However, if the aims of international leadership are to be fulfilled then they need to develop an active recruitment strategy, which faces outward not inward. There is no evidence of much activity to ensure an appropriate gender balance.

There is a need to continue to strengthen the international partnerships, particularly with European and US organisations. As Norway’s offshore hydrocarbon resources diminish it will need to focus more on becoming a knowledge/know-how based economy. In this emerging scenario the international reputation of CIPR will become increasingly important.

Potentially the centre in a position to attract good researchers from abroad, although its location in Bergen, a small town on the west coast of Norway may discourage many young researchers. They need to develop a strategy to market the centre as a desirable place to work.

The organisation of the centre should continue to translate into a high level of efficiency and good relations with the host institution and partners. This depends very much on discussions currently going on within the University of Bergen concerning current and future funding and organisational models for Centres of Excellence. It seems clear that there are continuing governance/management issues which need to be resolved.

Summary and Recommendations
The performance of the CoE, thus far, appears to have been at a level ***between very good and exceptionally good****. The Committee considered that stronger international partnerships would raise the profile of the centre's work substantially. It would have liked to have seen a greater number of international researchers visiting Bergen.*

5.9 Aquaculture Protein Centre (APC), Norwegian University of Life Sciences, Ås

Introduction
The Aquaculture Protein Centre (APC) is a "virtual centre" involving the Norwegian University of Life Science (UMB) at Ås, The Norwegian School of Veterinary Science (NVH) in Oslo and the Institute of Aquaculture Research AS (AKVAFORSK) at Sunndalsøra.
The vision of the APC is "to secure sustainable growth in aquaculture by providing integrated and basic nutritional, physiological, pathological and technical knowledge required for optimal use of protein in feeds for farmed fish. Research involves three thematic areas:

- protein and aminoacid metabolism
- gut physiology and fish health and
- feed ingredients and processing

Research Achievements at the time of evaluation
Research quality
Research undertaken has both a strategic and applied focus and though it does not perform well in terms of impact factor assessment, this is to be expected. Considerable substitution of fish protein is required if aquaculture (an important industry for Norway) is to expand. The work thus has direct relevance to the aquaculture and especially aquaculture feed industries. The three research themes cover a wide range of topics and expansion of the earlier work on the use of soy bean meal has demonstrated intestinal pathology in salmonids but positive effects in cod – this work has been taken forward by feed manufacturers and is being practically utilised. There is now an increasing element of molecular technology being used e.g. gene expression studies and increasing science quality has been stimulated through international collaboration.

In terms of Publications, in 3 ½ years, 67 peer-viewed papers have been published or are in press, with 41 papers submitted. Papers are being published in appropriate journals for the field, but not surprisingly, initially, papers come from earlier work and volume has increased in 2005/6 The Norwegian PhD system encourages early publication and the annual number of publications would be expected to increase from now on. A significant number of papers come from international collaborators – this is good but home production should increase. Satisfactory result.

The majority of milestones in this project are long term but expected progress has been achieved after original delays because of ill-health and maternity leave.

Scientific collaboration is expanding internationally and is contributing to quality. There are good links with the feed production industry though this is "less than expected". There is concern that

links with Dupont and Solae terminated at the end of 2005 and a definite need for overseas ”stars” based within the APC. Synergy between partners is reasonable but could be strengthened. Results from certain areas have contributed to development in others and have produced joint research and papers.

The APC is a contributor to UMB’s International Aquaculture Education Network. There is good involvement with MSc projects and PhD effort is now stabilised. Access to excellent facilities is being used by internal staff and overseas visitors. What about Marie Curie opportunities? There is no clear evidence of quality of researcher training but contributing institutions are experienced and internationally recognised.

Attraction of good foreign researchers has been disappointing– not enough effort has been made, accepted by APC as early efforts concentrated on recruiting a team from Norway. Future plans propose to increase international effort but in fact suggest reduction of “guest researchers” and drop in personnel and students from 2007 onwards. There is a definite need for more effort in recruiting overseas expertise, perhaps as Post Docs and PhD students.

Results are of major importance in commercial fish feed production and are increasingly relevant. Withdrawal of support from Dupont and Solae has not been explained. Profitability and sustainability of aquaculture is being strengthened as a result of the work of APC and work is of international relevance and being applied to a range of cultured species.

Research still essentially follows the original plan but international collaboration has led to introduction of new techniques and improved quality. Research is wide ranging but planning suffers from a lack of strength in depth. Future plans suggest further expansion of areas without expanding staff - this must be carefully managed and thought through as the total number of scientists is low compared to the range of activity even at the present time.

Organisational and administrative aspects
Governance is efficient. Board of 3 contributing institution representatives plus scientist representative with centre director as secretary. Executive group of 3 theme leaders plus centre director. Sensible addition of administrator to support Director allows focus on research quality. It is suggested that an international advisory committee which met annually would further increase quality output and help develop strategy and focus.

There is good collaboration between the partners with clear roles in each work package. Overall research environment is improved by cross fertilisation and direct industry links.

In the institutional self-assessment, the director appeared to be effective as both a researcher and manager and additional administrative support has doubtless helped. Future administrative support for the theme leaders is proposed and is to be encouraged.

The centre has excellent premises and equipment, well supported from the host institutions and the CoE grant.

Gender equality has been clearly addressed at all levels and is satisfactory.

Research plan for the future five-year-period
All major elements of the research plan are well considered and important in achieving the end result of sustainable feeds for aquaculture. Plans were initially realistic and are being achieved. The major work envisaged will continue but there are numerous proposed additions e.g. effects

on reproduction, disease resistance, intermediary metabolism and muscle growth dynamics, development of cannulation experiments and modelling work. There are concerns at this widening of the work areas in the face of reduced staffing. Clearer strategy is needed with clearer focus on priority areas.

Existing equipment is extensive and of good quality. Forward plans suggest the need for significant new equipment but details are lacking – all will depend on the results of a strategic review (with a new external advisory board?) to determine priorities.

The work proposal is innovative but needs more focus and would also benefit from more international collaboration. There is a danger of overloading the reduced number of scientists envisaged in the later stages of the project. Research on processing technology should provide very practical advice in future dietary constituents and processes.

In the later stages of the programme, there should be an ability to increase financial contributions from other sources as an indication of success and international leadership. No estimates of likely funding flows are made in the documentation provided.

Future plans indicate a reduction in Post Docs and a lack of ambition in recruiting more PhD students. Training is likely to be of good quality and sufficient scope. Efforts should be made to use the Marie Curie system to boost numbers.

A lot of collaboration has been established with international institutions but it is difficult to judge whether these simply reflect a range of MOUs or true collaborative research. The APC is in an excellent position to influence framework VII requirements and stimulate further collaboration.

In some cases, joint publications are being produced and this should be the aim of such collaboration. Further efforts should be made to expand true joint international collaboration.

The APC is in an excellent position to attract good researchers from abroad with its range of strategic research objectives, reputation and excellent facilities. More effort should be made to increase the compliment of foreign researchers through targeted advertising and even “head-hunting.”

The organisation of the APC is excellent and the provision of additional support to heads of theme areas should provide dividends in terms of quality output

Overall assessment

The APC appears to be working well as a virtual centre with its 3 host institutions collaborating well together. The three main themes of protein and amino acid metabolism; gut physiology and fish health and feed ingredients and processing have brought together the complimentary expertise in each of the institutions to address the issue of sustainable aquaculture, of key importance to Norway. Throughout the initial 3 ½ year period of the programme, major investments have been made in infrastructure and equipment providing up to date capability to deal with the research questions posed. Staffing has been strengthened, supporting staff developed and research student numbers built up. This has resulted in satisfactory publication output in terms of volume and quality. Both these aspects should be significantly improved in the remaining grant period.

Collaboration outside Norway has been developed but could be significantly increased and will also improve the international reputation of the APC and the quality of its research outputs. In this respect future effort should be strengthened in bringing overseas staff into the APC, either as guest researchers or staff and efforts should be made to increase the numbers of overseas PhD students. There should be increased effort to attract funding from the Marie Curie scheme of the EU.

Future research plans suggested a range of new techniques and experimental work, particularly involving intermediary transport and muscle growth dynamics, effects on reproduction and disease resistance and development of new ingredients and processing techniques. It was not clear how this would be achieved with the reduced staff and student numbers and the relative timing of the development of these areas was not clear. The new topic areas are important but may be stretching the human resources available if not clearly planned with a reduction in effort in other areas. It is suggested that the topic range proposed is too wide-ranging and efforts should be more focussed. The appointment of an external overseas advisory committee, also with industry involvement, would help to develop a clearer future strategy and clearer focus and support internationalisation.

The presentation provided to the evaluation committee did not adequately address the shortfall in international "visibility" and its resolution and did not supply a clear vision of the way to substantially increase current industrial funding though this was considered possible and achievable.

Some of the research themes would also benefit from intensive discussion with industry to ensure consumer acceptance of proposed feed ingredients.

Overall, the project has been well managed and has, so far, produced good, practical outputs. Future work is well supported by the host institutions, even after 2012. The work has international relevance and merit and is of a ***good to very good*** *standard.*

In conclusion, future plans should include the establishment of an international advisory committee, clearer strategy and focus and increased effort to further stimulate international position and improve industrial funding.

5.10 Centre for Molecular Biology and Neuroscience (CMBN), University of Oslo

The centre for Molecular Biology and Neuroscience is chaired by professor Ole Petter Ottersen, a well-known neuroscientist and there are altogether eleven principal investigators representing different areas of cellular and molecular neuroscience and molecular biology. The group leaders are as follows: professor Jan Bjaalie (Neuroinformatics), professor Magnar Bjørås, professor Niels Danbolt (Neuroanatomy), professor Arne Klungland, professor Michael Koomey, professor Stefan Kraus, professor Ole Petter Ottersen, associate professor Torbjørn Rognes, professor Johan Storm (Cellular Neurophysiology), professor Jon F Storm-Mathisen (Synaptic transmission) and professor Tone Tønjum.

The ambition of this centre has been to facilitate the interaction between different research groups at University of Oslo, working with molecular techniques whether within the nervous system or in other areas. The ambition of the centre is to broaden the interaction between different subdisciplines and expand the methodology platforms available to each researcher within the centre. The overall goal has thus been to facilitate the interaction to allow each research group to

apply a broader methodological repertoire with a focus on molecular (e g DNA repair) and cellular function as well as mechanisms to address a number of brain diseases and to find therapeutic targets at the molecular and cellular level.

Research achievements at the time of evaluation
The Centre of Molecular Biology Neuroscience has been very active and reports no less than two hundred papers in refereed journals from July 2002 until March 2006. A large number of the articles are published in high impact journals in the different focus areas of the principal investigators extending from DNA repair to neurological diseases and mechanisms of synaptic transmission.

The different areas have been divided into work-packages led by different group leaders. The first represents ***neuroinformatics*** (Jan Bjaalie). The centre has contributed importantly with the development of databases, extensive tool development and image registration and has taken on an international leader role in this aspect. The work-package in ***bioinformatics*** aims at coordinating neuro - and bioinformatics. The focus of this group has been on DNA, repair bacterial components, genome maintenance, mammalian transporter channels and the identification on single nucleotide polymorphisms. Jon Storm Mathiesen and Ole Petter Ottersen have had a pioneering role in identification the different components in ***glutamatergic synaptic transmission*** that is the major excitatory transmitter in the nervous system. At the same time glutamate can give rise to toxic reactions if released excessively under pathological conditions like stroke. Not only neurons but also glia cells have been found to release glutamate. The subsequent work-package on neuronal ion channels (Johan Storm) is focused on the role of different ***subtypes of potassium channels***, not only during physiological conditions, but also during neurological disease. Potassium channels play a major role in the nervous system and no less than ten mutations in potassium channels have been identified and are known to lead to disease states (e g epilepsy). The different potassium channels are also potential targets for drugs. ***DNA damage and repair*** and genome instability are relevant not least in the context of neuroscience and aging. Novel DNA repair mechanisms have been identified within this work-package and are clearly of importance for neurodegenerative diseases of different kind and its molecular mechanism. Another work-package deals with the ***homeostasis*** in the brain and the control of extracellular potassium, transport of water and brain oedema. It represents another major area dealt with by the chairman in interaction with Peter Agre, Nobel laureate and the discoverer of water channels. Work-package 7 (M. Koomey) deals with ***meningococcal genome dynamics*** is one area and the host - microbe interaction, which clearly is important for an understanding of the pathogenetic mechanisms. It is concerned with both interaction with the neuronal tissue and the glial responses. ***Stem cells and repair*** and memory formation are also a focus for the consortium.

From the above follows that the centre provides a very broad field of expertise and methodology and it appears that it has managed to create an efficient and stimulating interaction between the eleven group leaders that most likely had not occurred without the formation of the Centre of Excellence. Clearly the net result is a very productive and high profile environment within a number of related and important areas of research.

The centre has a very extensive international exchange with leading research groups. The research training is of high quality and clearly of international standard. The environment has attracted a number of foreign researchers, postdocs and doctoral students and in addition a number of guest professors have worked at the centre for shorter or longer periods including Peter Agre.

Organisational and administrative aspects
The centre is coordinated by Ole Petter Ottersen with Tone Tønjum as co-director. They report to the board for the centre appointed by the President of the University of Oslo. The board in turn reports to the top management of the university and 'Rikshospitalet-Radiumhospitalet'.

Rather than creating a separate administration at the Centre of Excellence, the administrative facilities already available in the different departments have been utilised. Although being in different buildings (the distance is not too great) this form of distributed governance has apparently worked well for the centre.

The interaction between the host institution and the centre appears to have worked smoothly. The chair of the centre has previously been dean at the medical faculty. He has done a very good job as coordinator and has at the same time continued to play a major role scientifically.

Research plan for the future five-year period
The research plans appear to be well structured in the different areas of the centre. The high research profile of the centre can therefore most likely be continued. The varied methodology and equipment available appear largely appropriate for the centre.

The training of postdoctoral and PhD students appears to be of high quality and the gender perspective is considered important within the centre. Extensive international collaboration with leading research groups occurs and the centre attracts good researchers at different levels from abroad. The organisation of the centre is appropriate for an effective interaction between the host institution and the partners.

*In **conclusio**n, the Centre for Molecular Biology and Neuroscience is well organised and contributes importantly to provide better facilities for each of the eleven groups, which have complementary expertise in different molecular and neurobiological areas. All three evaluators ranked the research at the centre as **exceptionally good**.*

5.11 Mathematics for Applications (CMA), University of Oslo

Objective
The main focus of on the centre is on mathematics motivated from applications with an emphasis on problems arising from modern scientific computing. The centre builds its activities on a methodical foundation in geometry, stochastic analysis and partial differential equations, combined with a strong emphasis on applications in the physical sciences.

Research Achievements at the time of evaluation
Indubitably, the research carried out by the centre has high international quality and led to new understanding in several research areas. It is at the absolute forefront internationally in all the four main areas: geometry, stochastic analysis, pde and applications to physical sciences.

The scientific production (200 papers) by researchers, postdocs, students and visitors is remarkable with a yearly average of more than two journal papers and 2.3 other kinds of publications. As for the number of publications, the record is outstanding. The staff published many high quality papers and many of the publications in internationally recognized journals are outstanding.

The centre has a very active program of visitors and strong international collaboration leading to joint publications. Clearly, this collaboration strengthens the research of the centre. Some of the

international collaboration is at the individual level, though there are some where the groups benefit from each other (e.g., one with Oak Ridge Lab).

The CMA's researcher training has been very successful. Twelve PhD students (who started before CMA creation) completed their theses whereas 10 were planned. There are a number of publications co-authored by students and postdocs, which attest that the training has been efficient and at the international level.

The centre has attracted good candidates and recruited high quality people through an open competition and international advertisement of positions.

There has been very substantial involvement with the industry, due, for a large part, to the strong collaboration with SINTEF. As a consequence CMA opened opportunities for important industrial dividends. Furthermore, the centre has been involved in rethinking the way science can be taught. Finally, the centre also involved in activities for school students showing that the centre is in the good direction to providing opportunities social dividends

The initial plan has been followed with no even minor changes. Collaboration with CIRP was maybe not in the original proposal but remains/expands the research to an area of critical national importance.

Organizational and administrative aspects
The CMA appears to be a tightly run organization with an autonomous administrative structure, which works well for both the centre and its host. It seems that administration is targeted to provide support to research and to create conditions for quality research. The role of the external scientific committee that helps discussing future research directions is positive.
The host institution assessment shows that the relation with CMA worked smoothly.

Part of the success is evidently due to the excellent leadership of Pr Winther. The atmosphere of the place is reported to be excellent and reflects a genuine satisfaction with the leader and the daily operations. According to researchers: "we find the situation close to optimal".

The centre has 26% female PhD students. This is a high ratio compared to other maths institutions. Unfortunately, the situation is less successful for postdocs and senior researchers. Only one senior female member has been appointed.

Research Plans for the future five-year-period
The work plan is the continuation of the same line of research carried out in the previous three years: a nice combination of stochastic analysis, geometry, pdes and applications. On one hand, 'why to change something which is working well' but on the other hand, one could expect a more ambitious program. However, there are some additional directions. For example, the fact that the research on stochastic pdes and its applications will be carried out actively. For some of the theoretical directions proposed, there is not a real link to the applications with broader impacts. Some new areas of applications are mentioned but there are not clear commitments.
In overall, the proposed research plan is a combination of very strong and current activities with new activities which build many bridges in exciting directions of research, both of fundamental mathematical nature as well as reaching deep into applications.

The proposed methods are largely a continuation of the current model which, by all accounts, is highly successful.

CMA is a ground for cooperation between mathematics and other areas. Apart from being a breeding ground for breakthroughs in mathematical science, the interdisciplinary focus of the centre is ideal to also impact the industry, the financial and medical sector as well as the utility producers. From this respect, CMA is a unique centre. One interesting example of this is the development for multi-modal imaging, something that requires knowledge of both pdes, geometry, possible stochastic modeling to account uncertainty, and a strong connection to the clinical world. This is an example of an application where CMA has the potential to develop methods with a great impact.

The centre plans to increase the number of Ph.D. recruits (from 25 projected initially, to 60 completed PhD's. Based on the first three year this is both realistic and commendable and will increase the research capabilities of the centre and enhance the pool of applicants to university positions being vacated during the coming decade. The number of postdocs will decrease in order to increase the permanent staff. This seems to be a correct step because it will allow CMA to branch out to different directions.

Measures have being put in place to address the gender perspective in recruitment. One can expect that the centre will continue the previous successful hiring of female Ph.D. students. The number of female permanent staff should increase.

The centre plans to keep the contacts established during the first period and to strengthen them. This looks sufficient in scope and quality.

Given the past experience and the high visibility of the centre (through international awards, invited speakers, etc.) one can expect the centre to be successful in attracting researchers from Norway and abroad.

Overall, CMA has been running very successfully and has achieved the main goals of the proposed plan very well. The centre accomplishments are very/exceptionally good with a large number of publications in reputable journals. The researchers are internationally recognized scientists and were able to attract excellent young people from Norway and abroad. The researcher training has been excellent. The proposed plan for the next five year period will very likely continue to foster these strengths.

The research of the centre is based on solid interrelations of theory, computation and applications and nicely build around geometry, stochastic analysis, pde and applications. The math component is strongly tied to applications but areas of the component are less strongly tied to each other as they could/should be. Strengthening the ties between the different areas of math involved in the centre will enhance the research of CMA and help to approach the applications in a more unified way. For example, a tight collaboration of pde and stochastic analysis can open the problems related to uncertainty quantification.

Conclusion
The CMA has the potential to become, in fact it already is, a dynamo for computational mathematics and modeling in Northern Europe and a highly visible player globally. Overall evaluation: ***Exceptionally Good.***

5.12 Centre for the Physics of Geological Processes (PGP), University of Oslo

The concept behind the PGP CoE is extremely novel and innovative and is already being emulated by other university groups around the world. Its research addresses the underlying

physical principles, which lie behind many common geological processes. PGP bridges a traditional gap between physics and geology.

Research achievements at the time of evaluation
The CoE has an excellent track record thus far as evidenced by the quality publication record (e.g. in the journal *Nature*) and the advances that have already been made. There is an incredible range of scientific activity being undertaken within the centre. It had very strong foundations at its inception because of the previous history of good research collaboration between the departments of Physics and Geological Sciences at the University of Oslo. Members of PGP have been extremely active in international outreach activities, presenting their results at all the major international conferences in this field, and in promoting public understanding of science. PGP has greatly increased the international reputation of both the University of Oslo and Norwegian science in general.

Over 100 publications have appeared in high profile international journals, including *Nature*. The senior staff members each appear to have produced an average of 3 papers per year since the centre started.

The centre has reached its original milestones and exceeded them in many areas. The number of students working within the centre is almost a factor of 3 greater than originally planned. A successful Masters programme is operational. Substantial research funds have been raised from external sources.

The level of national and international collaboration is exceptionally good. This has resulted in a dynamic research environment with frequent international visitors. These partnerships with other organisations have proved extremely beneficial to PGP in providing access to laboratory facilities and other infrastructure not available in Oslo. A high number of the centre's publications have an international collaborator as a co-author. Conference programmes organised by PGP appear to attract an impressive list of international participants.

The training provision appears to be very good and of an international standard. A PGP Masters programme was initiated in 2004, spanning the disciplines of physics, mathematics and geology. In its concept this is probably unique within Europe. The first students will graduate in 2006; it will be very interesting to see what their next career steps are.

The centre has attracted a number of highly talented more senior researchers from overseas. In addition there is a very strong cohort of young scientists.
PGP has actively sought collaboration with industry and has produced some very interesting solutions to a number of applied geology problems. A substantial part of its research is of direct relevance to the hydrocarbon industry.

In general the research programme appears to have followed the original plan; some changes have been introduced during the course of some of the projects, reflecting the evolving nature of the research. Seven core projects have now been identified which focus the research activities and maximise the use of the available resources.

Organisational and administrative aspects
The management structure appears to be very good. There is a single Board, appointed by the rector of Oslo University, which oversees both the operational and scientific direction of the centre. This structure has clearly been effective in supporting the excellent progress made by the centre thus far. The structuring of the research into a number of core projects appears to be

particularly effective; young scientists have been chosen as project leaders, which is both unusual and visionary, providing opportunities for career development. Responsibility for industrial collaboration and coordination of educational programmes has been delegated to specific individuals.

The relationship between the centre and the host institution (University of Oslo) appears to have functioned smoothly. PGP clearly has very strong support from the University of Oslo. In many respects PGP has been a highly successful and highly visible flagship project for the University.

Both Jens Feder and Bjørn Jamtveit have been strong and inspirational leaders of the CoE. Both are outstanding research scientists in their own right and also appear to be good managers.

The facilities provided by the University of Oslo whilst satisfactory at the outset, are now under some strain because of the success of the centre. As within all university environments these days space (or lack of it) is the main issue.

The leaders of PGP take gender balance issues very seriously and have promoted gender equality in their recruitment activities. Nevertheless it has to be recognised that post PhD there are significantly fewer women than men in both Physics and Earth Sciences. Currently only 2 of 23 senior scientists and 1 of 9 post-docs are female. There will be a young female project leader in the near future who should provide a good role model.

Research plans for the future five-year-period

The original research plan for the first 5 years of activity was extremely ambitious. The plan for the second phase builds on the strong foundation established up to now and pushes even harder at some very difficult problems in the geosciences. Five core projects have been identified. PGP will clearly not solve all the problems that it has identified. Nevertheless, the evidence from Phase I of the centre's activities suggests that they will have a number of high-profile successes. The proposed research approaches appear to be appropriate.

Without doubt PGP will continue to be extremely successful. The centre leaders have managed to build a young and very dynamic research team. Inevitably they will lose some of these researchers to permanent posts elsewhere. However, the international reputation and prestige of PGP will ensure its continuing ability to attract high calibre researchers to Oslo.

The researcher training environment within the centre and the University of Oslo is excellent. The fact that over half the staff of PGP are post-docs and PhD students demonstrates a strong commitment to the recruitment of young researchers. The PGP leadership recognises that it has an important task ahead in recruiting more female scientists to its research teams.

PGP has established a number of strong and long-lasting collaborations with national and international partners. The number of collaborators could of course be expanded further and this will no doubt happen during the second phase of activity. The centre has ambitions to become an EC-funded research centre.

The centre in a good position to attract first class researchers from abroad. It is already very well known internationally and has a number of talented overseas scientists on its staff. There is a steady stream of international visitors to the centre.

The available evidence suggests that the centre will continue to perform at a high level with good support from the University of Oslo. The management structure should actually be even better now that research has been focused into a number of sub-groups, each with its own leader.

Summary and Recommendations
The Committee considered that the performance of the centre has been **exceptionally good.** The centre leader, Bjørn Jamtveit, is a dynamic individual with a clear vision for the future of the centre.

5.13 Centre for Advanced Study in Theoretical Linguistics (CASTL), University of Tromsø

The Centre for Advanced Study in Theoretical Linguistics (CASTL) aims at an understanding of linguistic variation through an investigation of the parameters across which languages differ in syntax, morphology and phonology. To achieve this goal, the researchers of the centre employ the method of selective global comparison which is based on an in depth analysis of the formal properties of a set of genetically and geographically unrelated languages. The strategy they pursue is to explore variation in the fundamental blocks of syntax, morphology and phonology: categories and features. CASTL has recruited many excellent young researchers from Europe and North America who have formed a strong, internationally recognized group. The Centre is directed by professor Curt Rice, and the research conducted is organized around a core group of six senior researchers (Peter Svenonius, Gillian Ramchand, Michal Starke, Knud Tarald Taraldsen, Bruce Morén and Curt Rice).

Research achievements at the time of evaluation
CASTL is a successful and dynamic research centre, which has been at the forefront of developments in the field of theoretical linguistics and has been producing excellent results. The researchers involved in the centre are well-known and internationally respected; the highly innovative research they pursue has led to a new understanding of the properties of the human language faculty and the nature of cross-linguistic variation. CASTL's research is organized into projects around which research teams are built. The projects cover important areas of phonology, morphology and syntax, such as the nature of phonological features and the relationship between phonological features and phonetic behavior, the interaction between morphology and phonology, the properties and internal make-up of syntactic categories, the relationship between morphemes and syntactic nodes and the lexicon-syntax interface. The work that has been produced in all of these domains is outstanding. Particularly the research on adpositions, argument structure, decomposition, the division of labor in phonological theory and the phonology-morphology interface belongs to the most important theoretical developments in the past few years. There is no doubt that CASTL has become the top centre of theoretical linguistics in Europe and one of the major centres in the world.
CASTL has an impressive record of frequently cited publications on a broad spectrum of topics in syntax, phonology, morphology, semantics and acquisition. A number of these publications appear in first class journals such as Linguistic Inquiry, Natural Language and Linguistic Theory, Journal of Comparative Germanic Linguistics, Theoretical Linguistics, Probus, Lingua, Nordic Journal of Linguistics, Cognitive Linguistics, Journal of Slavic Linguistics. Other publications appear in edited volumes by major publishers. Volumes of this type are highly valued in linguistics because they contain work by experts on specific topics and undergo a strict review process, no less demanding than that of refereed journals. Finally, the research carried out at CASTLE appears in proceedings of major conferences such as NELS and SALT and prestigious working papers like the Working Papers in Scandinavian Syntax. The importance of these

volumes - which are widely read and cited – lies in the fact that they report brand new research while journals and edited volumes contain work that has been circulated for quite some time.

It is admirable that in a short period of time CASTL has managed to reach all of the ambitious goals stated in the original proposal. The group has hired prominent researchers and promising doctoral students, while at the same time establishing important subprojects in syntax, morpho-syntax, phonology and morpho-phonology, as witnessed by the impressive number of high quality conferences and workshops that have been organized by CASTL. Moreover, the graduate school has become the best program of its type in Europe. It should also not go unnoticed that CASTL founded the linguistic online database *LingBuzz*, which has quickly established itself as the standard tool for the distribution of electronic articles in syntax and related areas. Finally, CASTL's profile has been strengthened even more by a number of independently financed research projects, such as the Nordic Centre of Excellence in Microcomparative Syntax (NORMS).

National and international collaboration is one of the strongest qualities of CASTL. At a national level CASTL has long-standing relations with Trondheim, Bergen and Oslo. Internationally, CASTL has excellent relations and longstanding agreements with important universities and research institutions in Europe and North America such as MIT, NYU, University of Maryland, Princeton, Geneva, Meertens, UC London, Siena, Venice, Utrecht, Budapest. It hosts the NORMS, which connects it to researchers in Finland, Sweden and Iceland. The organizers of the Eastern European Generative Grammar group, which organize summer schools every year, are members of CASTL. CASTL's researchers attend numerous conferences and workshops all over the world and are regularly invited to teach at summer schools. Finally, it is impressive to note that in its first 3.5 years, CASTL has attracted about 400 guests to conferences, workshops and seminars on its premises.

The graduate school represents an important achievement. The school is organized according to the North American standards, which means that Master's and PhD students are offered intensive graduate courses and advanced seminars on a regular basis. As a result, Masters students are regularly accepted in prestigious PhD programs in North America, while PhD students distinguish themselves by their independent, original contributions to the field. The eminent success of the graduate school is certainly also a function of the fact that PhD students are closely supervised and guided towards choosing interesting dissertation projects. This situation differs significantly from other places in Europe, where students are usually left to decide on a topic on their own. Moreover, teaching and training is promoted by directly integrating graduate students in all stages of the research as active members of the research teams. Thus, students do not only participate in the shaping of specific questions, but are also expected to carry out their own research agendas on specific topics and prepare their own presentations and publications. That students are regularly offered the opportunity to present their work in the high quality workshops organized by CASTL further helps to enhance their strong research profile.

Even though geographically distant, the centre has been able to attract numerous internationally renowned senior researchers as well as postdocs which have become highly respected in the field, as evidenced by their impressive citation and publication records, among others. The high international reputation of the senior researchers is also reflected by memberships in the board of the international organization *GLOW* and in editorial boards of several prominent journals, the editorial responsibility for the squibs section of the journal *Linguistic Inquiry* and the fact that they are on a regular basis invited as keynote speakers at workshops and conferences. The graduate students, who apply to the program from all over the world, are - due to their excellent training – already early on in their careers in a position to produce interesting research on a wide

variety of different topics and languages. And many guiding visiting scholars from abroad enjoy the hospitality and the inspiring intellectual environment offered by CASTL.

In addition to its scientific value, the centre's research also generates directly applicable results. It contributes, for one, to the efforts to eliminate the negative stigma associated with minority languages and under-represented speech varieties by drawing attention to grammatical phenomena attested in understudied languages such as northern Norwegian dialects, Northern Sámi, the Bantu language Kitharaka and the Creole language spoken in Sierra Leone Krio. This way, the study of linguistic variation has a broader social impact. Other practical applications may include language documentation, the development of more efficient learning techniques and the standardization and creation of orthography for hitherto unwritten languages.

There haven't been major changes in the research plan, which has proven extremely stable. As anticipated in the original proposal, though, the organization of the subprojects has been revised in order to address better the changes in the field and to accommodate for the research interests of the hired personnel. This flexibility has improved the quality of the research conducted at CASTL because it has led to the formulation of important new subprojects (such as the work on adpositions) that were not included in the initial proposal.

Organizational and administrative aspects

CASTL's organizational architecture has greatly contributed to the efficiency and quality of the research produced. By being embedded in the faculty of Humanities, CASTL enjoys the infrastructural support of the University of Tromsø while at the same time having a high degree of autonomy in funding and management. The members of the Board of directors are appointed on the basis of their quality as researchers along with their administrative experience in running research projects. The fact that one person, the Centre Director, is responsible for carrying out the research plan leaves the other members of the group free to conduct their work without the burden of administrative duties. Subdividing the organization into projects maximizes the efficiency of the conducted research and gives students the opportunity to become active and responsible members of the research teams.

CASTL's collaboration with the Department of Languages and Linguistics at the Faculty of Humanities is mediated through the affiliate program, which enables local scholars with independent funding but related research to become associated with the centre. This has led to a very productive relationship between CASTL and the host institution. At the national level, CASTL has excellent working relationships with Trondheim, Bergen and Oslo. Linguists from these institutions regularly visit Tromsø to present their work, and their doctoral students are invited to visit accredited research training courses every semester. Research relating to Scandinavian syntactic variation is promoted through the NORMS, which connects CASTL to Helsinki, Lund, Oslo, Trondheim, Århus and Reykjavík. Finally, CASTL has excellent relations to all important linguistic institutions in Europe and North America.

Curt Rice is a distinguished phonologist who has an international reputation for his highly influential research. In his position as the Centre Director, he has displayed exceptional managerial skills.

The facilities and equipment made available to CASTL by the university are satisfactory, except that the Ph.D. students are located in a different building than the faculty and the rest of the staff. This is not an ideal situation; students would profit from an easy access to the faculty for questions and discussion.

The change from 20% women at the beginning to 45% now suggests that gender equality has been taken into account in CASTL's recruitment policy. As stated in the self-evaluation, the representation of women at the senior level needs to be improved.

Research plans for the future five-year-period

The research plan for CASTL's second five-year-period represents an evolved continuation of the initial plan. It incorporates a number of highly original, novel goals in the study of linguistic variation. In the domain of syntax, the plan projects a unifying theme for the various projects, i.e. the hypothesis that the core categories noun, verb, adjective and adposition are decomposable into series of abstract heads, which was not included in the initial proposal. Ramchand's new theory of argument structure constitutes a challenging alternative to existing approaches and is tested in a variety of phenomena from different languages. The project on adpositions aims at providing a solid characterization of the cross-linguistic properties of prepositions by looking into a wide variety of languages. In phonology, the project on Phonological Segmental Structure supports the hypothesis that the relationship between phonological segments/features and phonetics is much more abstract than assumed in current theorizing. The goals of the new research proposal are ambitious but they are also realistic since they explore well defined questions and build on solid previous results.

The method of selective global comparison, which is based on an in depth study of phenomena showing crosslinguistic variation in a restricted set of genetically and geographically unrelated languages, is the best way to study linguistic variation, as it avoids the limitations of microcomparison approaches and the superficial results of Greenbergian global comparison. The equipment available to CASTL is adequate for the type of research conducted.

There is no doubt that CASTL will continue to produce highly original research results and be an international leader in the field of theoretical linguistics. The quality of the proposed research, the organization of the subprojects and the high-level scientific profile of the research team guarantee the centre's success in the future.

CASTL's graduate program has become one of the best programs in the world. Graduate students are fully integrated in a stimulating intellectual environment, they undergo a period of intensive training in different areas of linguistics and they are guided to develop their own research skills by learning how to write abstracts for conferences, how to design and deliver presentations, how to develop arguments, and how to define research questions in the course of the development of a dissertation plan. With the funding available the centre will be able to continue to hire three to four new PhD students per year, which will permit the continuation of this excellent research training.

As a result of the measures that have been instituted to ensure gender equality, women are well represented at the student and postdoc level. The imbalance at the senior researcher level can be improved through future hires.

CASTL has an impressive record of international collaborations. It has established strong contacts and connections with top research institutions in Europe and North America. The organization of workshops and conferences forms an important part of its research life. These intense activities promise to continue and even increase in the second five-year period with the future organization of workshops and major conferences, the extension of invitations to international scholars, and the establishment of new networks through projects such as the Nordic Centre of Excellence in Microcomparative Syntax.

As it is known as one of the central places for linguistic research and training, CASTL will continue to attract short- and long-term visiting researchers from abroad who want to enjoy work in the stimulating and challenging intellectual environment provided by the local group.

Finally, given the outstanding achievements of the present administration, which is expected to remain unchanged in the future five-year period, the organization of the centre will certainly continue to support a high level of efficiency and consolidate the good relations with its host institutions and its partners.

Conclusion

In conclusion, as also pointed out by the three evaluators, the Centre for Advanced Study in Theoretical Linguistics qualifies as ***exceptionally good*** *both in terms of scientific value and in terms of leadership/organization. The significant achievements of CASTL are reflected by the high quality of research in important areas of linguistic theorizing; the strong publication record; the successful recruitment of excellent researchers from all over the world; various projects involving international collaborations; a well-functioning graduate school; and the organization of numerous workshops, conferences and summer-schools. All these factors have contributed to bring CASTL to the forefront of the developments in the field of linguistics. In addition, the integration of the Centre into the Department of Languages and Linguistics at the Faculty of Humanities through the affiliate program has led to the enrichment of the research environment at the faculty level.*

6. General observations and conclusions

The evaluation committee concludes that the CoEs in their respective fields have provided an important contribution to the development of Norwegian research. The centres have fostered and inspired a dynamic interaction across faculty and departmental borders, and have in some cases even promoted a change in the organisation of the institutions within which they are located. We therefore congratulate the NFR on an initiative that has had fundamental and beneficial effects on the research environment in Norway. Below we summarise our observations in the following points:

- The creation of a CoE often led to an enhanced visibility and attention to its field of research. This has led not only to novel research, but also to an ability to attract funding and support from other sources that had previously not been available. This includes support from the host institution, foundations, and/or industry. In many cases the additional funding has been larger than that contributed directly by NFR to the CoE.
- The formation of a CoE with a novel, often international, research environment and additional funding has stimulated to dynamic development and in many cases outstanding research, published in high profile journals.
- The most successful centres are characterised by a strong and dynamic leadership in terms of both intellectual/scientific direction and team management. This appears to be of particular importance for the CoEs, since they have often recruited scientists with different background training and types of expertise. To create an atmosphere conducive to interaction and creativity, the scientific environment and the team management are of critical importance.
- The committee notes that all CoEs have attempted to create a better gender balance. With regard to PhD students most CoEs have succeeded in this aim, while the number of women in senior positions is much smaller. We note that all CoE chairpersons were men, whereas women served as deputy chairperson in some cases. Clearly the ambition must be to reach a balance also in the more senior positions.
- It is important that the senior scientific staff of the different CoEs have a balanced age structure, so that scientists with a good standing can take over when older scientists retire. Clear succession planning is essential for future effective development.
- The committee has noted that many centres or their governing board report directly to the president of the host university. There may be some advantage to such an arrangement, but also problems in that the CoEs may become less well integrated in the faculty environment within which they would normally operate. A format for how the centres should be organised within the university structure would seem useful to develop.
- There is an urgent need at this stage for the host institutions for the CoEs to plan for the end of Centres' terms. This is important for at least two major reasons. First, it is essential to retain existing staff (particularly at the senior level) and recruit new staff, and to maintain high profile activities, at the CoEs during their last period. Secondly, it is vital to help ensure that the achievements of the Centres are built upon in some form, and not lost, after the end of their 10-year existence. Such plans need to be developed in interaction between the CoEs and the university or other organisation at which the CoEs are based. We note that some universities consider it important to take advantage of the development at the CoEs, provided that they continue to do cutting edge research. They

plan to continue the best aspect of the CoE efforts in other forms after the ten year period is ended, although concrete plans are not yet formed. In contrast, the representatives for the University of Oslo expressed the view that their CoEs would have to be closed, and that they had no possibilities to provide further support after the ten-year life of the CoE.

- Most CoEs appear to have an appropriate infrastructure with regard to research equipment, IT and administration. Some centres, however, expressed concern about the administration, particularly when different institutions were involved, and in a few cases the IT structure was not sufficient. With regard to finding solutions for a cost and effort effective administration, the experience from the first CoEs should be transferred in the form of 'best practice' routines, so that each new centre does not have to reinvent the wheel.
- Many centres complained about the difficulty to obtain sufficient space, in particular when they were growing fast. Another problem is when the centre has space in several buildings at some distance from each other. It is a clear advantage to have the CoE in one location, which facilitates interaction in different forms. It might be useful if when a CoE is established, there is a negotiation with the university/host institution, which emphasises the need to create appropriate space for the respective centres.
- The most successful centres had leaders with both scientific vision and managerial skills. To ascertain that this is the case for a potential CoE, it might be useful to have interviews as a part in the selection of new CoEs.
- The evaluation committee found that the review process initiated by NFR did function in an excellent way, with the background material from the CoEs and their host institutions, and the evaluation of three experts. A few minor details can be noted:
    - Before starting with the SWOT analysis it would be useful that the presenter provides in three – four minutes the scientific vision of the CoE,
    - The publishing routines are very different in for instance medieval history, engineering and life science. It would therefore be useful if the CoEs provided a short paragraph on the publishing routines in their field and how their publications compare to those of other prominent centres in their field. It would also be useful if the CoEs ranked themselves in a form of 'bench marking' in relation to other centres in the same area of research. The expert reviewers could also be asked to make a similar bench marking.
    - Some CoEs interviewed at the Midterm Evaluation proved to have excellent performance with regard to some activities, but less good in others. We recommend that NFR may ask them to respond to the critique with suggestions for improvement before it is decided whether a CoE should be continued.

The Centres of Excellence have thus each provided important development in their respective area of research and in addition had positive effects on the research environment at the faculty level. It is therefore recommended that NFR continues to support and extend the CoE program. We would like, nevertheless to point out that it is important to have a balance between support to centres and independent project grants. The latter type of grants to individual researchers provide the fastest way to pick up and support new cutting edge discoveries and have them scrutinized by review committees. Such project grants must be available to provide good support for individual researchers and their groups. Many outstanding discoveries, particularly in some but not all areas, are made by scientists with small research groups dedicated to a specific problem. The two types of research programs complement each other.

7. Signatures

Oslo, November 10th 2006

Sten Grillner (Chair)

Cecilia Albin | Elena Anagnostopoulou | Bertil Nilsson

Preben Terndrup Pedersen | Randolph Richards | Colette Rolland

Gerold Wefer | Majorie Wilson

Attachment 1 - Terms of reference

1.1 Introduction

The *Centres of Excellence (CoE)* scheme is designed to stimulate Norwegian research groups to set up centres devoted to long-term basic research of a high international calibre. The scheme is intended to raise the quality of Norwegian research. The scheme is open to longterm basic research without immediate application or social relevance, as well as to research with such relevance.

The CoE scheme is administered by the Research Council of Norway and funded by the yield on the Fund for Research and Innovation. Each of the centres may receive funding for a maximum of ten years.

The application process was divided in two phases. A prequalification round was based on a brief application. Following a thorough scientific assessments, forty applicants were invited to submit a more detailed application. Finally, 13 Centres of Excellence were established.

1.2 Background for the evaluation

The Norwegian Centres of Excellence scheme requires that each of the 13 centres be evaluated under the auspices of the Research Council of Norway after 3 ½ years, as calculated from 1 January 2003.

1.3 Purpose of the evaluation

The purpose of the evaluation is to assess the scientific quality and production of the individual centres in absolute terms and relative to the centres' original research plans. The evaluation will provide data to support the decision as to whether the individual centre is to continue for the entire 10-year period, or not. The Executive Board of the Research Council of Norway will take the final decision on prolongation.

1.4 Organisation

The evaluation will be performed by an international Evaluation Committee. The Committee will evaluate the individual centres based on a common scheme. To support the Evaluation Committee, a number of panels of experts will be set up to carry out detailed scientific assessments of the individual centres or groups of centres, according to criteria given in 1.5.

1.5 Conditions and basis for the evaluation assignment

The Evaluation Committee and panels are asked to assess the following elements and to discuss these findings in their recommendations:

1) The basic reference for the evaluation is provided for by the criteria on which the centres were originally selected.

2) The assessment will primarily focus on the scientific quality and scientific production of the centres, including the generation of original scientific ideas and the promotion

of these ideas. Publications, impacts of publications, establishment of (international) networks and output of doctoral candidates and post-docs are important criteria.

3) The scientific achievements and activities will be compared to that presented in the original plans, cf the agreement. It should be stressed, however, that well-founded adjustments in the plans as related to scientific findings in the project period will be accepted and even endorsed.

4) The plans for scientific activities for the centres' final five-year period will be evaluated. The assessment will include the plans for the centres when their CoE status and RCN funding expire.

5) The relations between the centres and the host institutions, the value added for the host institutions, as well as plans for preserving the value generated by the centres at the end of the CoE-period will be focused upon.

6) The research at several of the centres addresses fields in which the research results can produce substantial industrial or social dividends. However, research not explicitly aimed at such a target may also result in important industrial or social dividends. Where this is the case, the evaluations should point out such effects.

7) Finally, the evaluators will be asked to compare the different ways in which the CoEs have been organized and managed. Observations in this context, however, will not be used in any decisive manner for the evaluation results of the individual centres, but will provide information for the use of the individual centre and for future CoE planning processes.

To avoid giving a premature indication of the Council's decisions to prolongate individual centres, the Evaluation Committee is asked not to comment specifically on this issue.

1.6 Background material for the evaluation

The following written material will form the point of departure for the evaluation:

► *Self-evaluation* according to a standardised outline, from the individual centre featuring relevant information, including:
- research plan for the first five-year period;
- revised research plan for the second five-year period, including a plan for the winding-up period;
- a list of research results achieved up to the midway evaluation, supplemented by a list of publications and any bibliometric data that illustrates professional activities;
- an overview and justification for changes, if any, in the research plan;
- a list of the publications the centre considers to be its most important;
- an overview of researcher training and recruitment up to the midway evaluation, specifying the number of employees, their nationalities, age and gender;
- key financial and administrative figures and factors associated with the centre;
- important industrial or social dividends, if relevant.

► *Centres of Excellence. Report on a Norwegian scheme.* The Research Council of Norway, Oslo 2000 (English version – eller ny oppdatert kortversjon)
► *Centres of Excellence. Requirements and guidelines* (English version)
► *Centres of Excellence. The call for proposals* (English version)

2. Mandate for the Evaluation Committee

The evaluations of the individual centres are to emphasise the following elements:

Research achievements at the time of evaluation
The evaluation is expected to assess whether:

- the centre's research has been at the forefront of developments in its field, leading to outstanding research results and a new understanding that has affected national and international research in the field;
- the centre's publications have been satisfactory, both in quality and scope;
- the centre has reached its original milestones;
- the centre's national and international collaboration has strengthened the research performed at the centre;
- the centre's researcher training has been sufficient and of an international standard;
- the centre has been able to attract good foreign researchers, doctoral students, postdocs and senior researchers;
- in addition to their scientific value, the centre's research results may also open opportunities for important industrial or social dividends;
- there have been changes in the research relative to the plan, and whether these changes have led to better research.

Organisational and administrative aspects
Further, the evaluation should assess whether:

- the centre's form of governance and organisation has contributed to the efficiency and quality of the research;
- the relationship between the centre, the host institution and any partners has functioned smoothly, and whether the centre's research has led to mutual enrichment of the overall research environment;
- the head(s) of the centre has/have done a satisfying job, both as a researcher(s) and a manager(s);
- the premises and equipment have been satisfactory;
- the perspective of gender equality has been adequately taken into account in the centre's recruitment policy.

Research plans for the future five-year-period
Finally, the evaluation should assess whether:

- all segments of the research plan have original, ambitious, though realistic goals;
- the proposed methods and the equipment used are adequate and necessary;
- the centre's future research will have a chance of producing innovative findings, and whether the centre will continue to be an international leader in its field;
- the centre's researcher training is sufficient in scope and quality, and whether measures have been instituted to the recruitment of younger researchers;
- measures have been instituted to ensure the gender perspective in recruitment;
- the proposed international collaboration is sufficient in scope and quality;
- the centre will be in a position to attract good researchers from abroad;
- the organisation of the centre will continue to translate into a high level of efficiency and good relations with the host institution and partners.

Attachment 2 – List of background material

List of documents which have served as background material for the Evaluation Committee

General background material[1]

1. Centres of Excellence. *Report on a Norwegian scheme*. The Research Council of Norway, Oslo 2000 (English summary)[1]
2. Centres of Excellence. *Requirements and guidelines*. The Research Council of Norway, Oslo 2001[1]
3. Centres of Excellence. *The call for proposals*. The Research Council of Norway, Oslo 2001
4. *Criteria for evaluating the CoE applications*. The Research Council of Norway, Oslo 2001[1]

Background material for the Midway Evaluation

5. Midway evaluation of the Centres of Excellence. *Terms of reference*. The Research Council of Norway, Oslo July 2005. Published on the homepage of the Research Council 18 August 2005[1]
6. Midway evaluation of the Centres of Excellence. *The evaluation process*. The Research Council of Norway, January 2006[1]
7. Midway evaluation of the Centres of Excellence. *Guidelines for the preparation of evaluation documents*. The Research Council of Norway, January 2006[1]
8. Annual reports for the centres for 2003, 2004 and 2005[2]
9. Templates for fact sheet, self-evaluation, host institution assessment, plan for second five-year period and experts' appraisal form prepared by the Research Council of Norway[2]

Contracts

10. Contracts between the Research Council and the host institution of each centre, including project descriptions and budgets[3]

Documents prepared by the centres and their host institutions

11. Midway evaluation of the Centres of Excellence. A. *Fact sheet*[3]
12. Midway evaluation of the Centres of Excellence. B. *Self-evaluation*[3]
13. Midway evaluation of the Centres of Excellence. C. *Host institution assessment*[3]
14. Midway evaluation of the Centres of Excellence. D. *Plan for second five-year period*[3]

Experts' appraisal

15. Midway evaluation of the Centres of Excellence. Assessment of each centre made by three international experts[3]

[1]Documents distributed to the Committee members in the printed form
[2]Documents only available on the homepage of the Research Council of Norway
[3]Documents only available to the Committee members and the Research Council. Distributed in the printed form.

Attachment 3 – Program for the Centre hearings

Oslo meeting: Time line for the meeting of the Evaluation Committee

Monday 23 October 2006

Centre	Time	Program	Comments
-	0900 - 1000	Committee meeting	
PRIO: Centre for the Study of Civil War	1000 - 1040	Centre hearing and discussions[1]	Center leader Scott Gates, Martha Snodgrass, Centre Chief Administrator
	1040 - 1100	Committee discussions[1]	
-	1100 - 1110	Coffee break	
NGI: International Centre for Geohazards	1110 - 1150	Centre hearing and discussions	Center leader Farrokh Nadim, Anders Solheim and Suzanne Lacasse
	1150 - 1210	Committee discussions	
University of Life Sciences: Aquaculture Protein Centre	1210 - 1250	Centre hearing and discussions	Center leader Trond Storebakken, Åshild Krogdahl and Knut Hove
	1250 - 1310	Committee discussions	
-	1310 - 1400	Lunch	
NTNU: Centre for the Biology of Memory	1400 - 1440	Centre hearing and discussions	Center leader Edvard Moser, May Britt Moser and Scientific advisor Ruth Hagen Rødde
	1440 - 1500	Committee discussions	
NTNU: Centre for the Quantification of Quality of Service	1500 - 1540	Centre hearing and discussions	Center leader Peder J. Emstad (1.12.02-30.9.06), Center leader Svein J. Knapskog (1.10.06-), Ruth Hagen Rødde, Scientific advisor
	1540 - 1600	Committee discussions	
-	1600 - 1610	Coffee break	
NTNU: Ship and Ocean Structures	1610 - 1650	Centre hearing and discussions	Center leader Torgeir Moan and Professor Odd Faltinsen, Scientific advisor Ruth Hagen Rødde
	1650 - 1720	Host institution hearing and discussions	Prorektor Astrid Lægreid and Scientific advisor Ruth Hagen Rødde
	1720 -	Committee discussions	
-	1930 -	Dinner	

[1]The hearings will start with a SWOT-analysis presented by the centre (20 min), followed by a discussion between the centre representatives and the committee members (20 min). After each hearing the committee members will gather for 20 min of discussion. Total time reserved per centre: 60 min

Tuesday 24 October 2006

Centre	Time	Program	Comments
University of Oslo: Centre for Molecular Biology and Neuroscience	0900 - 0940	Centre hearing and discussions	Center leader Ole Petter Ottersen, professor Tone Tønjum and forskningsdekan Ole M. Sejersted
	0940 - 1000	Committee discussions	
University of Oslo: Mathe-matics for Applications	1000 - 1040	Centre hearing and discussions	Center leader Ragnar Winther, seniorrådgiver Helge Galdal and forskningsdekan Anders Elverhøi
	1040 - 1100	Committee discussions	
-	1100 - 1110	Coffee break	
University of Oslo: Physics of Geological Processes	1110 - 1150	Centre hearing and discussions	Center leader Bjørn Jamtveit, professor Anders Malthe-Sørensen and forskningsdekan Anders Elverhøi
	1150 - 1220	Host institution hearing and discussions	Prorektor Haakon Breien Benestad, forskningsdekan Ole M. Sejersted and forskningsdekan Anders Elverhøi
	1220 - 1240	Committee discussions	
	1240 - 1330	Lunch	
University of Tromsø: Centre for Advan-ced Study in Linguistics	1330 - 1410	Centre hearing and discussions	Center leader Curt Rice, Styreleder Kirsti Koch Christensen and representanten til styre for senior forskere Peter Svenonius and (beskjed 6/06)
	1410 - 1430	Committee discussions	
University of Bergen: Centre for Medieval Studies	1430 - 1510	Centre hearing and discussions	Center leader Sverre Bagge, Kirsten Moen and forskningsdirektør Kristen Haugland fra UiB
	1510 - 1530	Committee discussions	
	1530 – 1540	Coffee break	
University of Bergen: Centre for Integrated Petroleum Research	1540 - 1620	Centre hearing and discussions	Center leader Arne Skauge, Prof. Magne Espedal and Dr. Kristine Spildo (
	1620 - 1650	Host institution hearing and discussions	Forskningsdirektør Kristen Haugland, UiB, dekanus MNfak Hans Petter Sejrup
	1650 -	Committee discussions	
-	1930	Dinner	

Wednesday 25 October 2006

Centre	Time	Program	Comments
University of Bergen: Bjerknes Centre for Climate Research	0900 - 0940	Centre hearing and discussions	Center leader Eystein Jansen and Helge Drange
	0940 - 1000	Committee discussions	
-	1000 - 1050	Committee discussions. Drafting of report	
-	1050 - 1100	Coffee break	
-	1100 - 1300	Committee discussions. Drafting of report	
-	1300 - 1400	Lunch	
-	1400 - 1430	Departure for Gardermoen Airport	