

Midterm Evaluation of Thirteen Centres of Excellence (SFF-III)

Evaluation
Division for Science



**Norwegian
Centres of
Excellence**

Midterm evaluation of Thirteen Centres of Excellence (SFF-III)

Norwegian Centres of Excellence (SFF)

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The report can be downloaded at
www.forskingsradet.no/publikasjoner

Oslo, October 2017

ISBN 978-82-12-03643-7 (pdf)

1 Contents

2	Executive Summary	4
3	Introduction.....	5
4	Terms of Reference for the Midterm Evaluation	5
5	The Evaluation Process.....	5
6	The Evaluation Committees for the SFF-III Centres	6
7	Individual Centre Reports.....	8
7.1	Norwegian Centre for Mental Disorders Research (NORMENT).....	8
7.2	Center for Multilingualism in Society across the Lifespan (MultiLing).....	11
7.3	Centre for the Study of the Legitimate Roles of the Judiciary in the Global Order (PluriCourts)	15
7.4	Centre for Earth Evolution and Dynamics (CEED)	19
7.5	Centre for Environmental Radioactivity (CERAD).....	23
7.6	Birkeland Centre for Space Science (BCSS)	26
7.7	Centre for Intervention Science in Maternal and Child Health (CISMAC).....	30
7.8	Centre for Cancer Biomarkers (CCBIO).....	35
7.9	Centre for Arctic Gas Hydrate, Environment and Climate (CAGE)	38
7.10	Centre for Molecular Inflammation Research (CEMIR).....	41
7.11	Centre for Autonomous Marine Operations and Systems (AMOS)	44
7.12	Centre for Biodiversity Dynamics (CBD).....	48
7.13	Centre for Neural Computation (CNC)	52
8	The Evaluation Committees' Conclusion.....	55
9	Observations and Recommendations from the Generalists	55
9.1	Observations Regarding the Centres.....	55
9.2	General Recommendations to the Centres.....	55
9.3	General Recommendations to the Host Universities.....	56
9.4	Comments on the SFF Funding Scheme	57
10	Signatures	58
11	Attachment 1: SFF-III Centre Names, Alphabetical by Acronym.....	59
12	Attachment 2: Mid-term Evaluation of SFF-III: Terms of Reference.....	60

2 Executive Summary

The Centre of Excellence (CoE) scheme gives Norway's best scientists the opportunity to organise their research in centres in order to reach ambitious scientific goals. The aim is that the centres should generate ground-breaking results that advance the international research frontier. The CoE scheme has so far funded three generations of centres and a fourth generation is starting up in 2017.

Each centre receives funding for a period of 10 years, contingent on a positive midterm evaluation. The first generation of centres was evaluated in 2006 and the second in 2011. This report describes the evaluation of the thirteen CoEs that constitute the third generation. The purpose of the midterm evaluation is to assess the scientific quality and performance of the individual centres in absolute terms and relative to the centres' research plans. The evaluation will form the basis for the decision of the Research Council of Norway (RCN) as to whether the funding and status as SFF of individual centres are to be continued for an entire 10-year period, or will be ended after 5 years.

The midterm evaluation has been carried out in accordance with the Terms of Reference established by the RCN. The present report sums up the considerations and conclusions of the thirteen evaluation committees. The overall assessment of the different CoEs was based on their research achievements, the research plans for the next five-year period, and the organisation and leadership of the CoE.

Overall, the performance of the centres was impressive. A considerable quantity of research at the forefront of international knowledge boundaries is being undertaken and the centres are well recognised both nationally and internationally. All centres have published in field-specific top journals and many in top multidisciplinary journals such as Nature and Science.

The centre directors and many key scientists in the centres are internationally well known. In addition, the centres have attracted world class scientists from abroad, and their contribution is essential to both research and supervision of students. The centres attract highly talented students and postdocs and provide excellent training environments. Also, several centres should be commended for their research schools.

In general, the committees stress the importance of a strong scientific vision and clear strategic focus. Strong and dynamic leadership in terms of prioritising the most promising directions of the research and defining new territories of research is essential for the success of a centre. Another important factor is that mid-career researchers, PhDs and postdoctoral fellows are given sufficient time for research as well as good mentoring and training. It is also crucial that retirement of centre directors and key scientific personnel is planned early.

For the legacy of the centre it is important that the centre and the host institution have a clear exit strategy developed well in advance of the end of the centre period. The host institution should plan for taking care of the most successful scientists of the CoE and their competence.

The conclusion of the evaluation process is that most centres are evaluated as "Exceptional" and a few as "Very good" or "Very good to exceptional". Whereas all centres get top score on scientific quality, for some centres there are a few concerns regarding organisation. The committee therefore recommends that the decision on continued funding of four centres is postponed and made contingent on approval of a report that addresses the committee's main concerns. The conclusion for the nine other CoEs is that funding should be unconditionally continued.

3 Introduction

The SFF funding scheme was established in 2001 and gives Norway's best scientists the opportunity to organise their activities in centres that seek to achieve ambitious scientific objectives through collaboration and long-term basic funding. The ambition is to raise the quality of Norwegian research and bring more researchers and research groups up to excellent international standards. The scheme is open to 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 RCN and funded by the Ministry of Education and Research.

The thirteen centres of the third generation of CoEs (SFF-III) were selected after a call for proposals in 2011. The centre applications were evaluated and selected in a two-phase process and the new centres started their activities in 2013 (see attachment 1 for centre names). The SFF scheme requires that each of the centres be evaluated under the auspices of the RCN after approximately 3 ½ years.

The primary objective of the midterm evaluation is to reach a decision regarding whether to continue the individual centre's SFF funding and status for the remainder of the 10-year period or to terminate after five years. This was stated in the 2011 call and in the SFF-III contract between the RCN and each centre's host institution. The evaluation report provides the basis for the RCN's decision.

4 Terms of Reference for the Midterm Evaluation

The Terms of Reference for the midterm evaluation of the thirteen centres were finalised and approved by the RCN in February 2016. They provide the framework for the evaluation and mandate for the evaluation committees. The document giving the Terms of Reference is presented in attachment 2.

5 The Evaluation Process

The midterm evaluation has been carried out in accordance with the procedures set forth in the Terms of Reference (Midterm Evaluation of SFF-III: Terms of Reference, February 2016).

An evaluation committee with four members was appointed specifically for each centre. Two members were specialists in the research fields of the centre and two members were generalists, professors with broad experience in research management. The generalists evaluated several centres in order to compare them.

The centres provided the background material (defined in attachment 2 of the Terms of Reference) and these documents were sent to the centre's evaluation committee prior to the site visits.

The site visits took place over three weeks in May and June of 2017. During the one-day site visits, the committee members met with the centre leader and centre employees as well as representatives of the host institution. All site visits had one session where the committee had a private discussion with the PhDs and postdocs of the centre. The RCN suggested an agenda for the site visits in order for the presentations to focus on the evaluation criteria. During the site visit the committee asked questions, sought clarifications and discussed with the centre employees.

Based on the background material and the information from the site visit, the evaluation committee wrote its midterm evaluation report for the centre. The report comments on how well the centre meets the midterm evaluation criteria as described in the Terms of Reference. The midterm evaluation report also contains a list of concrete recommendations for the centre and assigns the centre one of five grades: weak, fair, good, very good or exceptional. The committee ends its report with a conclusion. The conclusion for each centre states whether it is the evaluation committee's opinion that the individual centre should receive continued funding, whether the decision should be postponed, or the funding should be terminated after 5 years.

The evaluation reports were sent to the centre directors and host institutions for fact-check. Five centres replied, and their comments were presented to the evaluation committees, which in all cases agreed and corrected their text.

Based on the individual midterm evaluation reports for each centre, the RCN will make the final decision on the midterm evaluation outcome for each centre.

6 The Evaluation Committees for the SFF-III Centres

The evaluation committee for each centre consisted of two specialists in the centre's field of research and two generalists that visited several centres. The committee members were appointed by the RCN and were as follows:

Committee member	Affiliation	Centres evaluated
Prof. Yvonne Rydin	University College London, UK	Norment, MultiLing, CERAD, Pluricourts, CEED, CAGE, CEMIR, AMOS, CBD, CNC
Prof. Evamarie Hey-Hawkins	Leipzig University, Leipzig, Germany	Norment, MultiLing, CERAD, CEED, Pluricourts
Prof., Director of Science Thomas Sinkjær	Villum Fonden, Denmark	Birkeland, CISMAC, CCBio, AMOS, CBD
Prof. Søren-Peter Olesen	Danish National Research Foundation, Denmark	Birkeland, CNC
Prof. Klaus Bock	European Research Council	CCBio, CEMIR
Prof. Paul Kaufman	University of Massachusetts Medical School, Worcester, USA	CISMAC, Birkeland*
Prof. Bart de Moor	KU Leuven, Belgium	CAGE
Prof. emer. Hans Ågren	University of Gothenburg, Sweden	Norment
Prof. Peter Falkai	Ludwig-Maximilians-University Munich, Germany	Norment

Prof. Marilyn Martin-Jones	University of Birmingham, UK	MultiLing
Prof. Margaret Deuchar	University of Cambridge, UK	MultiLing
Prof. Sisko Salomaa	University of Eastern Finland, Finland	CERAD
Prof. David Fowler	Centre for Ecology and Hydrology, UK	CERAD
Prof. Richard Gordon	Rice University, USA	CEED
Senior lecturer Dr. Ian Bastow	Imperial College London, UK	CEED
Prof. Yuval Shany	Hebrew University of Jerusalem, Israel	PluriCourts
Prof. emer. Ernst-Ulrich Petersmann	European University Institute, Italy	PluriCourts
Prof. Joseph Dwyer	University of New Hampshire, USA	Birkeland
Dr. Norbert Jakowski	German Aerospace Center (DLR), Germany	Birkeland
Prof. emer. Wendy Graham	University of Aberdeen, UK	CISMAC
Prof. Lars Åke Persson	London School of Hygiene & Tropical Medicine, UK	CISMAC
Prof. Caj Haglund	University of Helsinki, Finland	CCBio
Prof. Nils Brunner	University of Copenhagen, Denmark	CCBio
Prof. Ian P. Owens	Imperial College London, UK	CBD
Prof. Corey Bradshaw	Flinders University, Australia	CBD
Prof. Wolf-Christian Dullo	GEOMAR Helmholtz Centre for Ocean Research Kiel, Germany	CAGE
Prof. Gert de Lange	Utrecht University, the Netherlands	CAGE
Research leader Dr. Felix Randow	MRC Laboratory of Molecular Biology, UK	CEMIR
Prof. Ian Adcock	Imperial College London, UK	CEMIR
Prof. Bo Wahlberg	KTH, Sweden	AMOS
Prof. Pierre Ferrant	Ecole Centrale Nantes, France	AMOS
Prof. Michael Hausser	University College London, UK	CNC
Dr. Bruno Poucet	LNC - Aix-Marseille Université, France	CNC

*attended this site visit as an observer

7 Individual Centre Reports

7.1 Norwegian Centre for Mental Disorders Research (NORMENT)

7.1.1 Scientific output

The key aims of the project initially were (1) to identify genetic variants predisposing for schizophrenia and bipolar disorder, (2) to elucidate new targets for antipsychotic treatment, (3) to identify brain imaging phenotypes linking genes with clinical phenotypes, and (4) to predict clinical trajectories. The research output in the past 5 years fulfils the above aims, but has added several new areas.

Interesting new areas include stem cell research, using skin fibroblasts from patients and healthy controls, transforming them into lines of pluripotent stem cells (iPSC) and neuronal stem cells (NSC). Planned research on immunology and inflammatory events in the brain will involve these iPSC and NSC lines. The research group has also been involved in discoveries of new common gene variants associated with schizophrenia and bipolar disorder from GWAS studies in large cohorts. Together with other international centres they have had access to a large number of patients and controls. Breakthrough findings are for example the 108 gene variants being associated with schizophrenia, published in Nature (2016). Additionally, the group discovered very rare variants in cognitive disorders (also published in Nature). In addition, they developed novel statistical tools including LD-based analysis, annotation enrichment, and pleiotropy enrichment, and applied them to psychiatric disorders. In clinical samples, immune abnormalities have been detected (expression patterns) and biological mechanisms have been disentangled (for example mechanisms of the ANK3 gene in bipolar disorder). Another focus was the investigation of antipsychotic side effects and associated lipid metabolism.

Using MRI-based neuroimaging in large cohorts of patients with schizophrenia and bipolar disorder, effects of obstetric complications on structural abnormalities have been published. Another environmental factor was childhood trauma and its effect on age of onset and clinical characteristics of psychiatric disorders as well as its interaction with genes influencing hippocampus volume. NORMENT was one partner in the ENIGMA consortium, identifying novel genetic loci playing a role in variation of volume of brain regions (published in Nature). A cohort of patients with first-treatment schizophrenia and bipolar spectrum disorders has been established together with Norwegian colleagues from the NORSMI network with focus on function, cognition, and negative symptoms.

The published output from the last 3.5 years is broad, large, and of excellent quality. Since 2013, NORMENT has published 425 scientific articles (including 41 articles in journals with impact factors greater than 10 – such as Nature, Nature Genetics, Nature Neuroscience, JAMA Psychiatry, Biological Psychiatry, and Molecular Psychiatry). Main authorship (first or last author) by a NORMENT member was in 145 papers. Core researchers have received international funding, e.g. Hugdahl having received his 2nd grant from the European Research Council. Several prizes have been awarded to NORMENT members. The scientific quality is excellent.

7.1.2 Organisation

The scientific activities have benefited from the organisation of NORMENT as a centre. The centre is organised as a cross-disciplinary research centre providing added value of different basic infrastructure. In the core of the centre, infrastructure for patients' assessment, database and biobank service is provided. The management consists of eight core researchers with complementary expertise from different scientific fields. There has been a focus on working across work-units and on outputs with multiple authors from across the Centre, including different disciplines. Considerable effort has gone into building a collaborative culture oriented towards inventiveness; an example of this is the monthly Synergy meeting with minutes widely circulated. The management has been flexible in response to changing research needs. There has also been good collaboration between the sites in Oslo and Bergen. The research management has been effective, after initial problems were resolved. Gender balance is actively addressed. There is proactive planning for replacing staff about to retire.

The quality of the PhD programme is high with NORMENT-specific courses supplementing university programmes; the PhD students have a number of opportunities for interacting and building their capacities for cross-disciplinary research. There is also an emphasis on 'soft' skills. The number, quality and completion rate for PhDs is high. There is mentoring for young researchers, who are encouraged and supported to write grant proposals and engage in PhD supervision. There is very good interaction from faculty members with PhD students and postdocs.

The infrastructure allows for the participation in international collaborative projects, such as COGENT, ENIGMA, etc. Such collaboration is very strong with connections on data-sharing, analysis and paper-authoring. A range of partner institutions is actively involved. There is evidence of strong international interest in posts that become vacant within NORMENT. The international dimension is supported by the nature of the Scientific Advisory Committee, whose recommendations are actively implemented.

Administrative and technical support is of high quality. There is dedicated physical space but the success of NORMENT means that they are under pressure to find accommodation for all staff and facilities. The host institutions are supportive at present but it is important that this is maintained into the second phase and beyond if the legacy of NORMENT in bringing together and working across disciplines is to be maintained.

7.1.3 Future plans

The phase II project plan is ambitious but realistic, having seen the progress by the NORMENT group made in Phase I.

The researchers want to continue their seminal work on understanding the pathophysiology of schizophrenia and bipolar disorder focussing on the areas of "immune mechanisms" and "excitability". Furthermore better tools will be developed for clinical prediction and treatment outcome including new machine learning approaches for neuroimaging. Using these tools already available, but still growing large-scale longitudinal clinical cohorts will be investigated to predict disease progress and outcome. With respect to genetics the successful work from Phase I is continued, to assess rare, common and pleiotropic genetic variants. Functional and translational experiments will be conducted in large samples in the newly established Stem Cell Unit. Intervention studies with new substances especially relating to immune mechanisms will be implemented. Overall these approaches have the potential to achieve ground breaking results in the future, as have been

seen in project Phase I. Based on previous work in Phase I including the implementation of large patient cohorts, the work in Phase II seems to be feasible during the outlined funding period. The timescale and resources are necessary and properly justified.

Planning the future of the centre beyond 2023, the strategy outlined is successful and realistic, but could be more specific concerning resources needed, e.g. from the Universities and hospitals of Oslo and Bergen. The long term aim of NORMENT is to implement a research structure which may serve as database and biobank for researchers beyond this funding period until 2050.

7.1.4 Summary

NORMENT is an impressive centre of scientific excellence in psychiatry and neuroscience - well organised, extremely productive and offering proof of fruitful collaboration, both within the centre itself and between the centre and the international research community. NORMENT has come a very long way during the past 4 years, and will certainly increase its productivity in the next 5 years.

*Overall assessment: **Exceptional***

Recommendations

1. The host institution should recognise that NORMENT is at a pivotal time in consolidating its research activities and thus they need to prioritise the provision of physical facilities for the Centre, *inter alia* enabling the co-location of staff and research students.
2. The host institution should enable the NORMENT centre to continue with infrastructure (staff and facilities) of a sufficient critical mass to secure cross-disciplinary working beyond 2023, in order not to lose an international-leading resource on severe mental disorders.
3. There is already an implicit strategy for applying for grants but it would be helpful if this could be made more focussed and explicit.
4. The very fruitful field of stem cells should be continued with the selection of subjects for the studies guided by a hypothesis-driven framework. In addition, sufficient financial support should be secured for this important scientific method.
5. It would be recommended to have a public event, possibly annual, for the interested citizen informing about the important achievements of NORMENT.

Conclusion

The midterm evaluation committee recommends continued funding of NORMENT.

7.2 Center for Multilingualism in Society across the Lifespan (MultiLing)

7.2.1 Scientific outputs

There is ample evidence from the first research phase of the Centre for Multilingualism in Society across the Lifespan (MultiLing) that the Centre of Excellence funding strategy can generate innovation, synergy and research of international excellence. This is possible when, as in this case, the researchers involved have a sound understanding of the epistemological shifts taking place in their field and a clear vision of how they can advance knowledge-building. We live in times of intense social and cultural change. Contemporary mobilities, the creation of new diaspora, the advent of myriad new forms of communication, greater transnational connectedness and the far-reaching change taking place in the political and economic landscape of the world have all had a significant impact on the ways in which the relationship between language and society is conceptualised and researched. Multilingualism has also come to have a new prominence across the social sciences.

As researchers in applied linguistics and sociolinguistics have turned their attention to the multilingual realities of the late modern era, they have also begun to adjust their research lenses, reconsider their research methodologies and embrace greater multi- and inter-disciplinary research. New conceptual compasses and new lines of investigation are being forged, so as to take account of the particular social and cultural condition of our times. New lines of investigation are clearly visible in research being developed in the MultiLing Centre and in their research-related activities and significant new contributions are being made to international research on multilingualism. Moreover, the lifespan focus for the work being undertaken in the Centre – and the shared focus on becoming, acting and remaining multilingual - represents a major strength. It provides a means of addressing the challenges posed to established models of multilingualism by contemporary mobilities and diaspora.

The research being conducted at the MultiLing Centre is definitely at the cutting-edge of fields such as family language policy, language acquisition and the development of linguistic repertoires across the lifespan (including aphasia and dementia), multilingual practices (face-to-face and online), in local life worlds and in institutional settings (e.g. in education, health, workplaces and the law), language ideologies, language policies and language standardization, and language and semiosis in the public sphere (e.g. the study of linguistic landscapes). This research, much of it sparked by the groundbreaking publications of the Director previous to the Centre's existence, is also at the forefront of new intellectual movements and lines of theory-building in these different fields. The sheer range of research is also impressive and across this range, a significant portfolio of high quality publications has been built up during the first phase of the Centre's work. The level of excellence is demonstrated by the impact ranking of the journals in which publications have appeared and the prestige of the publishing outlets for different volumes.

The absence of any publications relating to research methodology was however noted, especially since Colloquium 2 (2014-2016) provided a forum for extensive discussion of such issues. Moreover, there has been considerable investment of time in research training and, presumably, in the planning, preparation and evaluation of the summer and winter schools. In addition, there has been an emphasis on interdisciplinarity. Perhaps, as they move into the next phase, the researchers based in the MultiLing Centre could consider publishing on aspects of research methodology (including

transcription, for example). There would be certainly be a good deal of international interest in this kind of research output. A veritable industry of social science output on research methodology has developed over the last few years – ranging from textbooks to innovative edited collections on particular dimensions of the research process. This surge in output has come in the wake of the epistemological shifts (mentioned above) that take account of the social and cultural conditions of the global era. In applied linguistics and sociolinguistics, these shifts constitute responses to the far-reaching changes that are taking place in the organisational dynamics of language use, due to contemporary mobilities and the advent of myriad new forms of mediated communication and the spread of English as an academic lingua franca. The MultiLing Centre is well placed to make an original contribution to this growing literature on research methodology.

7.2.2 Organisation

The present organisation has generated considerable research synergy and innovation and has also facilitated the production of a rich range of different kinds of research outputs. It has provided excellent support for research, particularly research by new researchers. MultiLing has a strong research leadership thanks to the talents of the Director, the Deputy Director and the Theme Leaders. The Director is to be particularly credited for her drive and creativity in establishing the centre in the first place, and for her skills in recruitment of promising colleagues. Her leadership is based on a vision and on a broad understanding of where and how world-leading research is being conducted in applied linguistics, psycholinguistics and sociolinguistics. Strategic use is also being made of international networks (e.g. INTPART). In addition, there is evidence of an openness to organisational change and genuine dialogue within the management team and with members of the Scientific Advisory Board. More recently, open dialogue within the Centre among all researchers has been established with open meetings; this is to be welcomed and is important to maintain.

Hitherto, the research organisation has been built on three main, partly inter-related Themes that are coordinated by a Theme Leader. There have been ample opportunities for interaction between researchers through the Colloquia and through ongoing seminars, visiting lectures, research training in summer, winter and spring schools and through diverse research dissemination and knowledge-exchange activities.

Extensive knowledge exchange has taken place through collaboration with national bodies (e.g. Statped, Språkrådet and FAFO). Furthermore, MultiLing has an excellent international network, extensive international research cooperation and resources to attract distinguished international scholars (e.g. the annual Einar Haugen lecture), thus increasing the visibility of the Centre.

The Centre has attracted excellent, talented researchers at all levels - doctoral, postdoctoral, established researchers (Professor II) and distinguished international scholars - as evidenced by the number of publications in excellent journals and books or book contributions.

There is support for doctoral students (e.g. co-supervision by both an internal and an external supervisor) and training (summer/winter schools) as well as the opportunity for research stays at a collaborating institution. However, there was concern that the existing Faculty training provision was not fully appropriate for the MultiLing doctoral students in terms of a tailored training programme and a consistent culture of frequent and regular contact and supervision. Career development of postdoctoral fellows is in place, e.g. a MultiLing-based mentoring programme. The excellent qualifications of postdoctoral research fellows is shown by the fact that the first five postdoctoral fellows appointed to the Centre have already been offered and taken up permanent positions at prestigious institutions.

The outreach and dissemination work of the MultiLing Centre is exemplary (e.g. the exhibition at the Oslo City Museum, the *Language Lounge* events, and the *Secret Language* film). The high number of media appearances is extremely impressive.

There is support from the Department of Linguistics and Scandinavian Languages, the Faculty of Humanities and the University of Oslo with respect to positions, space, and administration. In addition, there have been strategic initiatives such as the identification of the Centre as one of five research centres having the capacity to develop world-leading research communities. These initiatives have been crucial and are a significant element in the success of the Centre. However, greater attention should be paid to succession planning in the light of anticipated retirements.

7.2.3 Plans

At present, the same three research questions are still to be addressed. These questions remain relevant and ambitious, but one might expect them to be somewhat reformulated as a result of research already conducted. For example, results to date might have led to a narrowing of the focus of the questions, or to an orientation to theoretical contributions of the research. Currently the questions focus on descriptions of ‘what’ and ‘how’, but many of the centre outputs show that their results go beyond description to theoretical contributions. For example, during the site visit a researcher working on Theme 1 explained that the group’s research had produced evidence in favour of usage-based approaches to multilingual acquisition in contrast to those within a generative paradigm.

MultiLing has secured funding already for a number of “Flagship projects” (2015-2021) that echo the three themes and their ambition to seek further funding to ensure their continuation beyond 2018 is to be applauded. The projects linked to the new Research Professors will also resonate with the existing research themes. Theme 1 will no doubt be further developed through the establishment of the socio-cognitive lab. However, the overall coherence of the various projects needs to be clarified.

The section in the submitted self-evaluation report on “planned strategic initiatives/dimensions of research (2018-2023)” is presumably an important part for the continued centre funding. Enhanced focus on education, technology and Norway’s societal diversity is planned, but this is described more in terms of content and personnel than research questions and methodology. Taking into account the above points, we recommend the development of a new plan for the last five years of the centre. (See recommendations below).

7.2.4 Summary

MultiLing is an outstanding research centre, which has high international visibility and which is definitely producing research of international excellence. It is based on a clear vision and a profound understanding of the epistemological shifts taking place in the field of multilingualism in the wake of globalisation. The vision is underpinned by the impressive leadership of the current Director. In addition, the work on outreach, dissemination and knowledge exchange has been exemplary. The support from the host institution has also been of considerable significance. Moreover, there is real potential for the research in the second phase to be taken to a new level of international excellence. However, there is a need for a more strategic approach to be adopted as the Centre enters its second phase, as plans are made for the retirement of the Director and as clear steps are put in place for the Centre’s legacy.

Overall assessment: The scientific quality is exceptional and the centre organisation is very good.

General recommendations

1. Publications on research methodology linked to the Centre's research could well be developed as this is clearly an area of strength.
2. Consideration should be given to developing a specific doctoral training programme for research students within MultiLing that provides more tailored support for young researchers. The Centre might like to have regard to best practice in other countries such as: <http://www.esrc.ac.uk/skills-andcareers/studentships/doctoral-training-centres/postgraduate-training-guidelines/>.
3. There is a need to ensure greater consistency of supervision practice across the Centre and to review the current arrangements for supervision.
4. A clearer strategy for ensuring the legacy of MultiLing also needs to be put in place, going beyond educational proposals and securing the research capacity that has been built up during the CoE funding.
5. Given that the existing Director will retire during Phase II, it is advisable for planning to begin now for a phased replacement.
6. The centre should also prepare for the future retirement of Theme 1 Leader.

Main recommendation regarding the Research Strategy for Phase II

7. There is a strong need for a more strategic approach to be taken to the direction of research in Phase II, building on the very effective garnering of research ideas that has occurred in Phase I. Some steps have already been taken towards this but it is of paramount importance that a new Research Strategy be developed for the next five years. This should cover specific research questions and, for each research project and each subproject, a clearer overall framework within which individual projects can be situated. It should propose a structured and pro-active approach to research grant applications by core researchers. The new strategy should be consulted on within the centre with input from the Scientific Advisory Board and agreed by the Extended Leadership Team. It should be a matter of public record once agreed.

Conclusion

Based on the generalists' comparison of several centres, their conclusion is that this centre, within 6 months, must present a report with a strategy to follow up the main recommendation. This report will be assessed before the final conclusion is reached.

7.3 Centre for the Study of the Legitimate Roles of the Judiciary in the Global Order (PluriCourts)

7.3.1 Scientific output

The scientific output of PluriCourts is impressive. There have been many international conferences and a high number of publications, most of which are with excellent publishers. While the books published so far have been mostly collections of essays – having the advantage of incorporating the work of international experts in PluriCourts’ projects - there is an interest in increasing the number of more focused research manuscripts. One great advantage of PluriCourts has been the ability to generate truly inter-disciplinary scholarship at an excellent level – mostly, in law, political science and philosophy - and to apply it to 5 different research themes. This has already led to exciting research projects, such as those dealing with multi-level judicial remedies, challenges to legitimacy of investment courts, the inter-play between court positions and state-preferences, and reasons for under-representation of women sitting on international courts.

The Committee was impressed very much with the databases created in the first half of the project, which will provide researchers in the field with a very useful research tool. The Committee noted with satisfaction other planned and ongoing research initiatives which will similarly generate broadly available resources (although it is not clear whether the existing on-line infrastructure can adequately support them).

Another positive aspect has been the fact that the work of PluriCourts has enjoyed extensive and intensive collaboration from top-notch experts in relevant fields from around the world, and from iCourts (the parallel Danish international courts research centre), and has been instrumental in assembling in Oslo a very talented and highly-motivated group of advanced degree students and postdoctoral fellows. As expounded on below, the strong international research environment created in PluriCourts positively influences the training of junior researchers, and strengthens the international and research profile of the Faculty of Law and the University of Oslo.

Members of the Committee did have a few concerns about certain gaps in the research agenda followed up until now (e.g., not dealing directly with the ICJ and CJEU), with the limited interaction between the different pillars of the program and about the overall coherence and policy impact of the research agenda. Fortunately, most of these issues are satisfactorily addressed in the plans for PluriCourts 2.0 (see below), although some issues of interaction and coherence may return to the forefront after the end of PluriCourts, when a specific organizational framework is no longer available.

Other issues that can be improved in the second half of the project are the attainment of outside research grants (though the centre’s leadership is very minded to it) and greater accessibility of the centre’s activities and research to students in the University, to researchers and students in other Norwegian Universities and to policy makers.

7.3.2 Organisation

There is strong centre direction currently from the Co-Directors, which looks highly likely to continue after Prof. Ulfstein’s retirement in 2021. There are regular meetings with the coordinators of the different pillars and advisory input from an International Scientific Advisory Committee. Open meetings with all the Centre’s researchers are held weekly and, in addition, there are ample opportunities for scholarly engagement within the Centre through reading seminars and research

workshops/seminars. The efforts made at the start of the Centre have resulted in a collaborative culture within the Centre and what was described as an “open door” atmosphere. The administrative and technical support also appears to be excellent.

There are relatively few PhD students in the Centre relative to the number of staff. Where they are appointed across departments, their research training is shared; given the small numbers, there is no dedicated PluriCourts training programme for PhD students. However, they do engage in a joint summer school run with iCourts in Denmark, in PluriCourts training seminars and in courses run at other universities overseas.

There is a much larger number of postdoctoral fellows. These have a dedicated mentoring scheme and core curriculum, and there is evidence of a strong culture promoting their career development in a variety of ways. One fellow spoke of how confidence was boosted by their involvement in the Centre. While postdoctoral fellowships are planned to be for three years (a distinct competitive advantage), the Centre operates with flexibility on this point. The Centre does face problems with regard to administrative delays in processing and deciding on fellowship applications, arising from the University level. Postdoctoral fellows also reported problems with fulfilling their contractual requirements for teaching (at 10%) given the Fellows’ legal background and language skills, the use of research students for teaching and their situation outside of the main departmental structures; the Centre Directors reported awareness of this problem at Faculty level. It is unfortunate that some of the best postdoctoral fellows within PluriCourts may find it difficult to get a faculty position in Norway given the current norms on appointing within Departments of Law regarding existing language skills and professional qualification in Norwegian Law.

International mobility among young researchers is encouraged and financially supported. In addition, there are strong international links (through individual researchers rather than institutional agreements) and a series of visits by international scholars, including under the Fulbright Fellowship scheme. There are also strong connections to legal practice and policy organisations.

The current space and facilities for the Centre are excellent (although it took some time for these to be established). However, there are concerns about the move to a new building. The loss of cellular office space for all Centre researchers and high quality common rooms would seriously impact on the Centre’s competitiveness when attracting staff and researchers.

The Evaluation Committee further welcomed the exceptionally high degree of gender balance realized so far in the PluriCourts project.

7.3.3 Future Plans

The proposed research plans for the second 5-year period have been presented and discussed with the Evaluation Committee members in great detail. The proposed focus on more systematic comparisons and the existing in-house legal expertise justify the proposed extension from previously five areas of international adjudication (in human rights law, trade law, investment law, criminal law and environmental law) to three additional areas (ICJ, ITLOS, EU law). The additional focus on exploiting the existing multidisciplinary strengths (law, political science, philosophy) is likely to achieve ground-breaking publications comparing and integrating the – so far too fragmented – research on these eight areas of international adjudication. By identifying the particular contextual challenges of each area and elaborating their common legal and political challenges, the future research will enable new and important policy recommendations.

Based on the exceptionally successful scientific quality and centre organisation during the first 5-year period, the slightly revised, enlarged and refined scientific approach for the second period seems

convincing and feasible. The proposed implementation plan and demanded resources appear justified and necessary.

The broadening of the research convincingly responds to the new areas of concerns expressed by governments, such as proposals by the UK government to withdraw from the jurisdictions of the European Court of Justice and of the European Court of Human Rights, refusal by China to comply with the arbitration award recently rendered under the UN Convention on the Law of the Sea, or the EU proposal to transform investor-state arbitration into a new international court system. The PluriCourts objective of drawing policy recommendations from the comparative studies cannot be achieved without including the three additional sectors (ICJ, ITLOS, EU law) and without comparing and evaluating the diverse, legal and judicial methodologies applied by courts in these eight sectors.

The proposed re-structuring of the previously five research topics has been convincingly explained: As the 'legitimacy standards' advocated by international courts in these 8 sectors differ, it is convincing to now start with their comparison (new RT1). The multilevel allocation and separation of judicial authority (new RT2) has evolved into one of the most controversial problems in the 'Brexit' discussions and EU reform initiatives (e.g. EU accession to the European Convention on Human Rights). Furthermore, the proposed 'global public goods' methodology is promising in order to explore and compare the context-specific 'collective action problems' of different international courts more comprehensively. Similarly, the proposed focus on person-centred subsidiarity is very topical and justified in view of the civil society criticism of investor-state arbitration. Also, the proposed research on the transformation of the state-centred nature of international dispute settlement and on promotion of person-centred paradigms of transnational adjudication are highly topical and justified by recent developments. Given the extended sabbatical of Prof. Voigt, there is a question concerning the environmental law competences in the second phase.

The Evaluation Committee appreciated the large number of very good plans for preparing and submitting proposals to Horizon 2020 (in particular ERC) or other international funding schemes appropriate in this field of research. The recent appointment of Prof. Freya Baetens as the coordinator of the trade pillar of the PluriCourts project has already led to very convincing, new research initiatives that compensate the smaller number of publications in this field (notably in 2016).

As the research area of multilevel judicial governance of transnational public goods is becoming legally and politically ever more important and deserves to be further explored also after the end of the second 5-years period, the Evaluation Committee welcomed the assurances from both the Dean of the Law Faculty of Oslo University as well as from the PluriCourts Directors that the proposed 'exit strategy' will ensure continued research and teaching inside the Law Faculty on the 'PluriCourts subjects' beyond 2023 (e.g. in terms of PhD courses and specialized workshops on international adjudication, moot court procedures, 'legal clinic' case-studies). However, there remains some uncertainty about the specifics of the exit strategy and in particular about the new equilibrium that would be struck between teaching and research in the field and how the high standards of research achieved by PluriCourts will be maintained.

7.3.4 Summary

This is a unique and outstanding Centre of Excellence. Its political significance is bound to increase in the coming years with the increasing number of international courts and of international jurisprudence aimed at protecting international rule of law and other international public goods.

The centre's organisation and management structure are excellent, facilitating top-level research outcomes as well as attractive learning and superb career opportunities for the postdoctoral fellows as well as the PhD students. The impressive publications of PluriCourts' researchers are innovative and almost always of excellent quality.

PluriCourts is extremely well connected with high-level researchers worldwide, and also collaborates with related research centres. The interdisciplinary research with a focus on important legal, political or philosophical research questions has led the CoE to embrace an impressive variety of research dimensions and related methodologies as well as practical problems of multilevel judicial governance in almost all fields of international law and governance.

PluriCourts has a clear research vision and strategy for the next five years. The present support by the Faculty of Law and the Department of Public and International Law is highly appreciated, but needs to be continued during the second phase and beyond to ensure a successful continuation of the excellent, ambitious and important research and training that has been established by PluriCourts.

Overall assessment: **Exceptional**

Recommendations

1. The Centre should continue and expand its efforts to obtain support for its research activities through submission of grant applications and further research collaborations.
2. The research outputs should be diversified with a view to increasing the number of focused monographs, which will make a concrete theoretical contribution to the field.
3. While an increased emphasis on teaching international courts is generally commendable, this must not come at the expense of maintaining the high standards of research achieved by PluriCourts.
4. With regard to the publicly-available databases, their continuation, expansion, updating and technological development is strongly encouraged.
5. The postdoctoral fellows should be facilitated to engage in more teaching (up to 10%).
6. The Centre requires comparable space and facilities in the new building to its existing space; this would involve cellular space and common rooms.
7. The speed of recruitment for Centre staff needs to be increased to avoid loss of the best quality applicants.
8. The Centre requires a website that is fit for purpose.

Conclusion

The midterm evaluation committee recommends continued funding of PluriCourts.

7.4 Centre for Earth Evolution and Dynamics (CEED)

7.4.1 Scientific output

The Centre for Earth Evolution and Dynamics (CEED), University of Oslo, has assembled a world-renowned group of researchers, whose central focus is the study of the relationship of deep Earth processes to the largest volcanic eruptions to have taken place on Earth over the past billion years or so (so-called large igneous provinces, LIPs). CEED pays particular attention to the origins of this volcanism, specifically whether it is due to upwelling that originates from the core-mantle boundary, ≈ 2900 km below Earth's surface. CEED also focuses on the environmental impact of large igneous provinces, which have sometimes resulted in the extinction of much of life on Earth (so-called mass extinction events). CEED is thus addressing first order questions concerning the internal dynamics of, and life on, planet Earth. These questions remain as contentious today as during the 1960s and 1970s when plate tectonic theory began to revolutionise the Earth Sciences. We have found much of CEED's work over the years both exciting and compelling.

While addressing these questions, CEED researchers have consistently published an impressive number of innovative, topical (and in some cases controversial) articles. A significant number of these articles have been in highly-cited peer-reviewed international journals such as *Science*, *Nature*, and *PNAS*. Many of CEED's articles have high visibility, and citation indices and journal impact factors reflect well on the published work of CEED.

Much of the work done by CEED proceeds on the assumption that mantle plumes originate from the edges of the two large low shear velocity provinces at the base of the mantle (amiably dubbed Jason and Tuzo by Kevin Burke and Trond Torsvik). The idea that these ubiquitous features of global tomographic models are long-lived, dense, discontinuous thermo-chemical piles, with their immense size/volume suggests that chemical heterogeneity plays a fundamental role in governing lower-mantle dynamics. There is no doubt that this is an important research area, and it is good to see that CEED is carrying out research that explores the structure and dynamics of the lowermost mantle (Mohn & Tronnes, 2016).

Much of CEED's work has energized the community, both to critique and to build on their work. For example, several workers have questioned the LIP-LLSVP edge correlation hypothesis and this will no doubt be an area of continuing research, not only at CEED but in the global geodynamics community. In any event, the importance of much of the work has been recognised by scientific medals and awards received by key members of the CEED team. The results certainly convey the sense that CEED is delivering on most, if not all, of the promises it laid out in the original application and doing so at a very high level.

Overall, the scientific outputs are excellent and together represent a substantial body of creative, innovative, high-impact work.

7.4.2 Organisation

CEED benefits from strong and effective leadership. The Centre is organised into groups but there is a strong emphasis towards greater collaboration across these groups, particularly in the second phase. There will be even more emphasis on collaborative projects. Research students from different groups are co-located to encourage this and future PhD hires will also require supervision across groups. There is an outstanding Scientific Advisory Board and evidence of the Centre responding to their

suggestions. Public engagement and outreach, particularly to children and young adults, is excellent; and CEED is contributing to innovation in the curriculum in the host Department.

Early problems with the organisation of the Centre seem to have been resolved within 18 months of starting and this is working very well now. There is some dedicated administrative and technical support within CEED but the Director would welcome a greater resource, in this regard, not having to rely on Departmental and Faculty resources. Space is currently an excellent aspect of the Centre but it is clear that they will soon be at above-capacity. There is an urgent need to upgrade the facilities represented by the U-Pb TIMS Laboratory but an application for funds to do so has been submitted.

The PhD and postdoc communities were very complimentary about CEED. PhD students have access to national research schools in DEEP and CHESS, as well as courses within UiO. In addition some have access to international training courses (such as through SUBITOP, the European training network). It is clear that these training resources are strongly supportive of research students' development. The postdocs were less clear on their mentoring arrangements, beyond meetings with the leader of their group and UiO schemes (such as that for mentoring female staff). They do, however, have ample opportunity for international mobility and are clearly encouraged to develop into independent and confident researchers. Several have high-level grant application plans. They would welcome the opportunity to engage in limited teaching (they are currently 100% research) in order to qualify for future academic positions. Postdocs and PhDs would welcome more engagement with the host Department; the Head of Department recognised this issue and has plans in place to address it.

It was recognised that, in this field, there is a need to address gender dimensions. The Centre has a female Director and they have sought to achieve some degree of female representation in appointments at PhD, postdoc and staff level. The next two permanent appointments will be one woman and one man. However, the Centre is constrained by the rules for making appointments within UiO. For example, the world-leading female scientist, Professor Jahren, is currently not able to be appointed to a permanent post which is a potential significant loss to Norwegian scientific excellence; most countries would enable such an appointment. In addition the rules on having to release staff on temporary contracts after 4 years (to be reduced to 3 years) will lead to the loss of excellent young researchers, including women who might otherwise redress the gender imbalance in the field.

7.4.3 Future Plans

CEED plans to address some of the most fundamental questions in the Earth Sciences and to produce high-profile papers while doing so. In their original proposal, they laid out ambitious plans on which they have delivered. They now propose to continue much of this work as well as begin new directions that further elaborate on Earth crises, numerical models of Earth dynamics, and comparative planetology. While the Evaluation Committee is not sure that they can accomplish all that they propose in their updated plans, the committee is confident that they will produce a substantial body of high profile, high impact research in the process.

Some of the plans, such as the first-principles modelling of the physical chemistry of the lower mantle, are very specific. On the other hand, some plans are more exploratory in nature and it's hard to predict what course this research will take. We are encouraged by the growth and solidification of some of the research groups. For example, Earth Modelling (formerly Earth Visualization) is now headed by a full Professor of Geodynamics instead of a postdoc.

CEED has also proposed a new direction of research, "Water Planet" that will focus in the next five years on the role of water in the context of subduction, sea level change, and the solar system at large. It's a very broad topic, but fits naturally with research already in progress.

The CEED Director indicates that many of the senior staff are applying for ERC grants, which is to be applauded and is evidence that the centre comprises an extremely ambitious group of researchers. These applications span a broad range of subjects including degassing models for large igneous provinces, lower mantle mineralogy, and ancient and modern climate change. That many of the PIs involved have been shortlisted during ERC rounds over the past 5-6 years is a positive sign that at least some of these applications will bear fruit.

Overall, the plan seems excellent and we look forward to seeing the advances CEED will make in the coming years.

7.4.4 Summary

The Centre for Earth Evolution and Dynamics is headed by excellent scientists who have assembled a world-renowned group of researchers, addressing first order questions concerning the internal dynamics of, and life on, planet Earth. CEED is carrying out cutting-edge research and has the required unique infrastructure and equipment available (the palaeomagnetic lab, TIMS), thus being highly attractive to PhD students, postdocs and renowned scientists worldwide. Accordingly, CEED researchers have been very productive and consistently published in excellent journals.

Most of the work has a highly visible international profile and a high impact. Thus, CEED members have been extremely successful in attracting renowned grants (e.g., ERC and other EU grants). Their success is also apparent from the prestigious awards that the former director and other members of CEED have received.

The National Research School "DEEP" offers excellent courses, not only for PhD students in CEED. In addition, research at CEED has already led to new courses being introduced into the study programme at the Department of Geosciences. An even stronger integration into the Department of Geosciences is sought.

There has been support by the Faculty of Mathematics and Natural Sciences (space, infrastructure, staff), but the Faculty/University of Oslo may lose some proven talents if the present employment policy remains unchanged.

Overall assessment: **Exceptional**

Recommendations

- It is vital that the UiO fulfils the commitments to creating two permanent positions for researchers in the Centre, to ensure future plans can be carried out. It would be highly desirable if a permanent post can also be found for the current Wilson Professor, who is of world-leading status; we understand there may be potential for a joint appointment between the Departments of Geosciences and Biology.
- More generally consideration should urgently be given to means of retaining the best research talent associated with CEED that is currently on temporary appointments and to have regard to the need to improve gender balance when doing so.
- The UiO will need to address space constraints that are likely to emerge in the near future (if CEED continues to be successful with grant applications). It is also important that upgrading of the laboratory facilities are under-written by the University.

- There are concerns over the possible termination of financial support from the UiO (2m NOK p.a.) during or after the second phase of CoE funding. This requires urgent clarification.
- The mentoring scheme for postdoctoral fellows should be clarified, strengthened and communicated, and consideration given to offering them some limited teaching opportunities.

Conclusion

The midterm evaluation committee recommends continued funding of CEED.

7.5 Centre for Environmental Radioactivity (CERAD)

7.5.1 Scientific output

CERAD is clearly a global Centre of excellence in radioecology. The evidence includes an impressive number of peer reviewed publications in high quality international journals and a substantial increase in publications over the first 4 years of the CoE. The overall assessment of scientific output is excellent for quantity and very good for quality. It is necessary to qualify the judgement on quality, as the research field is relatively small and publications in radioecology seldom achieve very great prominence in the highest cited journals and this is reflected in citation metrics for both the papers and the leading members of the team. Other key indicators of the strengths of CERAD include participation and leadership in competitive EU research programmes and influential policy-related environmental radioactivity assessment reports and additional measures of esteem for senior members of the team (prizes, awards, honorary academic positions etc).

CERAD is unique, both in the research field and support of policy development in Norway and internationally in the field of risks from radioactivity. A particular strength of CERAD, and its location within NMBU has been the ability to attract new staff and research students, which has led to an increase in staff from 40 to 69, including international recruits over the first 4 years as a CoE. CERAD has fulfilled its goal of establishing an educational programme alongside its research agenda, with the only European MSc course in radioecology, a growing list of 17 PhD candidates, and 3 postdoctoral staff in 2016.

CERAD is highly regarded and well known among the professional stakeholders globally. This provides Norway with a high profile and a trusted status in radioecology. Supporting evidence is provided by the UNSCEAR Fukushima report presented to the UN General Assembly and the contribution to ICRP.

7.5.2 Organisation

The organisation of the centre is characterised by a strong sense of collective responsibility under the outstanding leadership of the current Director. There was an emphasis on team building at an early stage that has benefited the Centre. While the Centre has strong and visionary leadership, this is not at the expense of involving and indeed empowering other Centre staff; for example, significant roles have been given to Directors of Research and of Education. There is a Management Group that guides the Centre, as well as a Board for key decisions and monthly meetings of Theme Leaders.

The process of developing and revising the Strategic Research Agenda (SRA) is exemplary with its emphasis on full consultation within the Centre and making it a public document. The SRA is also used to guide the decisions by the Centre Board on funding projects through criteria of integration, relevance, impact and feasibility. The Agenda is supplemented by a detailed implementation plan/Road Map and indicators for achievement. However, it is not clear that the revised SRA will take CERAD to the end of its RCN funding.

The research programme is well managed and the organisation within CERAD is a considerable strength. A relatively small Research Centre is able to harness a really effective interdisciplinary research programme with this structure drawing on skills at NIVA, MET, NIPH and NRPA which are not present within the NMBU team, such as meteorology, marine and freshwater sciences and link these with agencies with responsibilities for health and environmental protection.

The involvement of the four key partners (outside the University) has led to a large number of part-time scientists being affiliated with the Centre. The Centre management team acknowledge that this has created challenges and propose to move to a situation where more are full-time (or at least have a greater percentage contribution). This is to be welcomed. There are excellent international connections, as well as policy and professional links. It will be important to maintain all these networks both in the second phase and also in the period after RCN funding ceases.

The PhD training works very well. There is use of the educational resources within the University as well as the unique MSc in Radioecology (which is taught in intensive modules, available to research students inside the Centre and also beyond the university and, indeed, Norway). Students have clear supervision arrangements. Research students are permitted to supervise MSc students and there are events for bringing the Centre's research student community together, as well as the more informal interaction that occurs within the Centre. This works well for PT as well as FT students and all have access to adequate physical facilities within the Centre. Postdoctoral fellows are mentored and both guided and encouraged to engage in grant applications. They are able to become involved in PhD supervision.

The host institution, NMBU, demonstrates its commitment to and support of the Centre in a variety of ways. The Pro-Rector sits on the Centre Board and University Guidelines have been drawn up for how CoEs should fit into the University structures. The University provides technical support, space, equipment and funding for PhD positions as well as other finance (on the basis of demonstrated success in grant applications). They are committed to the long term existence of the Centre at the University and that the Directorship of the Centre should remain a FT University post.

7.5.3 Future Plans

The proposed research programme objectives for CERAD over the next 4 years are well presented and ambitious. With the need to bring together the component parts from collaborating partners, especially in quantifying uncertainties in the risk assessment, this will be an important challenge for the teams. They will certainly have an impact on international research priorities in radioecology, such as the SRA of the European Radioecology Alliance and provide valuable contributions to international organisations including UNSCEAR, ICRP, IAEA and IUR.

The current Director is proposed to retire early in the second phase and the succession will have to ensure a Director with a strong scientific vision and outstanding scientific track record, as well as management skills.

For the period beyond the CoE, a discussion has begun on maintaining research capacity on radiological protection within CERAD but have yet to be resolved.

7.5.4 Summary

CERAD is a global Centre of Excellence and a flagship for Norwegian science with an agenda that is also highly relevant for society. The Director and Management Group have performed extremely well. There is an excellent team spirit and enthusiasm making the Centre very attractive for collaborations but also for PhD students and postdocs. Network building both nationally and internationally, also with practitioners and politicians, has been outstanding. The Strategic Research Agenda is very ambitious and relevant. The scientific results are excellent in terms of publication quantity and very good for publication quality.

The excellent infrastructure, multidisciplinary team building, development of a high-level strategic research agenda and highly professional programme execution during the first four years have

created a strong foundation for the Centre's future ambitious research plans. Furthermore, there is excellent support from the host organisation for the present and future plans of the Centre.

*Overall assessment: **Very good to exceptional***

Main recommendation

1. The succession planning for the Director of CERAD needs to start in the very near future and be subject to stringent quality control with regard to scientific quality. An open call may be most appropriate for ensuring this.

Recommendations

2. The Strategic Research Agenda will need to be revised once the new Director is in place.
3. The exit plan for CERAD after RCN funding ceases needs to be developed and needs to contain a clear vision of excellence in science, as well as support for radiological protection.
4. There should be a move away from a large cohort of part-time scientific positions towards more 100% positions.

Conclusion

Based on the generalists' comparison of several centres, their conclusion is that this centre, within 6 months, must present a report with a strategy to follow up the main recommendation. This report will be assessed before the final conclusion is reached.

7.6 Birkeland Centre for Space Science (BCSS)

7.6.1 Scientific output

The scientific research at BCSS focuses on scientific topics related to magnetospheric, ionospheric and atmospheric phenomena such as aurora, ionospheric currents, particle precipitation and Terrestrial Gamma-ray Flashes.

The scientific tasks contribute to the main question “How is Earth coupled to space?” which is an essential part of understanding the entire system in all its complexity. The research has been divided into 4 groups:

Group 1: The research made in the first 4 years has been focused on systematically exploring the physics behind auroras at both hemispheres, understanding the differences in the two hemispheres, e.g. concerning the energy input or the intensity of currents flowing in and out of the ionosphere. The initial results illustrated the importance of the By component of the interplanetary magnetic field (IMF) to explain some differences of auroras at both hemispheres in a new way. In particular, a new concept of how IMF By induces a By component in the closed magnetosphere was developed and confirmed, which received much attention in the scientific community.

Group 2: The high-latitude ionosphere is a key region when considering space weather phenomena and their impact on technical infrastructures in space and on Earth. Nowadays, substantial findings can only be made by comprehensive studies that include different types of measurements to get a complete picture. Consequently, the related BCSS research effectively utilizes data from spacecrafts, EISCAT, SuperDARN, geomagnetic observatories, all-sky-cameras and GNSS receivers. In a series of internationally well recognised papers published by the BCSS, it has been shown how the leading edge of the tongue of ionization (TOI) and polar patches are associated with small scale irregularities of the ionospheric plasma and their impact on the related radio scintillations of GNSS- signals. Coordinated measurements of Super DARN radar echos and optical observations of auroras have revealed some important conclusions for improving the accuracy of SuperDARN measurements.

Group 3: Energetic particle precipitation (EPP) and its impact on the upper atmosphere at the altitude range of about 60-80 km height will likely become an important research topic in climate research because EPP increases the production of NO_x and HO_x causing a reduction of ozone. BCSS scientists developed a novel approach to derive the total precipitation flux by combining telescope measurements with the theory of wave –particle interaction in the magnetosphere. So it is possible now to improve the estimate of the OH production caused by EPP by one order of magnitude. Findings related to the impact of planetary and gravity waves during sudden stratospheric warming indicate the importance of combining different types of observations and modelling with the Whole Atmosphere Community Climate Model (WACCM) to get new insights. Consequently, according to the original plan, BCSS has established successful collaboration with the Bjercknes Centre of Climate Research thus being well prepared for the next 5 years.

Group 4: The study of Terrestrial Gamma-ray Flashes (TGFs) is a fairly new research area bearing the potential for novel discoveries. So the questions are still of elementary type: How common are TGFs? How and at which height they are produced? How intense they are? Thus to answer these questions a systematic study is required. The scientific objectives provide a convincing guideline to study this phenomenon in a reasonable way. BCSS effectively uses ground, and space-based observations to find answers to these questions. Furthermore, laboratory experiments as well as a specific aircraft

campaign bring progress in answering these questions. It is evident that the number of occurrences and associated sites increases with the improvement of methodology and detectors. The outstanding TGF research at BCSS is internationally well recognised, e.g. by getting considerable ESF and EC funding as well as by highlighting results in well recognised journals like GRL.

Space and ground instrumentation groups: The interdisciplinary character of the research in the four groups requires different types of ground and space-based measurement techniques and facilities. This requirement is taken into account by coordinating national assets in an effective way. Notable is the cooperation of group 4 scientists with the space instrumentation group in developing and constructing space instrumentation for the upcoming ASIM mission of ESA. Such a close partnership for developing a Modular X-ray and Gamma Sensor (MXGS) is beneficial for both sides.

The new SuperDARN radar deployed in 2016 at UNIS is an essential contribution to explore ionospheric dynamics at high latitudes. In combination with other ground based facilities like the GNSS network and SuperMAG essential contributions primarily for groups 1 and 2 and for exploring the high-latitude ionosphere in general can be expected.

In conclusion, based upon the quantity and quality of the publications in top peer-reviewed journals, the number of presentations (especially invited presentations) at international scientific meetings such as the AGU and EGU, the involvement of the centre in space instrumentation projects, the number of masters and PhD students graduated, the number of prestigious awards received, the high caliber of researchers in the centre and their international reputations, and the importance of the scientific topics being pursued, our evaluation is that the centre is on the level of excellent international research.

7.6.2 Organisation

The centre leader is an excellent scientist renowned in his field and stands out as a strong driver of the joint endeavor. He is highly visible as a leader, directs meetings with great authority and communicates very clearly. The group leaders Karl Magnus Laundal, Kjellmar Oksavik, Hilde Tyssøy and Martino Marisaldi showed appreciation for the centre aim and were given freedom to pursue their individual targets. The centre brings together international top experts to one place. Further, the hiring of Michael Hesse and Therese Moretto Jorgensen has been a significant gain for the future development of the centre. Also, the SAB seems to give very valuable input to the centre to keep focus and to aim high. It also has provided valuable input on organizational and management issues.

The centre has obtained focus by dividing the research into 4 clear topics that collaborate actively. It is clearly the impression that the centre structure is an appropriate way of organizing this type of research which provides very good synergy between scientists working on theory, modelling and observation. The two instrumentation groups add an important practical dimension to the centre. In addition to this, BCSS intensively promotes its own development of specific devices needed for research. The public outreach group is very dynamic and has accomplished impressive results. Based on the media attention they have received so far, clearly the general public has a great interest in the research they are doing. The BCSS is very well networked on national as well as international level seeking for competent partners who can significantly contribute to the research tasks. The ground and space based observational facilities focusing on established national assets is well organised and thus support the research in an optimal way.

The semi-annual meetings seem very important for the exchange of ideas, presentation of data and joint identity of the centre. The electronic fora for communication and presenting questions appear highly useful for a centre with several nodes.

From the meeting with the 5 postdocs and 3 PhD students it emerged that they all received good supervision, enjoyed a productive collaboration within the groups and had the opportunity to visit the best laboratories in the world for extended stays. The committee appreciates that the postdocs get a minimal of 3 year contracts and feel an ownership to their research. However, the committee would like to encourage young scientists that will most likely not get a permanent position at the centre to move on rather than to stay in the centre so long that their value on the job market declines. The general extension of PhD projects to 4 years is valuable. It was suggested during the meeting that the centre could establish a hands-on lab to foster further creativity. The centre should be congratulated with its proposal to establish an international research school within space science. The centre is encouraged to get inspiration from other RCN Centres of Excellence when developing its research training plans for doctoral, postdoctoral students and junior staff. E.g. the centre CCBio at UiB has established a research school from which inspiration can be achieved.

It was a pleasure to hear about the strong support from the faculty and the promise to contribute with faculty positions and 20% of the current RCN revenues after the centre expiration in 2022.

7.6.3 Future Plans

The proposed research described in the plan for the next 5 years is ambitious, since it addresses very fundamental and long standing problems. The changes described are normal adjustments made to on-going research that takes place over an extended period of time:

Group 1: We support their plan to combine new data sets with theory and modelling of magnetic reconnection into a comprehensive study. The MHD modelling to study the physical processes indicated in the observations is feasible when considering the installation of the advanced BATS-R-US model directly at BCSS. We also note that Michael Hesse, who has recently joined the BCSS group, has expanded the expertise in MHD modeling.

Group 2: Currents play a key role in understanding the magnetosphere –ionosphere coupling. We agree that the planned exploration of the relationship between currents and geomagnetic measurements is still of great interest. Understanding the generation and propagation of ionospheric convection pattern is not only of great importance for fundamental research but also for estimating the ionospheric impact on space-based navigation signals from GNSS. The required systematic investigation of ionospheric convection, which necessitates the inclusion of Super DARN, space based measurements (e.g. SWARM, DMSP), EISCAT and other measurement instruments like GNSS receivers, is well addressed. There exists a reliable data base: BCSS operates a SuperDARN radar since 2016 thus giving the centre full access to SuperDARN data. Other data are also available from EISCAT or their own GNSS network.

Group 3: The combined use of observations and models is the right way to get new findings. The full utilization of models like WACCM, as described, requires a close cooperation with other expert groups on national and international level, e.g. with the Bjerknes Centre for Climate Research. The SOLENA project provides a well-suited platform for studying complex features of the interaction of energetic particle precipitation with the middle atmosphere and related coupling processes with the thermosphere and ionosphere. The research is feasible since WACCM can be accessed from BCSS.

Group 4: Research is continued based on observations and analyses made in the first period. The experimental data sets will be greatly improved when MXGS data from ASIM becomes available. It is good to see that coordinated modelling and laboratory experiments are planned to get deeper insight into the characteristics of TGFs in relation to lightning. Ground and space-based lightning

detection results shall be combined with TGF observations. The work of the instrumentation group provides a solid background for getting high-quality state of the art measurements.

7.6.4 Summary

The BCSS has within a last few years become a world-class research centre, attracting top rated people and doing cutting-edge research on several important topics within space science. The committee finds that the scientific research is of the highest caliber with an outstanding international reputation. The centre is likely to become an even stronger internationally player within real cross-disciplinary activities with expertise covering the atmosphere, ionosphere, magnetosphere, particle physics and astrophysics from an experimental, analytical and modeling perspective. The centre constitutes a scientifically fruitful environment for young scientists. The future plans of establishing a research school within space science would further increase the likelihood of recruiting outstanding young scientists.

Overall assessment: **Exceptional**

Conclusion

The midterm evaluation committee recommends continued funding of BCSS.

7.7 Centre for Intervention Science in Maternal and Child Health (CISMAC)

7.7.1 Scientific output

The CISMAC reports set out an impressive range and quality of research activities, building on earlier work by the host institution – the Centre for International Health (CIH) at the University of Bergen (UiB), and contributing to new knowledge relevant to the CISMAC overall goal of “equitable reductions in maternal & child mortality and fostering child development”.

In terms of this mid-term evaluation, it is important to acknowledge that four years is a comparatively short period to achieve major scientific outputs in this field of research. Most of the deliverables for the period 2013-2016 emanate from projects not initiated by CISMAC, but with contributions from researchers at CISMAC or within its network. From 2014, five papers are included in the CISMAC publication list, followed by 13 and 30 in 2015 and 2016, respectively. Out of this total of 48 articles, 14 have CISMAC first authors. The research has been published in 23 journals, with the Lancet leading with nine publications, followed by BMC Pregnancy and Childbirth (six), PLOS One (six) and BJOG (four).

CISMAC’s performance at this stage has to be judged primarily on the basis of the robustness of the primary studies conceived and now underway, many of which will not deliver results until after 2018. The publication trajectory of CISMAC’s own studies will thus continue to rise in the coming years. Evidence of the early stage in CISMAC’s deliverables is also reflected in the Director’s own choice of five significant published papers. The first four describe important findings from primary research, meta-analysis or research synthesis, and although members of the CISMAC network are included, particularly from SAS in India, some of this work pre-dates the start of CISMAC.

The on-going research studies cover a diverse range of interventions, mostly evaluated with randomized designs – cluster or individual-level. Several are essentially efficacy studies seeking to improve outcomes for newborns and infants in South Asia and Africa. The diversity of research questions linked with CISMAC could be argued to be one of its strengths, particularly when a common study design (i.e. RCTs) is used. However, the use of a unifying strategic focus to guide the selection of these and further studies was not obvious to the review committee (Recommendation 2). During the site visit, the CISMAC team referred to guidance from international prioritisation, but the committee was surprised by the lack of implementation research in the CISMAC portfolio (current and proposed), since this is an acknowledged gap in maternal, newborn, child & adolescent health (MNCAH) and frequently ranks high in priority exercises.

The high quality of scientific activity being undertaken by CISMAC reflects effective networking among strong researchers, both south-south & north-south, which was also well-illustrated during the site visit presentations and discussions. The review committee was impressed by some interesting methodological developments being fostered by CISMAC, including equity analysis alongside trials and evaluating a case-control with follow-up design. However, we also felt the strongest feature was the significant capacity-strengthening in high quality design and conduct of randomised trials, both in the global south and in Norway, and recommend (recommendation 3) that this “unique selling point” of CISMAC is given greater prominences in its publicity and future plans.

The committee sought during the review to explore the fundamental question of the “value-added” from CISMAL as a Centre, both to the published studies and to the ten on-going projects as of mid-2017. We recommend development of an explicit monitoring system to ensure that the unique and added contribution by CISMAL is more apparent in the forward period (recommendation 4). From the documentation and the site visit, we are of the opinion that much of the research may have happened or been initiated without the existence of the centre, and from similar funding sources for the individual studies. However, it would have lacked strong Norwegian partners and involvement were it not for the CISMAL consortium.

In summary, the review committee believes the sum of scientific activities completed or underway by early 2017 and presented under the umbrella of CISMAL, is of excellent international quality. There are, however, recommendations for further improvement.

7.7.2 Organisation

There are highly-experienced researchers linked with CISMAL, and mechanisms are in place to ensure strong research governance, including quality assurance, from strong leaders. For example, the committee was particularly enthusiastic about CISMAL’s dedication to the external review of trial protocols.

However, the manner in which specific research questions and projects are chosen was less clear. The committee recommends (recommendation 2) that there be more consideration of thematic coordination in this process. In other words, CISMAL should not only develop core expertise in trials, but should also develop a core science mission which underpins their use of this methodology for addressing key evidence gaps.

The committee felt the CISMAL organizational framework should facilitate scientific outputs, but noted that it was hard to assess the full range of synergies between groups from the written materials and the site visit. A key related question is how to assess whether this is a Centre per se (“where the sum is greater than the individual parts”), versus a collective of important research projects which work well individually (vertically) but with limited horizontal connections, including multi-country projects. It appears that there are strong but informal interactions among researchers in the design phase of RCTs. These interactions could be formalised and strengthened across the entire research continuum – from project conception, to data capture and analysis, through to dissemination (See Main recommendation).

Consistent with these ideas, the committee also felt the Centre should explicitly develop structured research training plans for doctoral, postdoctoral students and junior staff, including synergies with the newly-planned track in Implementation Research (recommendation 6). It was unclear to the committee if and how such plans currently emerge. We recommend (recommendation 7) that CISMAL should also consider ways to make itself an international destination for research training, for example, by having regular summer school courses covering the core research expertise of the faculty. Such an initiative would also be a strong recruitment platform. This would naturally best be done by working together with the existing teaching and training capacity of CIH and the wider department/faculty. CISMAL is also encouraged to consult with other RCN-funded Centres of Excellence when developing its research training plans for doctoral, postdoctoral students and junior staff; for example, CCBIO at UiB has established a research school which could provide some insights and inspiration.

The committee was particularly encouraged by the dedication of UiB to assuring the future of CISMAL and its research endeavors, and by the clear recognition by the University of the significant

contribution that CISMAL provides to its commitment to being a global institution. Specifically, we noted the UiB commitment of 20% of current RCN funding after the end of SFF status for at least 10 years.

In summary, the review committee agreed that CISMAL has an excellent research governance framework and process based on strong and experienced research leaders. There are, however, recommendations for further improvement.

7.7.3 Future Plans

The objectives for the second 5-year period Stage 2 are similar to Stage 1, and built around 5 further trials. The committee, however, felt the strategic framework guiding the selection of these future studies (and partners) was also not clear. The proposed portfolio will continue to be based on the conduct of individual projects, mostly single-site, and addressing highly-focused research questions. Apart from generating new knowledge along the continuum of care, there was little evidence in the documents or site visit on how the projects fit together and make “the sum of new knowledge greater than the individual parts”, so collectively advancing knowledge around a major health challenge, such as infections in newborns (recommendation 2). Similarly, the committee felt that the gains in efficiency and generalizability from conducting multi-country trials should feature strongly in a centre of excellence like CISMAL, particularly given the 10-year funding opportunity. Moreover, we agreed there was a missed opportunity to explore the effectiveness of at least one of the key interventions proven efficacious in Stage 1 (recommendation 8). The committee noted the absence in the plans of a natural evolution towards the design and conduct of robust implementation research is key to meeting the CISMAL objectives on sustained health gain, and in this second 5-year period, more attention to GRIPP (getting research into policy and practice) would also be an important activity but is unclear from the current description (recommendation 9). Similarly, we recommend CISMAL to reflect on its role in undertaking secondary research, particularly meta-analyses, which was prominent in Stage 1 but less obvious in Stage 2. Such research remains an important activity as an integral part of training the next generation of researchers as well as for capacity-strengthening more generally (recommendation 10).

The five new projects are well-summarized in the documents provided and the site visit gave further insights. These seem to vary considerably in terms of both complexity and certainty of funding. The committee thus feels it is important for CISMAL to build-in greater flexibility in the plans for Stage 2. This will allow for not only the inevitable drop-out or slipped time-lines for studies, but also for responses to emerging priority questions in MNCAH and for changes in direction based on findings from Stage 1 as described above. Moreover, it would appear that many of the Stage 1 studies will still be active when the Stage 2 ones start, and the committee noted this is likely to present a challenge to the capacity of CISMAL to provide adequate research management.

There remains an area of the continuum of care which the committee felt was comparatively under-represented in the Stage 2 plans – namely, interventions explicitly to improve maternal health outcomes and well-being. The proposed SELMA project is the main exception. However, the state of development of this intervention by WHO, and indeed whether this can be largely attributed to CISMAL and called a “CISMAL study”, remains unclear. During the site visit, the Director acknowledged the weaker presence of the “M” in CISMAL in Stage 1, and attributed this to a lack of international prioritisation exercises. The committee noted that clear priorities for research on maternal health were, however, available during Stage 1 from other respected sources, such as the Global Strategy for Women’s and Children’s Health. We recommend (recommendation 11) that CISMAL adopts a framework which not only considers key evidence gaps impacting on the health and

wellbeing of women and mothers in their own right, but also actively looks for opportunities for research conducted alongside those studies focused primarily on newborn and child outcomes. A good example would be the longitudinal study in Pakistan. This approach would seize the opportunity provided by the comparatively long time window afforded CISMALC.

In summary, the plans for the remaining five years are, overall, of an excellent quality. There are, however, recommendations for further improvement.

7.7.4 Summary

The review committee believes the sum of scientific activities completed or underway by early 2017 and presented under the umbrella of CISMALC, is of excellent international quality. The diversity of research questions linked with CISMALC could be argued to be one of its strengths, particularly when a common study design (i.e. RCTs) is used. However, the use of a unifying strategic focus to guide the selection of these and further studies was not obvious to the review committee. The review committee agreed that CISMALC has an excellent research governance framework and process based on strong and experienced research leaders. There are, however, recommendations for further improvement of the organization of the centre.

Overall assessment: **Very good**

Main recommendations

1. Explicitly formulate objectives for developing greater synergies between the research projects (horizontal linkages) at all points in the research cycle.
2. Develop and use a unifying strategic focus to guide the selection of further studies.

Recommendations

3. Give greater prominences in CISMALC publicity and future plans to its significant capacity-strengthening in high quality design and conduct of randomised trials, both in the global south and in Norway.
4. Develop an explicit monitoring system to ensure the unique and added contribution by CISMALC is more apparent in the forward period.
5. CISMALC has the potential to make a significant contribution to addressing key challenges to health improvement for women, mothers, adolescents, children and newborns through robust implementation research. Undertake an explicit options appraisal exercise to explore the rationale, modalities and implications of increasing its portfolio of implementation research.
6. Formalize structured research training plans for doctoral, postdoctoral students and junior staff, including synergies with the newly-planned track in implementation research.
7. Consider ways to ensure CISMALC remains an international destination for research training by having regular summer school courses covering the core research expertise of the faculty.
8. Explore gains in efficiency and generalizability from conducting more multi-country trials, and opportunities to conduct follow-on studies from key interventions proven efficacious in Stage 1.
9. Develop a clearer framework on GRIPP (getting research into policy and practice) to ensure it features strongly in Stage 2.
10. Reflect on the role of CISMALC in undertaking secondary research, particularly meta-analysis, which was prominent in Stage 1 but less obvious in Stage 2.

11. Adopt a framework, which not only considers key evidence gaps impacting on the health and wellbeing of women and mothers in their own right, but also actively looks for opportunities for research conducted alongside those studies focused primarily on newborn and child outcomes.

Conclusion

Based on the generalists' comparison of several centres, their conclusion is that this centre, within 6 months, must present a report with a strategy to follow up the main recommendations. This report will be assessed before the final conclusion is reached.

7.8 Centre for Cancer Biomarkers (CCBIO)

7.8.1 Scientific output

CCBIO concentrates on the following overlapping programs:

1. Mechanisms of Tumor-Microenvironment interactions (preclinical studies)
2. Exploration and validation of cancer biomarkers
3. Clinical applications and trial studies

We have the following comments to the program

Interactions between cancer cells and the surrounding stromal cells and matrix are of increasing interest as it is believed that such interactions play a major role in determining the malignant phenotype. Accordingly, a better understanding of the biological determinants for stromal-cancer cell interactions may lead to the development of novel therapeutic interactions in cancer. Indeed, the recent developments within immune-oncology are strong proof of the importance of understanding how different cell types interact in the tumor tissue. However, it is also clear that at present we have only partly unraveled these interactions and much more is to be learned in this exciting research field.

1. The CCBIO has over the last 3.5 years performed extensive studies on stromal-cancer cell interactions using both preclinical models and human cancer samples. Several promising biomarkers have appeared and pilot clinical correlation studies have provide the first evidence of associations between some of the biomarkers and patient outcome. Moreover, some of the identified biomarkers hold promise as novel targets for cancer therapy.

A slight change in the research program was introduced by including studies related to immune-oncology where CCBIO now has discovered a potential association between one of their biomarkers and cancer cell/immune cell interactions. This finding is planned to be tested in a clinical setting using patients with melanomas. The evaluation committee finds the work to be excellent but suggest that fewer cancer forms are being included in order to focus the work.

2. The different groups have focused on certain biomarkers, mainly in breast cancer, prostate cancer, melanoma, oral cancer, gynaecological cancers and in hematological malignancies. They have performed several molecular functional studies in order to prove the importance of the different biomarkers. The use of liquid biopsies is innovative and timely.

The clinical material in Bergen is limited and therefore the groups have established a collaborative network of researchers able to provide validation series of patient samples. They have plans of including their biomarkers in prospective oncology studies, which however will not provide results for years. Therefore validation of collected retrospective material is more efficient and acceptable. The evaluation committee finds the results and plans concerning this program very good.

3. Although CCBIO has plans to test some of the biomarkers in relation to Axl inhibition, we are lacking a more thorough plan for the clinical validation of the identified biomarkers. For

example, it is not clear how CCBIO will validate the prognostic biomarkers. Moreover, the clinical plans for the Axl biomarker as a predictive biomarker for Axl inhibitor treatment appears somewhat preliminary. We also need more information on the trial designs for prospective studies. What will be the end-points, the inclusion and exclusion criteria's as well as the expected number of patients to be enrolled?

7.8.2 Organisation

The centre is very large distributed over 7 departments, 4 faculties and with 8 PIs in the three integrated biomedical research programs (preclinical studies, biomarker discovery and validation, clinical studies) and four closely organised associate programs (ELSA research, health prioritisation ethics, economics, bioinformatics).

It is recommended to focus the research and therefore also the organization. As part of this it should be considered to ensure stronger collaboration at the junior level. This can be facilitated by several means e.g. through including junior scientists in the management and/or ensure co-location of all junior scientists. The committee therefore recommends the centre and faculty to consider a co-location of at least the junior scientists to increase research interactions and collaborations between the research groups. To improve the interaction between basic science and clinical research, shared positions (50/50 %) should be encouraged.

The centre should be congratulated on its strong focus on research training and internationalization. The inclusion of ethics and health economics strengthen the profile of the centre and research school. Other Centres of Excellence in Norway should be inspired by the school! The research school is a true "role model" for excellent research training.

Furthermore, it is commendable that about half of the PhD students and post docs are recruited internationally. The international recognition is acknowledged through the high quality adjunct professors. The physical presence at CCBIO in Bergen through their contribution to the research and research training is applauded.

It is still early with respect to social impact but the centre has already deeply reflected on how they want to contribute through responsible research and innovation (RRI), education and more classical innovation.

The gender balance among PhD students and post docs is appropriate; however the gender balance at the senior level could be improved. A clear strategy for how to do this is recommended.

The committee was impressed by the centre administration and technical support.

7.8.3 Summary

The Centre has to be congratulated by the quality of the already performed research. In particular we want to acknowledge the international research school as already being extremely successful by bringing the junior scientists together and to share research performed in the different groups in the Centre. The evaluation committee was impressed by the capacity and quality of the Centre management. However, for the future plans of the Centre, the evaluation committee would recommend more focus, fewer research projects, more interactions between the basic scientists and the clinicians (at the hospital), and more defined and specific plans for clinical validation of the biomarkers.

The evaluation committee applauds the commitment of the University to support with 20% of the RCN funding the Centre for 10 years following the termination of the support from the RCN.

Overall assessment: **Very good to exceptional**

Recommendations

1. Increase collaboration with clinicians including the formation of a clinical scientific advisory board
2. Make written plans for subject 3 (Clinical studies). These plans should cover the biomarker validation studies as well as the use of the response (Axl) biomarker. We expect the plans to cover studies bringing the biomarkers to level 1 of evidence.
3. Engage the clinicians from surgical, oncology and hematology departments in Bergen in the planning of the validation and trial studies.
4. Increase patient involvement
5. Increased focus and fewer research projects, e.g. focus on fewer cancer forms
6. Establish the frames for co-localization of scientists in order to improve collaboration among all centre scientists particular the junior scientists
7. Increase international competitive funding
8. Improve gender balance for senior scientists
9. Describe how assay validation for biomarkers are secured

Conclusion

The midterm evaluation committee recommends continued funding of CCBIO.

7.9 Centre for Arctic Gas Hydrate, Environment and Climate (CAGE)

7.9.1 Scientific output

The design of CAGE's seven workpackages portrays the centre's excellence in an impressive setup. This is the only interdisciplinary centre world-wide studying all aspects of gas hydrate including its regional and global climate impact. They focus on gas hydrate formation, distribution, dissolution and related biosphere interactions. This important biological aspect is being developed more in the next phase, however, the centre has already managed to expand its expertise in this direction.

Compared to the stated intentions, as outlined in the proposal (that were already very ambitious for a scientific field that is not easy to tackle) CAGE has done exceptionally well, well above what may have been reasonably expected. Major, innovative technological developments have been made, partly in collaboration with others, both industry and academia, national and international. The scientific outcome in published papers is impressive.

The centre has achieved, in a short time, wide international visibility and impact by a high number of scientific publications and conference contributions. Starting from 4 faculty positions, the centre has grown to almost 60 total staff, which illustrates the positive and excellent research dynamics.

7.9.2 Organisation

The organisational and managerial structure of CAGE is 'lean' and 'clever'. There is no heavy administrative overhead, and the leadership is collaborative and inspiring; it deals pragmatically with challenges. This type of management style is highly effective in such an interdisciplinary environment, which also mixes pure science and advanced technological development. The management team seems to be driven by a sense of common purpose and has managed to cope with a large expansion in the number of people and size of budget in a short period.

The CAGE leadership has found several ways to support research of excellence. The clever management style drives the whole consortium in the direction of scientific excellence as witnessed by many papers in high-impact journals such as Nature and Science. The overall scientific quality is guided by an international scientific advisory board, consisting of established leaders in their field and a national steering committee. In addition, CAGE is very well embedded internationally.

In terms of science outreach and communication, there is visionary leadership shown, with impressive results (both quantitatively and qualitatively) coordinated by a dedicated communications manager. For example, the presentation of the Mid-term Report and the visualisation of scientific results was exemplary. There is a particular emphasis on outreach to children.

The Centre already makes a considerable contribution to the international policy agenda on climate change and sustainability but there are opportunities to expand this further to communicate with stakeholders in government, industry and society.

The training of junior researchers is supported by a well-governed AMGG research school as well as by university courses and a mentoring programme. The PhD community is generally very well-served by the Centre, although there are some issues of intra-Centre communication. It is notable that the majority come from outside Norway but many wish to find a further position in the country.

Leadership has been shown with regard to investments in research infrastructure, including ICOM, the contribution to the development and building of a new research ship, and the way in which a database-management system was set up to cope with the tsunami of data and the commitment to making this open-access.

CAGE seems very well embedded in the local host university. There is evidence of support from the local university authorities, financially and in terms of human resource management, as well as in infrastructure support. However, such cross-disciplinarity can be challenging for university leadership.

Although a point of concern raised by the committee was about the succession of the current Director, this issue is currently being dealt with satisfactorily. There is no significant gender imbalance; for this particular scientific field, it is exemplary and has resulted from strong direction from the leadership.

In conclusion, the leadership, vision, management and organisation of CAGE are outstanding.

7.9.3 Future Plans

All seven WPs have in common to aim to better quantify the processes under study, both in data acquisition and in modelling. This is extremely ambitious, since the quantification of fluxes is technically challenging. Examples are: quantification of CH₄ sources (biogenic, thermogenic, abiogenic), long term in situ observation, quantification of seasonal, annual, decadal and millennial variability, quantification of sea air fluxes, or advanced model development, to name but a few. Such a quantification approach will lead to a more comprehensive understanding of the controlling influence of CH₄ on climate and life in the past, present and future, which is of the highest societal relevance. This demands a great degree of integration between WPs. Special attention has to be paid to the increasing role of microbiology. This requires contributions from other disciplines, such as detailed pore-water and sediment characterisation, and assessing source, site and quantities of potential methane generation, and its release into the water column. Such more extensive study of the microbial contributions will potentially also lead to increasing scientific integration of the WPs. This integration is also highly recommended for the Ice Cold Micro-organisms Lab (ICOM) and should not only be restricted to data input for the Lab's operations. The evaluation panel also appreciates the collaboration and integration with other institutions, such as the Bergen and Oslo groups, and national research infrastructures.

The outlined scientific approach for the second phase is challenging but feasible for this excellent scientific team, provided that continuing and even increasing integration and collaboration can be achieved. CAGE has the necessary expertise and excellent technological support in-house and additionally is targeting consolidation and expansion of new and existing collaborations. ERC-grants have been and are being submitted; the evaluation group was very pleased to hear that measures exist to grant permanent positions/professorships to successful applicants. There are also plans for expanding into integrated ocean drilling programme (IODP) initiatives.

One concern is that full continuation of WP7 depends on additional financing for which, later this year, a proposal will be submitted to RCN. However, even if not granted, the envisaged ship-based measurements for WP7 will continue.

Although started already during the last period of the first phase, there will be a broadened emphasis on the microbial interaction on seabed and water column methanotrophy, applying innovative lander systems and long term monitoring. The new establishment of the ICOM lab will allow a better understanding of these microbial processes in combination with in situ experiments on the seabed.

The comparative study of past warm periods will strengthen the modelling of future developments. These new directions, including the further development of 4D seismics, are extremely beneficial for the overall goal of CAGE and well justified.

The new directions are a continuation of a successful path and broaden the research in a most comprehensive way that will strengthen CAGE's global leadership and position as world class research centre.

7.9.4 Summary

This is an excellent centre with an outstanding programme of research that is ambitious and yet fulfilling those ambitions. The scientific outcome in published papers is impressive, there are many papers in high-impact journals such as Nature and Science. The programme is clearly structured but operates as an integrated whole, thanks to insightful leadership, careful organisation and a research question-driven approach. Young researchers (PhDs, postdocs, and early career researchers) are enabled to become autonomous researchers and collectively they offer the prospect of continuing and spreading the CAGE legacy. Engagement with the wider public is exemplary and there is scope for expanding that with policy-makers. There are strong plans in place for the next five years and for after the CoE funding ends; the support of the University plays an important role here.

Overall assessment: **Exceptional**

Recommendations

1. CAGE should ensure that the use of the planned ICOM Lab is fully integrated into the work of CAGE, across the different workpackages, during the second phase.
2. The University leadership should recognise that cross-disciplinary research, particularly across faculties, offers a lot of opportunities but simultaneously poses certain challenges (e.g. allocation of PhD positions, professorships and resources).
3. Some attention needs to be given to improving the regular communication within CAGE so that it reaches all research students, young researchers, etc.
4. Efforts should be made to equalise, in so far as it is possible, access to conference funding for all research students including those affiliated with partners.

Conclusion

The midterm evaluation committee recommends continued funding of CAGE.

7.10 Centre for Molecular Inflammation Research (CEMIR)

7.10.1 Scientific output

CEMIR is a vibrant and internationally unique research centre focussed on innate immunity. The quality of its faculty is excellent, group leaders, postdocs and PhD students are enthusiastic and the institute is becoming recognised internationally as a competitive player. The 2016 conference on the Molecular Mechanisms of Inflammation was very successful and helped to put CEMIR onto the scientific map. Repeating the conference in due time under the CEMIR logo will be highly beneficial.

Within the last funding period the recruitment of two young group leaders has contributed to the development of CEMIR by providing additional expertise. From the plans presented we foresee that these two groups will be central to future science at CEMIR by providing crystallization points and cutting edge techniques.

Some very nice publications have come out of the centre, both in terms of mechanistic studies and translational research. Translational research making use of biobanks and patient material has been important for previous research and will be even more important in the future. These resources are almost unique to CEMIR. Combined with the proven excellence of CEMIR in mechanistic studies, high impact results can be expected.

CEMIR is in a unique position of having six international adjunct professors, who play an important role in teaching graduate courses and serve as readily available collaborators and trainers for postdocs and students in highly specialized methods. Adjunct faculty are outstanding in their publication record with multiple papers in absolutely top journals. CEMIR is clearly on a positive trajectory with very high potential and is therefore likely to produce excellent output in the next phase.

7.10.2 Organisation

CEMIR has strong leadership from the Director and research group leaders and an overall culture of collective working. Projects emerge from the cross-fertilization of ideas from different research groups, organised under a set of Centre themes. These themes have been reorganised, following advice from the Scientific Advisory Board, into five areas for the second phase of the centre. Collaboration within the Centre is fostered by a series of events: weekly Centre meetings, research group meetings, group leader and research theme leader meetings, an article club, guest lectures and seminars and an annual retreat.

The Centre has the benefit of a substantial team providing technical (11 people) and administrative (1) support. In addition there is excellent infrastructure available for the laboratory-based work and for imaging (CEMIC). This infrastructure is based within the Faculty and thus more widely available; it is also secured beyond the life of the Centre. The availability of biobanks is also essential to the Centre's work.

The international collaboration is excellent. Researchers collaborate and co-publish with adjunct professors and younger researchers are encouraged to visit their laboratories. There is wider international collaboration with some 32 institutions. There is evidence of response to the suggestions of the Scientific Advisory Board: appointing new research group leaders in specific areas; running an international conference; having annual meetings; and seeking further faculty appointments.

Research students (on both PhD and MD pathways) are well supported and benefit from an excellent research environment. The adjunct professors run three week-long modules every year to provide specialist training and funding is available for conference attendance. Young researchers at all levels are enabled to become effective autonomous researchers, including applying for their own funding. Teaching is generally a choice not a requirement. While postdocs are also well integrated into the Centre they do not have the benefit of a dedicated mentor (separate from their scientific advisor). Neither the research students nor the postdocs have a specific forum nor formal representation within the meetings of the Centre.

Gender balance has been considered. There is a predominance of women among the research students and postdocs and efforts have been made to increase their representation at more senior levels. Since 2013 the percentage of female professors has risen from 17 to 28% and three of the five research theme leaders are now women.

7.10.3 Future Plans

CEMIR has a strong focus on basic innate immunity and how it relates to human disease and has established itself as a unique institute globally. They have a critical mass that can be developed further. The evaluation committee commends the combination of basic and translational research. This is reflected in the new theme names and milestones.

The proposed research and objectives expand on and extend the original goals. The primary objective of CEMIR remains the identification of new diagnostic tools and therapeutic targets for inflammatory diseases through research on inflammation initiated and regulated by pattern recognition receptors (PRRs). The current proposal has essentially the same objectives but the Centre has reorganised itself into 5 Research Themes to foster collaboration and provide synergy by incorporating the two new groups. It is pleasing to see that the established and ongoing biobanking system is playing an increasing role in the research plans.

The Adjunct Professor and International collaborations are very good but these should be periodically reviewed to ensure that all provide the same excellence in terms of student/Fellow mobility and skills, as well as high impact outputs.

The Centre leadership are aware of the need for additional university-level support and external international funding to ensure the long-term success of their focussed research. They have plans in place to achieve this.

7.10.4 Summary

CEMIR has made an excellent start and continues to produce excellent research outputs. The groups as a whole integrate well and show extensive collaboration. The science continues to go from strength to strength in both the basic and translational areas. The centre has recruited extremely well in specific areas to strengthen the science core.

CEMIR is well-led. Its scientific activities are well documented and the plans for the future are well established, particularly after the re-arrangement and more focussed perspective of the scientific themes. The collaboration with clinicians is highly commended.

THE CEMIR centre is well administered with excellent co-localization for all the scientific groups. It became clear during the site visit that the role of the SAB has been important for the scientific priorities of the centre.

The ERC Senior and Junior Fellowship submission plans are clear. The focus should perhaps be for more ERC Fellowships and increased applications for EMBO and Marie-Curie postdoctoral Fellowships.

Overall assessment: **Exceptional**

Recommendations

1. The Centre should continue to focus on a limited number of critical high impact basic and translational areas.
2. The integration and recognition of the centre in the faculty appears well established; however, a plan for a sustainable integration after the termination of the funding from RCN is recommended to ensure continuity of the scientific activities.
3. It is recommended to increase the number of applications for international research funding.
4. The international collaborations (adjunct professorships and other links) should be reviewed to ensure the same degree of excellence in terms of student/fellow mobility and skills, as well as high impact outputs.
5. It is recommended to have a postdoc/research student forum associated with the centre administration.
6. It is recommended that an annual/biennial major international research conference is established by the centre in order to improve the international visibility of the centre and its activities.

Conclusion

The midterm evaluation committee recommends continued funding for CEMIR.

7.11 Centre for Autonomous Marine Operations and Systems (AMOS)

7.11.1 Scientific output

AMOS is an excellent centre in terms of scientific output. It leverages on some very successful previous research in the fields of cybernetics and marine systems. The scientific output can be measured by, for example, the contributions from the Key Scientists, the AMOS Research Projects, the PhD candidates, and the AMOS Laboratories.

The five most important publications as cited by the centre are all papers in the main scope of AMOS, and they show the diversity of the research topics. However, three of these are overview papers and not all are in top journals. The Key Performance Indices for 2013-2016 show that the scientific output by quantity is on the level of excellent international research. One reason is the legacy from previous and ongoing projects including those based in Centre for Ships and Ocean Structures (CeSOS).

The Key Scientists have an excellent competence in control systems with applications in a broader sense, complemented with expertise in marine structures and hydrodynamics. The two most distinguished professors in terms of scientific impact are Thor I. Fossen and Tor Arne Johansen. They have a long track record of joint collaboration and very solid CVs and high impact factors. Kristin Pettersen is a world expert in motion control and robotics. This is confirmed by, for example, her IEEE Fellow Award from 2017. Jorgen Amdahl has a strong track record in marine structures and Asgeir Sorensen has a strong track-record in marine control systems with applications to ocean structures, ships and marine robotics. Marilena Greco is recognised worldwide for her expertise in marine hydrodynamics, which is only partly reflected in her current formal indicators. Globally, for marine structures and hydrodynamics, the scientific production, although at a high level, seems to remain dominated by the two senior scientific advisors, Torgeir Moan and Odd Faltinsen.

An important challenge that the centre faces is how to integrate the research in more general marine technology with that in cybernetics. This challenge is confirmed by the mapping of current co-publications across the centre staff which shows few publications with authors from the different areas.

To conclude, the quantity of the scientific output from AMOS is on the level of excellent international research. A unique advantage is the excellent infrastructure for combining theoretical research with very challenging real world demonstrations, which also provides an excellent basis for collaboration with industry and international partners and produces strong technological innovation. The weaker aspect is the lack of connection between the two key areas of AMOS.

7.11.2 Organisation

Since 2013, AMOS has developed into a substantial research and innovation centre with more than 90 PhDs. The core team, with 6 key scientists and 2 senior scientific advisors, has been strengthened with 23 affiliated scientists and adjunct professors. It is a well-structured centre with an excellent leadership and extensive experimental resources. The director of AMOS, Asgeir Sorensen has an appropriate background and competence for leading such a broad centre. The co-director Thor Fossen is also experienced and guarantees an excellent balance between applied research and theory. The structure with a board of directors, senior scientific advisors and an international

scientific advisory committee seems to work well, as does the support for innovation research partners and the user panel from research partners, companies and industry.

The centre has grown rapidly. To ensure a continuing high scientific level, focus and cohesiveness are some of demanding challenges that the leadership of the centre needs to consider in the next phase. With a centre with several nodes that are physically separated, this is an even larger challenge. For example, the interaction between the two knowledge fields: 'Hydrodynamics and Structural mechanics' and 'Guidance, navigation and control' seems already limited and the full potential is not yet been explored.

To ensure cohesiveness in the future, co-localisation would be ideal. This is also a wish expressed by the junior scientists during the meeting with the committee. Centre administrative support is being put under pressure by the growth. The centre is hosted by NTNU, and does benefit from its central administrative and management support. NTNU is to be congratulated on its commitment to AMOS and for having it centrally within its overall strategy.

AMOS is a centre with more than 90 PhD students. Research students are encouraged to have extended visits to overseas laboratories and institutions, which is welcome. In addition to required courses, the day-to-day research training of the individual students is a combination of support and advice from other junior scientists and meetings with the main supervisor(s) face-to-face from approximately every week to every month. The centre should consider if this could be further strengthened, e.g. by recruiting more post docs into the centre. More post docs may also be a good platform to improve the gender balance at the junior level.

Consistent with these ideas, the committee also felt the centre should explicitly develop structured research training plans for doctoral, postdoctoral students and junior staff, beyond the current EU Marine UAS platform and the Ocean School of Innovation. This training could also develop synergies with the planned research; it was unclear to the committee if and how such plans currently emerge. We recommend that AMOS should also consider ways to make itself an international destination for research training, for example, by having regular summer school courses covering the core research expertise of the faculty. Such an initiative would also be a strong recruitment platform. This would naturally best be done by working together with the existing teaching and training capacity of the centre and the wider departments/faculties.

7.11.3 Future Plans

The research questions for the second phase of the centre are almost the same as for the first phase. The focus is on autonomy and control for marine operations. These research questions are rather general, but the focus on marine systems makes the centre unique.

The extent of research fields that can potentially contribute to the development of autonomous marine systems is enormous. Clearly AMOS cannot cover everything and a clear focus on the main targets should be given. Also some important research topics are being addressed in the NTNU research departments, but need not explicitly be covered by AMOS, e.g. optimization of ship resistance and propulsion, hydroelastic modelling of large ships. What will be inside AMOS and what will be outside is difficult to figure out.

The specific research needed in hydrodynamics and marine structures modelling for reaching the targets of the centre is currently unclear, and plans for stronger interaction with marine cybernetics and control have yet to be developed. In addition to experimental work, advanced Computational Fluid Dynamics (CFD) modelling is certainly necessary for the development of innovative control strategies for underwater vehicles (e.g. improvement of the manoeuvring capacities via flow control

on appendages). The proposed plan to build competence in satellite technology seems less obvious for a centre in marine technology; the reason for this new field was not well explained.

It was not completely clear how the appointment of Geir Johnsen from Department of Biology to a Key Scientist' role will benefit AMOS. He will bring in important competence in terms of new applications for autonomous marine systems, but will add less in terms of the core technology. It would probably be more natural to strengthen competence in hydrodynamics and marine structures or the connections to computer science and software technology.

7.11.4 Summary

This is a very good centre that undertakes considerable excellent research, with a unique capacity in applications, making links across theory, numerical modelling, physical model building and experimentation. They have excellent facilities for trying out new technologies and tackling the difficult challenge of combining fundamental research with applied innovation. The outputs are strong and the throughput of research students very high. The infrastructure that the centre staff have access to provides an excellent research environment and the university is highly supportive of the centre's activities. However, the centre has not achieved full integration of expertise from across the different departments in terms of the research projects that it pursues. This raises a challenge for the second phase of the centre, where a distinctive integrated research environment and linked doctoral training programme could be developed.

Overall assessment: **Very good**

Main recommendations

1. Develop a stronger and more focussed scientific strategy that balances and integrates the different research areas that the centre covers.
2. Develop a strategy to publish an increased percentage of the AMOS papers in top-ranked journals and to co-publish more within the centre.

Recommendations

3. The strategy of AMOS with respect to the use of advanced CFD modelling should be clarified.
4. The suggestion is to have a more focussed "Future Key Scientist" strategy particularly in new exciting research topics (e.g. machine learning; cybersecurity; artificial intelligence), identifying and attracting talented junior researchers.
5. For those junior scientists, where appropriate, the centre should encourage them to do extended postdoc positions abroad, preferable at strongly competitive research institutions.
6. Consideration should be given to developing a series of activities (such as Away-days and regular meetings) which will enable greater integration of the research students supervised from different departments.
7. AMOS is encouraged to get inspiration from other RCN Centres of Excellence when developing its research training plans for doctoral, postdoctoral students and junior staff.
8. The University needs to recognise the challenges involved in having a major centre located across different departments, each with their own faculty and not co-located in terms of buildings.
9. It is recommended that AMOS together with NTNU ensures that the administrative support is sufficient for the increased interaction within AMOS.
10. Consideration should be given to increasing the size of the Scientific Advisory Committee and the frequency with which it meets.

Conclusion

Based on the generalists' comparison of several centres, their conclusion is that this centre, within 6 months, must present a report with a strategy to follow up the main recommendations. This report will be assessed before the final conclusion is reached.

7.12 Centre for Biodiversity Dynamics (CBD)

7.12.1 Scientific output

In general, the CBD is performing at an internationally leading level, producing a substantial body of high-quality publications in leading journals. There also appears to be a positive trajectory with respect to the volume of high-quality output, suggesting that the benefits of the Centre funding are beginning to be realized. Through this body of work, the CBD has made influential contributions on a series of important topics, including the links between ecological and evolutionary dynamics, quantitative genetic constraints to evolutionary change and fitness, the relationship between selection and plasticity, and evolutionary stasis.

To date, the CBD's contributions have been strongest in its traditional areas of activity: population ecology, evolutionary genetics and the links between these two research areas. It has been less successful with respect to the third research area, community ecology, and the links between community ecology and the other two areas. This is an important issue because it is the three-way links between the three areas that are the most important and exciting element of the research programme, so this shortfall needs to be addressed.

The CBD states that its ultimate goal is to “improve our ability to predict how changes in the environment affect biological diversity” at genetic, species and community levels. Again, there is evidence that the CBD is producing novel predictive models in the areas of population dynamics and adaptive change, and are using experimental and field study systems to test those models. But there is less evidence of this in the case of community ecology and, most importantly, it is not yet clear that they have identified a series of case studies, where improved predictions are urgently needed by external stakeholders.

7.12.2 Organisation

The Centre has a collaborative culture, supported by strong leadership, and a management structure that promotes discussion and interaction. This structure has been reorganised during the first period of the Centre from a flat, to a more hierarchical, format — a change much appreciated by the evaluation committee. This incorporates regular meetings between leaders of the research groups as well as of the Centre as a whole, together with an annual retreat. The Scientific Advisory Committee meets yearly and is acknowledged to offer robust advice, which the Director has taken on board.

The training of research students is effective but could be more prominently signposted as a research training programme. There are four courses offered by CBD members, as well as ad hoc workshops and NTNU courses. This year, a two-week summer school will take place in Trondheim, after having been delivered overseas in previous years. There is scope to embed and expand this. In terms of training, the Centre has the real opportunity to become a world-leading hub of scientific training that goes well beyond in-house workshops, postgraduate training, and early-career researcher development. The leadership group may wish to consider implementing a funded (or at least, partially funded) training series that invites applications from younger researchers globally to participate, from which only the top-level competitors will be successful. This could extend the typical ‘how to’ workshop series that focuses on specific methods to one that seeks to address research questions along with the methodological training to do so. This could be a certifiable series in the vein of the highly successful NCEAS (nceas.ucsb.edu) or NESCent (nascent.org) approaches in

the USA, where successful participants gain not only training, but publications, recognised certification, and prestige from involvement.

Research students are encouraged (for Norwegian-trained students, required) to go abroad for a period of time. Some further support is needed to enable research students to develop their career plans effectively. Early-career researchers are encouraged to become autonomous, making grant funding applications and leading their own groups. There is an annual research plan process that enables them to be mentored in their career development.

The host university, NTNU, indicated strong support for the Centre and links with their overall research strategy, but did not commit to specific resources to ensure the legacy of the CBD. The facilities for the Centre are good, but the split in location between Floor 1 and Floor 3 of the main building is problematic.

The Centre has taken a pro-active role in advancing greater gender equality that is to be commended. There is a member of staff with specific responsibility for promoting this and a Centre committee. Workshops have been held, both for female staff members and the entire Centre (a compulsory event). The composition of the Scientific Advisory Committee could also be revised to be more gender-equal, providing important role models.

The Centre is involved in the university's engagement with schools. There are plans in place to develop public engagement further through social media and new visual material. This will be based on bought-in expertise, but all Centre members should receive support and training in effective outreach, including younger researchers.

7.12.3 Future Plans

Clearly the challenge of reconciling the mechanistic links between population/genetic models and community-level dynamics has been recognised by the Centre leadership. The evaluation committee agrees that this is one of the principal challenges to fulfilling the Centre's ambitious aims. The Centre is identifying concrete ways of seeking to make these links. However, the plans need further elaboration, potentially along the following lines.

1. The principal questions to be answered from the planned linkage of the research streams are yet to be identified. These can take the form of detailed conceptual descriptions with possible avenues of analysis, with the view to publish these conceptual models prior to solving the analytical dilemma (see below).
2. In-house workshops run at regular intervals and organised by a cross-section of relevant principal investigators and members of their research teams could be helpful. These would ideally take the form of NCEAS/NESCent-style, 5- to 7-day analysis and writing sessions within dedicated spaces (preferably away from the investigators' primary working environment), with full catering, evening social events, and accommodation provided. The main aim of each workshop would be to analyse and write a specific paper that deals specifically with the community-population/genetic linkage, with the completion of a 1st draft at the end of the workshop. This would entail a good cross section of researchers (from PhD to top-level professors), substantial pre-workshop organisation (including data preparation), and freedom from external distractions.
3. Community genesis, resilience, and function are all well-established sub-disciplines of community ecology, but they remain largely phenomenological and are based on some overly simplistic rules of assembly (e.g., neutral vs. niche theory). The spatial components of these sub-disciplines are becoming more sophisticated, so linkages with other renowned community ecologists are desirable.

Names like Shurong Zhou (Fudan University), Marc Cadotte (University of Toronto), Fangliang He (University of Alberta), Kevin Gaston (University of Exeter), and Jean-Dominique Lebreton (CNRS, France) come to mind. With the explicit aim to provide new mechanistic (population dynamical) dimensions to rules of community assembly and maintenance (as well as ecological function) with the modern tools of spatial community ecology would be a fascinating innovation in ecology.

4. The line of enquiry regarding community-level means (or some other parameters) of functional traits might not necessarily provide the mechanistic underpinnings needed to resolve the issues stated above. The power of phylogenetic information is possibly more useful for explaining community-level variance in ecological function.

5. Restricting communities to specific guilds (e.g., birds, fish, etc.) is one way of marrying community and population ecology; however, incorporating multiple trophic levels describes more complexity in ecosystem behaviour. Therefore, marrying spatial community ecology with network theory might provide some of the pathways in which population dynamics can modify the mechanistic linkages.

6. Related to the scientific outputs already achieved, new lines of enquiry that deal specifically with the trade-offs between anthropogenic (artificial) selection through processes like offtake (hunting, poaching, pet trade, fishing, etc.) and adaptation to environmental change (e.g., climate change) could provide a better basis for an application to the sophisticated models being developed. Such examples could also serve as (admittedly simplified) test cases for the community-population links mentioned above. Elements within these could consider (a) optimal eradication/mitigation strategies for invasive pests, (b) how population extinction increases species extinction risk, and (c) when and where Allee effects and inbreeding depression begin to dominate persistence probability.

7.12.4 Summary

The Centre for Biodiversity Dynamics (CBD) has become a world-class research centre, attracting top rated people and doing cutting-edge research seeking to address questions of fundamental importance to biodiversity, and is performing at an internationally excellent level. The committee finds that the scientific research is of the highest calibre with an outstanding international reputation. The Centre is likely to become an even stronger international player within community and population ecology. The committee finds that the scientific strengths of CBD are in its capacity to apply advanced mathematical approaches to biodiversity questions AND its ambition to unify quantitative biodiversity theory across three levels of organisation (genes, populations, and communities). That remains a rare and exciting combination and there are clearly many future opportunities. However, the main challenges include inter alia combining the mechanistic linkages between spatial community ecology and population dynamics, and identifying and addressing examples of globally relevant biodiversity problems.

From the meeting with the junior scientists it emerged that research training is at a good level. The PhD students received good supervision, enjoyed a productive collaboration within the research groups and had the opportunity to visit the best laboratories in the world for extended stays.

The future research plans for CBD maintain the three core research areas (genes, populations, and communities) but propose to focus on a series of particularly interesting topics and, most importantly, to improve integration across the three themes. This is particularly important for the third research areas, community dynamics, which is currently less well integrated with the other two.

In conclusion, based upon the quantity and quality of the publications in top peer-reviewed journals, the number of presentations at international scientific meetings, the number of postdocs and PhD students, the number of awards received, the high caliber of researchers in the Centre and their

international reputations, and the importance of the scientific topics being pursued, our evaluation is that the Centre is on the level of excellent international research.

Overall assessment: **Exceptional**

Recommendations

1. The Centre should focus on the big challenge of unifying population dynamics, evolutionary genetics and predictive community ecology.
2. The university needs to communicate clearly how they will support the Centre after the RCN funding ends.
3. In terms of training, the Centre should take the real opportunity that exists to become a world-leading hub of scientific training.
4. Early-career researchers and research students should be involved at an early stage in the new initiatives that research groups are proposing to enhance collaboration within the Centre.
5. All options to move towards the goal of gender equality within the senior level of the Centre should be pursued.
6. There should be clear career pathways after postdoc positions, to retain scientifically excellent early-career researchers.
7. The university should provide single, unified space for the Centre to enable them to fulfil their interdisciplinary mission.

Conclusion

The midterm evaluation committee recommends continued funding of CBD.

7.13 Centre for Neural Computation (CNC)

7.13.1 Scientific output

Since its creation in Trondheim in 2013 the CNC has become a world-leading centre in systems neuroscience research. It has a strong focus on the grid cell system in the medial entorhinal cortex, which was discovered by Edvard and May-Britt Moser in Trondheim over a decade ago (as recognised by the award of the Nobel Prize in 2014). Grid cells have inspired an entirely new field of neuroscience, in which they remain the undisputed world leaders. Grid cells have attracted attention from both experimentalists and theorists as they represent a neural mechanism for path integration, and it is difficult to over-emphasize the remarkable impact their discovery has had - and continues to have - on fields as diverse as computational neuroscience, psychology, cognitive neuroscience, neuroanatomy, etc. To support, complement and extend their work on the grid cell system, the leaders of the CNC have attracted an outstanding team of scientists to the Centre, who are now well-integrated into the local scientific environment and producing world-leading work.

The quality and impact of the work produced by CNC scientists is at the highest international level, judged by any standard. First, they have published many groundbreaking papers in top international journals, with a dozen papers in the leading journals in the field (e.g. Nature – including 3 Nature Articles, considered the pinnacle of scientific publishing; Science; Neuron; Nature Neuroscience; etc) during the review period – a remarkable track record of achievement. Second, they have attracted the most prestigious competitive international funding, including ERC grants at various levels (3 Advanced Grants to May-Britt and Edvard Moser; a Consolidator Grant to Doeller; and Startup grants to Yaksi and Whitlock), HFSP grants and NIH grants. Third, scientists at the Centre have been awarded numerous scientific prizes and distinctions, most notably of course the Nobel Prize to May-Britt and Edvard Moser, but also the Louisa Gross Horwitz Prize, the Lashley Award, and the Koerber European Science Prize to the Mosers; FENS Young Investigator Prize to Yaksi; and the Radboud Science Award to Doeller. Fourth, scientists at the Centre are regularly invited to give seminars at renowned institutions around the world (often for keynote and named lectures). Fifth, the Centre attracts some of the best students and postdocs from around the world, a testament to its outstanding scientific reputation. Finally, the renown of the centre is demonstrated by the large volume of media interest in the Centre, as well as coverage of discoveries made by CNC scientists by respected international newspapers such as the New York Times, Huffington Post, the Guardian, and Scientific American.

In summary, the quality of the scientific output from the Centre is indisputably in the category of “excellent international research”; indeed the Centre is one of the most successful and productive neuroscience centres worldwide, providing an outstanding and inspiring beacon for a new kind of neuroscience research at the interface of systems, molecular, anatomical and computational neuroscience.

7.13.2 Organisation

The CNC has built a very well-functioning organisational structure now composed of 7 research groups with complementary approaches to the common mission. The matrix organisation is built upon the research groups working on 10 work packages with contributions from several groups in each project. The centre leaders meet each week to discuss scientific as well as organisational issues. In addition there are meetings of the whole centre (including early career researchers), together with

a journal club, data club and occasional retreats. Together this structure contributes to a very collaborative culture within the centre.

The technical support and animal care is well developed. The administrative support likewise gives the centre an impressive capacity to organise conferences, summer schools, research exchange, visitor programs, recruit internationally and engage in outreach. Moreover the efficiency of the administrative apparatus allows the scientists at all levels to focus their efforts on world-leading scientific research. The CNC has an exemplary track record of public dissemination, providing stories to large global newspapers and organising public lectures and science festivals, resulting in near-daily media coverage and engagement of school children and adults of all ages.

The MSc and PhD programs are well functioning with 16 finished PhD candidates and currently 22 PhD students. The possibilities of having international master students and medical students on a fast track MD are interesting. The idea that young PIs get two mentors – one national and one international - sounds very stimulating for the education of young talent. Research students similarly get joint supervision and postdocs get a scientific mentor. The national Research School is impressive in its scope. It includes advice on non-academic careers; a PhD networking event every two years provides this for students who do not attend the summer school. Overall, the fact that the alumni from 30 countries have obtained tenured jobs at excellent universities speaks to the centre's effective and high-level training.

The Scientific Advisory Board is composed of 5 renowned international scientists that meet every 3 years. While this might be considered infrequent, the SAB has given a number of clear recommendations that the CNC has followed.

There is a good gender balance at the research student and postdoc level. The centre and the faculty recognise the importance of addressing issues of gender imbalance at the higher levels of centre staff and are seeking to make some progress through the appointment of a new research leader in the near future.

CNC is now formally organised under the Kavli Institute, which is permanent and part of the Faculty for Medicine and Health Research. This new arrangement seems to rationalize the relationships between the different parts of the university organization for CNC. A new chair of the Institute is soon to be appointed; currently Professor May-Britt Moser is chairing the Institute. The Evaluation Committee's understanding is that the university has given a clear commitment to CNC through providing posts for key research leaders in the event of the centre's funding being reduced; however, there is a need for a similar commitment on research infrastructure and running costs.

7.13.3 Future Plans

The overall aim to CNC for the next 5 years will remain in line with the objectives previously defined for the first 5-year period, namely to "understand how brain cells work together in complex networks to generate higher mental functions". Building on the discovery of grid cells 12 years ago, they will ask how a well-defined neuronal circuit can be involved in memory.

As in the past, the overall strategy will be high risk – high gain, a strategy fruitful so far. The research program is organised into a series of 10 workpackages, including the seven workpackages initially planned, which have now been complemented by 3 additional workpackages focusing on areas represented by the 3 new recruits (minibrains; parieto-frontal circuits; entorhinal codes in human cognition and their degeneration during Alzheimers disease). An additional workpackage on the developmental aspects of brain networks is proposed but its implementation will depend on the successful recruitment of a specific high-level female candidate.

The research objectives are astonishingly ambitious, precise and underpinned by intense cooperative efforts between the seven principal investigators since all workpackages involve at least two principal investigators. An additional feature of the programme is that they rely on a combination of recent technological advances that permit exquisite manipulation, recording and imaging of neural activities in brain networks.

Based on these scientists' remarkably productive track records, it is highly likely that the different projects will be successful. First, the expertise of the different groups in their respective fields is world-leading. Second the technical support is excellent. Third, the objectives are well thought-out, focused and realistic (even though very ambitious).

In conclusion, the Committee acknowledge the excellence of the research plans of the CNC for the next 5-year term.

7.13.4 Summary

The Centre for Neural Computation was inaugurated in 2013 based on May-Britt and Edvard Moser's initial work on grid cells with a strategy described in 7 well-defined work packages. During the last 4 years the centre has further established its role as a world leading centre working towards unravelling how we navigate through space. The scientists are clearly driven by curiosity, go directly for the big questions, apply the techniques necessary to address these, and have annually made break-through discoveries in the field. The centre now has 7 groups with complementary scientific expertise, all contributing to the common mission in a matrix organization. The centre forms a fruitful environment for the career development of PhD students and postdocs. CNC recruits highly talented junior and senior scientists and has put Trondheim on the global neuroscience map. It is strongly recommended that the centre is continued for another 5 years.

Overall assessment: **Exceptional**

Recommendations

1. To provide for the stability of this national flagship research centre and secure its long term future, an early decision on continuation of funding beyond 2023 is needed to avoid the risk of losing excellent scientific capacities.
2. The commitment of the university to making permanent key research leaders posts within the centre is highly laudable and essential for retaining the remarkable collection of talent that has been assembled here; it would be highly desirable that a commitment could also be given to funding research infrastructure, laboratory space and running costs.
3. Consideration should be given to appointing a personal mentor for postdocs.
4. The provision of career discussions with PhD students and postdocs should be enhanced, including further exposure to an international range of job opportunities within and outside academia.

Conclusion

The midterm evaluation committee recommends continued funding of CNC.

8 The Evaluation Committees' Conclusion

The midterm evaluation committees find most centres to be "Exceptional" and a few "Very good" or "Very good to exceptional". Whereas all centres get top score on scientific quality, there are a few concerns regarding the organisation of some centres. The committees find it beneficial that four centres develop specific parts of their strategy further and therefore conclude that the decision on continued funding of those four is postponed and made contingent on approval of a report that addresses the committees' concerns. The conclusion for the nine other CoEs is that funding should be unconditionally continued.

9 Observations and Recommendations from the Generalists

The generalists each visited several CoEs and their observations and general recommendations are listed below.

9.1 Observations Regarding the Centres

- Overall, the performance of the centres was impressive, with a considerable quantity of research being undertaken at the forefront of international knowledge boundaries. Innovative connections are being made between different fields and approaches, suggestive of significant new findings.
- The centre directors and many key scientists in the centres are internationally well known for the high quality of their research. All centres have published in field-specific top journals.
- Many centres have published research in top multidisciplinary journals such as Nature and Science and impacted on several research fields.
- The centres have attracted world class scientists and have employed them as professors, associate professors or guest researchers. Their contribution to both research, supervision of students and as role models for postdocs is an essential factor for the centre's success.
- The CoE status has increased the number and quality of applications for postdoc positions at the centres.
- The centres provide excellent and cross disciplinary environments for PhDs and postdocs.
- All centres have developed new courses; new PhDs and master courses give the students the background for performing their own research in the centre. In addition, all centres arrange international summer schools or research schools on the research topics of the centre.
- The centres have been actively disseminating their research and have been very visible in Norway.
- The centre directors and scientists at the centres give many invited talks at key conferences.
- The centres receive very good administrative support.

9.2 General Recommendations to the Centres

- The centres are alerted to the need for a revised research strategy as they move from the first to the second 5-year period of funding, giving their research greater focus and concentrating on the most innovative aspects likely to deliver results. Focus must be on creating synergy between any fragmented research areas of the centres.
- Strong and dynamic leadership in terms of prioritising the most promising directions of the research and defining new territories of research at the interface between different

disciplines is essential for the centres.

- It is important that all centres devise, adopt and monitor a strategy for publishing in the highest quality international journals.
- The centres need to focus more on securing international research funding to demonstrate international competitiveness.
- Young researchers/postdocs should be included in the centre's leadership team.
- Retirement of the centre director must be planned very early. The new centre director must actively create her/his own strategy for the centre and bring in renewal in order to sustain the centre's ability to perform breakthrough research. When key scientists retire, the centre's strategy should state clearly whether the competence should be retained or whether new directions should be explored.
- Attention needs to be paid to the impact of the centre on mid-career researchers, as well as PhDs and postdoctoral fellows; these mid-career researchers may find themselves balancing ongoing teaching and administrative responsibilities with new research expectations in a way that can be difficult to handle. Much depends on how the funding for the centre is used in relation to these staff members.
- The centres should ensure that there is an appropriately tailored and fully implemented research training programme for PhD students. Such a programme should include one responsible supervisor and a second supervisor (e.g. international professor from another field within the centre), common courses for all PhD students in the centre to create a cross-disciplinary knowledge basis, encouragement to participate in the centre's international research schools, planned meetings with supervisor, plans for conferences and publishing, exposing the students to an international network and mentoring on writing applications and the writing process. As there will not be positions for all the excellent PhDs and postdocs in academia, exposing students to other career options and transferrable skills is also important.
- In order to attract the best local students to the centre, teaching at bachelor/master level, dissemination targeted at students, invitations to student tours at the centre and a good connection to the university department(s) are important factors.
- Co-localisation is a key factor for fruitful collaborations within the centre. If that is impossible, it is crucial to create mandatory meeting points for all employees in the centre. The students need to have common seminars and meet on a frequent basis.
- The centres should already focus on the legacy of the centre, i.e. develop a strategy for project applications that will support the strong research environment and the cross disciplinary research to be partly maintained by project funding after the centre ends.

9.3 General Recommendations to the Host Universities

- Co-localisation is essential to the value of being a CoE because daily exposure to cross-disciplinary discussions fosters breakthrough ideas and creates a fertile training environment for students. The universities are urged to prioritise co-localised space for the centres, also as they grow in size.
- The centres attract very talented postdocs and young researchers. For some selected scientists the faculty should see their opportunity to keep them, for example through bridge- or tenure-track positions.
- The universities should support the centre after the 10-year period by securing positions for the outstanding researchers. To secure the best research, the universities must be clear on their financial support after the RCN financing ends. Also, the most fruitful cross-disciplinary research should be supported as well as the co-localisation of research from e.g. different

departments or faculties.

- There is a distinction between those centres based in the humanities and social sciences, and those based in natural and medical sciences. There are rather different research cultures operating that affect publication strategies, the approach to PhD students and expectations of collective work. This may lead to supervision overload on key scientists, and since this work does not lead to publications, cause their own research to suffer. The different institutional situation of the humanities/social sciences and the natural/medical sciences may need consideration.

9.4 Comments on the SFF Funding Scheme

- The RCN CoE funding scheme is an outstanding programme for Norway and the RCN is to be congratulated for its great success. The CoE scheme provides medium/long-term certainty to underpin investment in the best researchers and their ideas. From similar programs in other countries it is well documented that this type of funding creates new important science and establishes internationally recognised research environments to train the next generation of top scientists. It is also known that the societal impact of such a funding model is significant.
- The centre directors express that interaction between them is important so that they may exchange experiences and learn from each other. Retreats and courses where they get the chance to meet should be arranged by the RCN.
- The RCN should follow up the centres on how they ensure the next generation of internationally competitive scientists.
- There is an issue regarding how the infrastructure for some research (both equipment and space) is safeguarded both during the life of the centre and afterwards.

10 Signatures



Prof. Yvonne Rydin



Prof. Evamarie Hey-Hawkins



Prof. Thomas Sinkjær



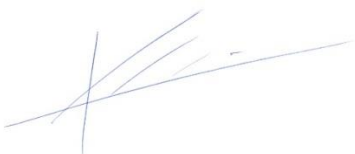
Prof. Søren-Peter Olesen



Prof. Klaus Bock



Prof. Paul D. Kaufman



Prof. Bart de Moor

11 Attachment 1: SFF-III Centre Names, Alphabetical by Acronym

Centre acronym	Centre name	Centre director(s)	Host institutions
AMOS	Centre for Autonomous Marine Operations and Systems	Asgeir Johan Sørensen	Norwegian University of Science and Technology
BCSS	Birkeland Centre for Space Science	Nikolai Østgaard	University of Bergen
CAGE	Centre for Arctic Gas Hydrate, Environment and Climate	Jurgen Mienert	University of Tromsø
CBD	Centre for Biodiversity Dynamics	Bernt-Erik Sæther	Norwegian University of Science and Technology
CCBio	Centre for Cancer Biomarkers	Lars A. Akslen	University of Bergen
CEED	Centre for Earth Evolution and Dynamics	Carmen Gaina	University of Oslo
CEMIR	Centre for Molecular Inflammation Research	Terje Espevik	Norwegian University of Science and Technology
CERAD	Centre for Environmental Radioactivity	Brit Salbu	Norwegian University of Life Sciences
CISMAC	Centre for Intervention Science in Maternal and Child Health	Halvor Sommerfelt	University of Bergen
CNC	Centre for Neural Computation	May-Britt Moser	Norwegian University of Science and Technology
MultiLing	Centre for Multilingualism in Society across the Lifespan	Elizabeth Lanza	University of Oslo
NORMENT	Norwegian Centre for Mental Disorders Research	Ole Andreassen	University of Oslo
PluriCourts	Centre for the Study of the Legitimate Roles of the Judiciary in the Global Order	Geir Ulfstein, Andreas Føllesdal (alternating)	University of Oslo

12 Attachment 2: Mid-term Evaluation of SFF-III: Terms of Reference

Midterm Evaluation of SFF-III: Terms of Reference
February 2016

1. Introduction..... 2

2. The midterm evaluation objective..... 2

3. The midterm evaluation outcomes..... 2

4. The midterm evaluation criteria..... 3

 4.1 Evaluation criteria for the first five-year centre period..... 3

 4.2 Evaluation criteria for the project description for the last centre period..... 4

5. Evaluation committee members..... 4

6. Time schedule for the midterm evaluation 5

7. Background material for the evaluation committee 5

Appendix 1: Relevant parts of the SFF-III contract for the mid-term evaluation..... 6

Appendix 2: Background material to be sent to the evaluation committee..... 7



1. Introduction

Thirteen Centres of Excellence (CoE) were started between January and September 2013. These centres were selected in the third call for CoEs and are in Norwegian referred to as SFF-III. Their first five-year financing period will thus end between January and September 2018. The centres will be midterm evaluated in 2107. Based on the mid-term evaluation, the Research Council will, for each centre, decide whether or not the centre will receive financing for the second five-year period.

The 13 centres, labelled by their acronym and the centre leader surname, are presented in Table 1. The headings indicate the overall research field of the centres and their geographic locations.

	Life Sciences	NatTek	HumSam
Trondheim	Neural Comput. (Moser) <i>CEMIR</i> (Espevik) Biodiversitet (Sæther)	<i>AMOS</i> (Sørensen)	
Oslo	<i>NORMENT</i> (Andreassen)	<i>CEED</i> (Torsvik)	MultiLing (Lanza) <i>PluriCourts</i> (Føllesdal)
Ås		<i>CERAD</i> (Salbu)	
Bergen	<i>CISMAC</i> (Sommerfeldt) <i>CCBIO</i> (Akslen)	<i>Birkeland</i> (Østgaard)	
Tromsø		<i>CAGE</i> (Mienert)	

2. The midterm evaluation objective

The primary objective of the midterm evaluation is to form the basis for the decision regarding whether to continue the individual centre for the remainder of the total 10-year period or to terminate the centre's SFF funding and status after five years. This was stated in the 2011 call and in the SFF-III contract between the Research Council and the host institution for each centre.

Appendix 1 contains text extracts from the "Requirements and guidelines" that are relevant for the midterm evaluation. The document "Requirements and guidelines" is a part of the SFF-III contract between the Research Council and the host institution for each centre and was also published in the 2011 call.

3. The midterm evaluation outcome

An evaluation committee will be appointed specifically for each centre. Based on the background material provided by the centre and the impression from a *site visit*, the evaluation committee will write a midterm evaluation report. The report will comment on how well the centre meets the midterm evaluation criteria. The three main criteria are the same main criteria as in previous SFF midterm evaluations:

1. The scientific quality
2. The centre organisation
3. The plans for the second five-year period and the strategy for the centre after this

The midterm evaluation report will also encompass a list of concrete recommendations for each centre and assign one of five grades between "weak" and "exceptional".

The committee shall conclude with a main recommendation. The main recommendation for a centre will be one of the following three:

1. Continue the centre for the last five-year period.
2. The centre must take corrective actions in order to follow up important recommendations. After 6 months, the actions will be evaluated as sufficient or not, and the centre will be recommended to be continued or terminated.
3. Terminate the centre.

The Executive Board of the Research Council of Norway will decide, for each centre, whether or not the main recommendation from the midterm evaluation will be followed.

If the Board's decision is that a centre must take corrective actions, the centre's actions will be evaluated after 6 months. The administration of the Research Council may call upon the evaluation committee, or additional expertise, for the evaluation of the actions in those cases where such expertise is of importance. The new evaluation will recommend continuation or termination of the centre. The Executive Board of the Research Council of Norway will decide on whether or not to follow the recommendation. The centre will not be terminated before this board decision, even if the 60 months first period is exceeded.

The evaluation report will be made public.

4. The midterm evaluation criteria

The centres will be evaluated both with respect to their achievements so far and with respect to their plans for the last five-year period.

4.1 Evaluation criteria for the first five-year centre period

The main criterion is the scientific quality:

1. *Is the quality of the scientific output from the centre on the level of "excellent international research"?*

The organisation of the centre is also to be evaluated:

2. *Is the centre's organisation excellent for the research?*

Under this point, there are additional sub-points to be evaluated:

- *Has the scientific output been profiting from the "organisation as a centre" (e.g. interaction between researchers / research groups)?*
- *Does the research management contribute to improved research?*
- *Is the quality of researcher training (PhD) on a high international level?*
- *Are the plans for career development for junior researchers good and is independence encouraged?*
- *Is the international research cooperation excellent and contributing to research?*
- *Is the centre attracting excellent research talents and researchers?*
- *Is the outreach/dissemination of high quality and of a suitable volume?*
- *Have the actions to improve gender balance, in particular among the senior researchers or potential senior researchers, been functioning well?*
- *Are the partner institutions contributing to the centre?*
- *Is the administration and technical support of high quality?*
- *Is the physical organisation of the centre working well?*
- *Is the centre well supported by the host institution management?*

4.2 Evaluation criteria for the project description for the last centre period

The project description for the second five-year period may refer to the present research and state that all - or parts of the present research will be continued. In addition, new directions of the research (if any) must be emphasized, and dis-continued research must be mentioned. A rough implementation plan for the research is an important part of the description.

When it comes to the organisation, emphasise plans to employ researchers with specific new expertise (if any), re-organisations (if any), changes in the researcher training (if any), the plan for submitting proposals to international funding schemes, plans for improving gender balance and plans for the centres' research after the 10-year financing ends.

Evaluation criteria for the research plans:

- *To what extent are the proposed research and objectives still ambitious, with the potential to achieve ground breaking results?*
- *To what extent is the outlined scientific approach for the second period feasible?*
- *To what extent are the proposed timescales (implementation plan) and resources (financial, use of research infrastructures, etc.) necessary and properly justified?*
- *To what extent are changes in the research positive and well justified?*

Evaluation criteria for the organisation of the centre:

- *Are there offensive plans for preparing and submitting proposals to Horizon 2020 (in particular ERC) or other international funding schemes appropriate for this field of research?*
- *If the scientific field is characterized by a gender imbalance, are the plans to support development of research talents of the under-represented gender towards qualification for more senior-level positions appropriate?*
- *To what extent are changes in the organization positive and well justified?*

Is the strategy for continuation of the most successful research after the second period realistic and sufficient? (< 0,5 page)

5. Evaluation committee members

The evaluation committee for each centre consists of 4 members:

- Two internationally recognized experts in the research field(s) of the centre.
- Two international generalists – professors with a broad experience in research and management of research groups/centres.

The two experts will be specific for each centre. In total there will be 3 generalists that each will visit 8-9 centres. The generalists will therefore get an overview over many centres and be able to compare the different centres.

The members of the evaluation committee for each specific centre will receive the background material (see next section) two months before the evaluation *site visit*. The committee members are asked to:

- Read the self-assessments and annual report from the centre. Other information available through websites, science indexes, journals etc. may also be assessed for a fuller picture.
- Prepare a sketch for the evaluation report and formulate some questions to be sent to the centres before the *site visit*. (Other questions may pop up and be discussed at the *site visit*.)
- Conduct *site visits*.
- Write a consolidated assessment report. Correct any factual mistakes after consulting the centre on the text

6. Time schedule for the midterm evaluation

2016 / May	The centres are informed about the midterm evaluation criteria, required background material, timeline and procedure.
2016 / July	Centres may suggest 3 impartial experts in their field(s). The administration may appoint one of them to the evaluation committee.
2016 / Nov	Appointment of evaluation committees
2017 / Mar 1 st	Submission deadline for self-evaluation and annual report for 2016
2017 / Mar 15 th	Material is sent to the evaluation committee
2017 / May/June	Evaluation committee performs site visits (3 full weeks with 1-week breaks)
2017 / June	Evaluation report from the evaluation committee is finished and sent to the centres for fact check
2017 / Aug/Sep	Research Council deadline for submitting the Evaluation Report to the Executive Board

7. Background material for the evaluation committee

The background material is specified in Appendix 2. In short, it will consist of:

- Annual report (with specified contents)
- Self-evaluation from the centre – a document from the centre director to the evaluators
- Self-evaluation from the host institution to the evaluators
- The financing and costs of the centre (at the host institution)
- Report from each partner to the evaluators, including centre-related financing and costs
- Project description for the last five years of the centre
- Information on contract changes etc. from the Research Council
- The SFF application and the call text from 2012

In addition, available open material on the internet etc. may be assessed by the evaluators.

Appendix 1: Relevant parts of the SFF-III contract for the mid-term evaluation

This appendix contains the text extracts that are relevant for the midterm evaluation, cut from the "Requirements and guidelines". The document "Requirements and guidelines" is a part of the SFF-III contract between the Research Council and the host institution for each centre and was also published in the 2011 call.

§ 12 Scientific and administrative follow-up

12.4 About 3 ½ years after the centres are established, a midterm evaluation of each centre is to be conducted under the auspices of the Research Council of Norway. The evaluation will be conducted using a common process for all the centres and on the basis of a mandate decided by the Research Council's governing bodies. The evaluation is to assess the scientific results achieved by the centres relative to the original project description. Further, the evaluation is to assess the plans for the centres' scientific activities in the potential final five-year period. In addition, the Research Council of Norway will evaluate the administrative framework at each centre. The Research Council will draw up the mandate for the evaluation, which will primarily be based on the same principles and aspects for evaluation as those used in the previous midterm evaluations of the individual centres.

12.5 The midterm evaluation will form the basis for the decision regarding whether to continue the individual centre for the remainder of the total 10-year period or to terminate the centre's SFF funding and status after five years, cf. Section 14.1. The Executive Board of the Research Council of Norway, or a party authorised by the Executive Board, will take the final decision on the matter.

.....

§14 The centres' period of operation – cessation of SFF funding from the Research Council

14.1 Research Council funding for each centre is provided for a period of up to 10 years from the start-up date. A midterm evaluation of each centre will be conducted under the auspices of the Research Council approximately 3 ½ years after start-up, cf. Section 12.5. If the evaluation has a negative outcome, the centre's funding will be dis-continued five years after the start-up date. If the evaluation is positive, the centre's period of operation will be extended to 10 years. Once SFF funding from the Research Council has ceased, be it after five or 10 years, the centre will no longer be part of the Centres of Excellence (SFF) scheme.

14.2 The Research Council of Norway will establish criteria for the evaluation and the decisions that will form the basis of the termination or extension of the centres after five years, cf. Section 12.5. The host institution must pay special attention to personnel-related factors when closing down a centre. In particular, upon cessation of activity, a host institution must ensure that master's and doctoral students have the opportunity to pursue and complete their study programmes on schedule.

Appendix 2: Background material to be sent to the evaluation committee

The centre director, the host institution and the partner institutions are kindly requested, before February 28th 2017, to prepare the following material for the assessment committee.

The material will create the basis for the evaluation with respect to the three overall criteria:

1. The *scientific* quality
2. The centre *organisation*
3. The *plans* for the second five-year period and the strategy for the centre after this

For each document listed below, the most relevant criterion is indicated in *italics*.

Annual ("glossy") report (mainly *organisation*, partly *scientific*)

The annual report for 2016 must be delivered to the Research Council by the end of March 1st 2017. The evaluation committee will need some facts from the centres that will probably be better presented and illustrated in the Annual Report than in the "self-evaluation report". The contents of the Annual Report shall therefore contain the following standard headlines (in addition to any self-chosen headlines):

- Highlights from the first four years (publications, books, prizes, major conferences arranged ++)
(*< 1 page*)
- Organisation chart of the centre (*< 1 page*)
- The centre board (*< 1 page*)
- Scientific Advisory Committee (*< 1 page*)
- Research groups with research leaders (PIs), researchers and fellowships (max 2 pages per group)
- Researcher training – PhD in the centre including a list of PhD dissertations so far (+ gender), postdoc training, courses (*< 2 pages*)
- Research collaboration across research groups in the centre – scientific results of collaborations in the centre and collaborative projects (*< 2 pages*)
- International collaboration – scientific results of collaboration, co-authorship (*< 1 page*)
- Dissemination and communication (*< 2 pages* including examples)
- Societal impact¹ or innovation/industrial impact (if relevant). Only concrete results (for example reports for policymaking and patents; but not "will be important for future...") (*< 2 pages*)
- Publication list (separate clearly between peer reviewed journal publications, books, anthologies, peer reviewed conference proceedings etc.; there is no need for a very long list; less important publications may be skipped and instead summed up by counting)
- Full list of personnel at the centre (*<2 pages*)

The major scientific results and research projects of the centre so far should also be presented, but it is up to the centre to decide where it fits into the annual report.

Self-evaluation report from the centre director

The self-evaluation should contain six parts indicated by (a) – (f) in what follows.

- (a) The centre's five most important scientific publications or other scientific outputs
(*scientific, ~1 page*)

Describe why these publications are important. What is the centres' role in this research?

¹ From "Evaluation of research in the humanities in Norway" 2016: "The impacts of the research may include, but are not limited to, changes in activity, attitude, economy, capacity, attention, competence, policy, practice, or understanding. The changes may occur among individuals, groups, organisations, in public opinion, or in society at large. The changes may be local, national or international." Effects on other research are the main focus of the SFF-III midterm evaluation and are not to be reported as impact cases.

(b) How can the evaluators identify the centre publications and the centre output?
(*scientific*, < 2,5 pages)

Define how the evaluators can identify the centre scientific production in Web of Science, SCOPUS, Google Scholar etc.)

Some examples:

- In the funding agency field, the publications may be identified by "Research" and "Council" and "Norway" combined with the grant number field "2232xx".
- The unique search string in the "address" field that identifies papers from the "Centre for Micro Biology" is "(Centre for Micro Biology) AND Bergen", and limited to the years 2013-2016.
- The unique search string in the "address" field that identifies papers from the "Centre for Micro Biology" is "((cmb OR ((center OR centre OR ctr) AND (micro OR micr) AND (biology OR biol))) AND (oslo OR bergen))", and limited to the years 2013-2016.

For some fields of research, mainly within the humanities and social sciences, important research may have been communicated through other channels than scientific journals and the academic impact of the work may be identified in other ways than through citations. If this applies (partly) to the centre's research, please define how the most important research can be identified. The centre's evaluation committee will discuss whether the suggested procedure is suitable for the centre's field of research. For these centres, the centres' identification in the Research Information System in Norway (CRISStin) may be relevant.

In some fields of research, indicators like "use of datasets by peers", "use of software tools by peers", etc. may be relevant to measure impact of research. If this is the case: please describe.

New research fields established by the centre or new cross-disciplinary research may not yet have achieved breakthrough results. Please describe between zero and four of the most promising research projects in progress, < one half page each. Describe the hypotheses, the research so far, preliminary results, plans and realistic outcome (including possible breakthrough results) of the research. Where or how will the future results most probably be published?

(c) Changes in research/research objectives (*scientific*, < 1 page)

How well have the original objectives been reached? Have the objectives or the research plans been changed? In that case: What was changed and why were the plans changed? (Possible answers: Very promising new results required more focus of the research in that direction, breakthrough in international research opened up new hot directions, we discovered dead ends, etc.)

(d) Scientific advisory committee (*scientific*, < 1 page)

When have the scientific advisory committee meetings been arranged? Briefly sum up comments and advice from the committee. Have the centre changed the research after these discussions? Why or why not?

(e) Core competence (*scientific*, < 1 page)

Did the centre lose any of its core members since the application phase? Did this have consequences e.g. for the collaboration in the centre or the planned interdisciplinary research? Will any of the research leaders (Principal Investigators) be retired in the second period? Which actions have been taken to replace current or future missing competence? Are there arguments for replacing lost/retired competence with a different competence instead of replacing?

(f) Organisation of the research, management and administration (*organisation*, < 1 page)

Elements that have functioned well, solutions that were less successful?

Financing and costs at the host institution (*organisation, ~1 page*)

- The spread sheet for SFF financing as defined in the progress reports (summing up 2013, 2014, 2015, 2016)
- Financing from and cost of partners
- Major cost elements at host institution (research infrastructure, reagents, expeditions ++)

Self-evaluation report from the host institution (*organisation, < 1 page*)

Did the establishment of the centre have impact on (not all points must be answered)

- Research at the host institution, research in other research groups (positive or negative)
- Interdisciplinarity, collaboration between departments/faculties internally at host institution
- Collaboration nationally/internationally
- Recruitment strategy
- Teaching/studies/courses/research schools
- Research strategy at host institution

Describe briefly the host institution's plans for the centres' most important research after the centre period is ended.

Report from each partner, including centre-related financing and costs

(*scientific, organisation; per partner: ~1page on organisation and <1 page on scientific*)

- Financing of the project at the partner
(use the SFF progress-report excel sheet for financing, for the partner)
- Major cost elements at the partner in the first period
- Describe the partner's contribution to the research in the Centre, publications in the research field of the centre, co-publications with host-institution or other groups in the centre


Project description for the last five years of the centre (*plans, < 6 pages*)

- 1) Planned research
- 2) Organization

The project description for the second five-year period may refer to the present research and state that all - or parts of the research will be continued. In addition, new directions of the research (if any) must be emphasized, and dis-continued research must be mentioned. A rough implementation plan for the research is an important part of the description.

When it comes to the organisation, emphasise plans to employ researchers with specific new expertise (if any), re-organisations (if any), changes in the researcher training (if any), the plan for submitting proposals to international research funding schemes and plans for achieving gender balance among senior researchers.

In addition, the strategy for continuation of the most successful research after the CoE-funding ends must be briefly described.



This publication may be downloaded from
www.forskningsradet.no/publikasjoner

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Cover design: Design et cetera AS

Oslo, October 2017

ISBN 978-82-12-03643-7 (pdf)