

Multi- and Interdisciplinary Research on Environment and Development

Action Plan 2002 – 2004



Environment and Development Division

Multi- and Interdisciplinary Research on Environment and Development

Action Plan 2002 - 2004



**The Research Council
of Norway**

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Research Council of Norway
P.O. Box 2700 St. Hanshaugen
NO-0131 OSLO, NORWAY

Telephone: (+47) 22 03 70 00

Telefax: (+47) 22 03 70 01

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Foreword

The research challenges related to environment and development are complex and call for a comprehensive approach. Thus, multi- and interdisciplinary research provides an important tool for solving these problems. It is often the dialogue between disciplines that leads to the most exciting breakthroughs. Such dialogues are also important because they allow the individual researcher to place his or her research in a social context, and thereby enhance communication between the research science community and society at large.

The Research Council of Norway presented a number of instruments and measures designed to strengthen multi- and interdisciplinary research cooperation in its *Strategic Plan for Research on Environment and Development (1996)* and the *Action Plan for Environment and Development – Time to Take Action (1999-2001)*. Moreover, the *Environmental Action Plan (2000)* of the former Ministry of Education, Research and Church Affairs requested that the Research Council assess national experience with multi- and interdisciplinary environmental research, as well as examine and propose methods of evaluation and support that will promote research cooperation between disciplines. In Proposition to the Storting No. 1 (2002-2003), the Research Council is asked to continue its efforts to further develop expertise in interdisciplinary cooperation.

The Research Board for the Environment and Development Division has sought an active role in the efforts to strengthen multi- and interdisciplinary research. At a meeting on 12 December 2001, the Board adopted the *Multi- and Interdisciplinary Research on Environment and Development – Action Plan 2002-2004* as a follow-up to the guiding documents mentioned above. This action plan is intended to provide guidelines for the work of the Environment and Development Division, and to facilitate the overall efforts of the Research Council to deal with interdisciplinarity issues. It is our hope that this document will be useful in the national and international debate on how to tackle the challenges and capitalize on the potential of the interdisciplinary mode of working.

This plan is the result of a review of national and international documentation, as well as the outcome of a dialogue with the scientific community. We would like to thank all those who have participated for their important contributions to this work.

Oslo, May 2003

Karin Refsnes
Executive Director

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1 Executive Summary

The research challenges related to environment and development are complex and call for a comprehensive approach. Thus, multi- and interdisciplinary research provides an important tool for solving these problems. It is often the dialogue between disciplines that leads to the most exciting breakthroughs in science. Such dialogues are also important because they allow the individual researcher to place his or her research in a social context, and thereby enhance communication between the research science community and society at large.

In light of this, the Environment and Development Division wishes to strengthen its efforts regarding multi- and interdisciplinary research activities. A large number of detailed analyses and studies on interdisciplinarity have already been carried out. This action plan has a practical approach, focusing on the following questions: what are the barriers inhibiting interdisciplinarity; what is the relationship between interdisciplinarity and quality at different levels of education; how should guidelines and instruments be shaped to enhance the incorporation of multi- and interdisciplinarity into research on environment and development?

This plan is based on a review of existing documentation and other input from meetings, seminars, etc. The background, main objectives and basis for this document are described in greater detail in Chapter 2.

Chapter 3 examines the use of the many different concepts associated with multi- and interdisciplinary research. For the purposes of this document, the term “interdisciplinary research” has been employed as a collective designation for all research activities involving the interplay between two or more disciplines. As used here, the concept of interdisciplinary research encompasses a wide spectrum in terms of the scale of the research activity, its scientific range, the level of ambition relating to the integration of the sciences, the underlying motivation and the level of aggregation. The range is so great that there is no straightforward manner in which to deal with interdisciplinary research. The relationship between interdisciplinarity and the disciplines is also discussed. The main conclusion drawn is that disciplinary and interdisciplinary research represent two aspects of the

same issue. Interdisciplinary research is important both as a tool for solving problems and as a constructive contribution to disciplinary development.

Chapter 4 discusses various problems and issues associated with interdisciplinarity. It is shown that, despite a new positive trend, there have been and still are institutional barriers to interdisciplinarity; that it is important to incorporate interdisciplinary thinking into all stages of the planning and organization of research activities; and that interdisciplinary research activities often need more resources and longer time-frames than monodisciplinary activities do. Quality assessment of research projects has often discriminated against interdisciplinary research. While it is not necessary to devise specific quality criteria for interdisciplinary projects, an effort should be made to refine the common evaluation criteria to make them more applicable to interdisciplinary research. With regard to the education and qualification of researchers, it is difficult to determine when and how interdisciplinarity should be introduced in academic training. Consideration must be given both to achieving a solid disciplinary foundation and to ensuring openness towards other fields. Interdisciplinary fields are not perceived as possessing high merit in the same way as individual disciplines. This is due, among other things, to fewer possibilities to publish in high-status scientific journals.

What action can the Research Council take? Chapter 5 presents the specific measures that will be implemented by the Environment and Development Division. These can be summed up as follows:

The Environment and Development Division will

with regard to the relationship between interdisciplinarity and quality:

- Revise existing quality criteria and evaluation systems to ensure that these are suitable for use in assessing all types of research.
- Establish a resource group/panel of recognized experts that can be utilized in the evaluation and processing of applications for multi- and interdisciplinary activities.
- Request that the Culture and Society Division examine more closely whether there is a need to conduct further study into epistemological aspects of the interdisciplinary approach.

with regard to interdisciplinarity in the planning, organization and implementation of research:

- Devise a “checklist” containing points related to multi- and interdisciplinarity that should be kept in mind when appointing programme development groups, programme committees, etc.
- Incorporate special aspects relating to interdisciplinarity into the mandates of the programme development groups, programme committees, etc.
- Examine the potential of the programme committees to function as strategic bodies.
- Devise mechanisms to strengthen cooperation across programmes and divisions within the Research Council, across dividing lines between independent research institutes and between research institutes and teaching institutions.

with regard to interdisciplinarity and research funding:

- Maintain the practice of earmarking allocations to multi- and interdisciplinary problems and topics.
- Actively employ reward structures that encourage multi- and interdisciplinary cooperation where this is necessary.
- Request that programme and scientific committees, etc., actively follow-up the measures outlined in the *Strategic Plan for Research on Environment and Development* and the *Action Plan for Environment and Development – Time to Take Action*, and submit annual reports to the Division Research Board on the application of such measures.

with regard to interdisciplinarity and education:

- Invite academic institutions to participate in a dialogue on issues concerning interdisciplinarity, education and knowledge development.
- Provide grants for national and international researcher training courses where a special need for this arises.
- Provide supplementary funding for fellowship holders who need additional expertise from other fields in connection with their work on a doctoral degree.

with regard to interdisciplinarity and reward structures:

- Assess the status of academic journals in order to ensure equal opportunities to publish in scientific periodicals of proven quality for researchers in all fields of study, regardless of their disciplinary and/or interdisciplinary orientation.

2 Background, Main Objectives and Basis for this Document

The problems related to environment and development are complex and they call for a comprehensive approach. Individual disciplines can rarely provide solutions to such comprehensive problems, although they may contribute significantly to the “big picture.” Multi- and interdisciplinary research is not a goal in itself, merely a tool for solving problems. (Strategic Plan for Research on Environment and Development, Research Council of Norway, 1996).

Background

This action plan has evolved out of a desire to examine the measures employed by the Environment and Development Division to strengthen multi- and interdisciplinary activities. This will make it possible to determine whether these measures are adequately functional, and whether they are sufficient in light of national and international knowledge about the challenges posed by, and potential inherent in, interdisciplinary research cooperation.

The Strategic Plan for Research on Environment and Development and the Action Plan for Environment and Development– Time to Take Action 1999 – 2001 each present a number of strategic instruments and measures designed to strengthen multi- and interdisciplinary research cooperation. The Division has followed these up by encouraging larger (and when appropriate longer lasting) multi- and interdisciplinary projects under the auspices of the programmes as well as the independent funding schemes. Moreover, the programme committees have been asked to set budgetary targets within the relevant programmes for how much should be allocated to multi- and interdisciplinary projects, and a greater degree of interdisciplinarity has been stipulated in the strategic institute programmes. The Division has also decided to establish a specific set of rules for processing applications for multi- and interdisciplinary research projects. Follow-up of this last initiative has been deferred until the completion of this action plan.

The relationship between interdisciplinarity¹ and quality emerges as a topic of debate in virtually all national and international discussion concerning interdisciplinarity. The *Action Plan for Researcher Recruitment in Environment and Development 2001-2003* also focuses on this, among other things. One of the measures specified in that plan is the clarification of both the prerequisites for ensuring interdisciplinarity and the relationship between interdisciplinarity and quality at various levels – in basic higher education, doctoral programmes as well as at the post-doctoral level.

In its *Environmental Action Plan (2000)*, the former Ministry of Education, Research and Church Affairs requested that the Research Council assess national experience with multi- and interdisciplinary environmental research, and examine and propose methods of evaluation and types of support that will promote research cooperation between disciplines. Based on these recommendations, the Ministry will determine whether it is appropriate to earmark certain budget funds, e.g. independent project funding within environmental research, for multi- and interdisciplinary research activities.

Primary Objectives and Basis for this Action Plan

The “interdisciplinarity complex” comprises a scientific challenge that has been acknowledged by researchers and research funders alike, but they remain unable to find a satisfactory approach despite a wide array of analyses and studies. Methodological and theoretical issues, particularly in relation to problems associated with interdisciplinarity, have been a topic of discussion and investigation for as long as research on environment and development has occupied a place on the research policy agenda. The complexity of problems relating to environment and development makes this field especially well suited as a case study for identifying factors that respectively inhibit or promote interdisciplinary cooperation at a more general level. Factors relating to multi- and interdisciplinarity are a concern for the Research Council of Norway as a whole, and this action plan is therefore also intended to facilitate the Research Council’s general efforts to deal with these issues.

This document is the result of a process aimed at ensuring that multi- and interdisciplinary research is adequately incorporated into the Division’s

¹ To simplify the terminology in this report, the term *interdisciplinarity* will be used consistently, also in contexts in which the terms multidisciplinary or multi- and interdisciplinarity would be more correct.

activities. Most importantly, these involve strategic thinking, planning, application processing (programme-related and independently funded), evaluation and recruitment. Subsidiary goals include:

- clarifying factors and barriers relating to interdisciplinarity within research on environment and development;
- clarifying the relationship between interdisciplinarity and quality at different levels of education;
- devising guidelines and measures to strengthen the Division's efforts within multi- and interdisciplinary research on environment and development.

This action plan is based on a review of existing documentation and input from meetings and seminars within the Research Council and with partners to the Research Council. The purpose has been to extract conclusions from the extensive national and international efforts that have already been carried out, and to make these operational in the form of guidelines for the Division's activities. Contributions from the Division's programme committees, the independent research institutes and various central scientific communities as well as other Divisions of the Research Council have played an important role in this process. They have helped to identify and elaborate factors that are crucial to ensuring the success of interdisciplinary research initiatives. Examples of the written input received, in some cases in summarized form, are included throughout the text.

3 What is Interdisciplinarity?

There is every reason to believe that the need for knowledge about complex interlinkages and systems will intensify in the future. This implies that the research and education sector will have to increase its efforts to develop expertise and deliver results that reflect a composite reality. This is a challenge that must be faced by education and research institutions, the Research Council and the financing authorities. A submission from Dr. Anne Lyche Solheim, former deputy chair of the programme committee for the research programme *Globalization and Marginalization. Multi- and interdisciplinary research on development paths in the South*, pinpoints this challenge:

“The knowledge that we seek is fundamentally interdisciplinary in nature...”

Dr. Anne Lyche Solheim

For developing countries, sustainable development is far from realized in a reality characterized by uncontrolled urbanization and industrialization, continued rapid population growth and further marginalization of the poorest segments of the population. The overexploitation of the resource base in developing countries is increasingly apparent. This is manifested in the destruction of the rain forests, declining aquatic fish stocks, accelerating air pollution and an acute lack of water combined with mounting water pollution, which in turn generates escalating health problems and diminished food security. If we are to solve these problems, we will need more knowledge about the links between the environment and development viewed in the context of the problems confronting developing countries. The knowledge that we seek is fundamentally interdisciplinary in nature, and should generate new research programmes in the interface between environmental and developmental research.

3.1 A Multifaceted Concept

The purpose of the Environment and Development Division in examining the issue of interdisciplinarity is a practical one, and is not aimed at

debating the pros and cons of interdisciplinarity as such. Nonetheless, these efforts have indicated that there is still a need to probe some of the key epistemological aspects of the interdisciplinary approach. This is a matter that will require the attention of higher learning institutions as well as the Research Council, especially within the Culture and Society Division.

Problems relating to environment and development are complex, and call for a comprehensive approach in which a number of disciplines must participate, either in parallel or as part of a more or less binding cooperation. Thus, multi- and interdisciplinary activities both provide a crucial tool for problem solving and encourage originality and innovative research in the interface between disciplines. At the same time, excellence in research in individual disciplines will continue to be of paramount importance to the Division's activities.

Interdisciplinarity is not a goal in itself; it is a means of solving specific research questions. Such questions may be defined in a social context, or may arise from a disciplinary approach. Interdisciplinary research is not a precise concept to be distinguished substantively from other types of research; rather, it is a question of degree of integration. The purpose of working in an interdisciplinary mode is to open the door to a broader understanding of a problem and its magnitude.

There is also a more wide-ranging societal component to interdisciplinarity – as a channel for the flow of information between research and society. The individual disciplines have the advantage and disadvantage of isolating specific aspects of a problem. While this makes the problem easier to deal with, it also narrows its scope, thus decreasing its ability to provide answers to the complex issues with which society is concerned. In the context of society, the strength of interdisciplinarity lies in its capacity to depict the intricacy of the problem area, and, based on this, to communicate insight to society.

Interdisciplinary initiatives tend to emerge in scientific circles when the problem being subjected to research transcends the framework for a single discipline. At the same time, actors outside the research community have problems that need to be solved, and call for research to contribute to finding these solutions. The challenge lies in “matching” the internal scientific potential and needs with the external requirements. Experience from a project in the research programme *Fisheries in Developing Countries* provides a good illustration of this:

Management, co-management or no-management?

Researcher Eyolf Jul-Larsen

Probably the main reason why those of us who have been involved in the project decided from the outset to commit a lot of our time to preparing our application, lies in the framework and design of the Research Council's *Programme for Fisheries in Development Countries*.

- a) It is sufficiently specialized to make it realistic to apply for adequate funding.
- b) The work programme explicitly calls for a link between social science and biology/eco science.
- c) The programme called for solutions to practical problems, which was an advantage. It is unlikely that we would choose to participate in such a project merely to achieve scientific development within our respective disciplines.

It is common to distinguish between three types of interdisciplinary research, depending on the level of ambition in terms of the degree of integration²:

Multi-disciplinary research: autonomy of the different disciplines; does not lead to changes in the existing disciplinary and theoretical structures.

Inter-disciplinary research: formulation of a uniform, discipline-transcending terminology or common methodology; cooperation within a common framework shared by the disciplines involved.

Trans-disciplinary research (also known as cross-disciplinary): research based on a common theoretical understanding and accompanied by a mutual interpenetration of disciplinary epistemologies.

² Interdisciplinary Research on Development and the Environment. SUM Report No. 10.

Based on these distinctions, the terms employed in the *Action Plan for Environment and Development – Time to Take Action (1999–2001)* are defined as follows:

Multi-disciplinary research: *research in which several disciplines are used in parallel to elucidate comparable problems.*

Inter-disciplinary research: *research in which the theory and/or methods of several sciences are integrated into the same study and analysis.*

Viewing interdisciplinarity as a degree of integration between different disciplines makes it easier to deal with the inherent ambiguity of the concept. In this understanding of interdisciplinarity, there is a continuum of degrees of integration of research activities ranging from additive cooperation between two or more separate disciplines at one end to total scientific integration at the other.³ A view such as this does not imply a normative assessment of scientific integration as “better” than multi-disciplinary cooperation. The degree of interdisciplinarity is determined by the research question, it is not related to methodological appropriateness or project quality *per se*. The Centre for Development and the Environment at the University of Oslo (SUM) elaborates this point, among others, in its detailed comments to the draft action plan for multi- and interdisciplinary research.

Interdisciplinarity is expressed at different levels: in the structure and organization of research institutes and organizations, in teaching and in research. Requirements relating to interdisciplinarity are likely to be more diffuse and general when applied to interdisciplinary research communities as opposed to a specific research programme or limited research project. Within the Research Council, interdisciplinarity is primarily dealt with in terms of the planning, implementation and follow-up of research programmes and projects, but the ability of the Council to fulfil its objectives will largely be determined by the organization of scientific activities at research institutions and teaching programmes at higher learning institutions.

³ Forum for Development Studies 2/00: Molteberg, Bergstrøm og Haug: Interdisciplinarity in Development Studies: Myths and Realities.

The nature of interdisciplinary research activities may vary in terms of a number of different elements:

- Size – from projects carried out by an individual researcher to a large team of researchers. The former projects lead to a type of “personal interdisciplinarity” in which an individual researcher has full command of more than one discipline, which is seldom, or generates interdisciplinary integration by interpreting and applying research findings from those disciplines considered to be necessary and relevant to the overall analysis. Interdisciplinary activities tend to take place in teams of researchers, which again may vary greatly in size. There is some dispute within scientific circles as to whether or not interdisciplinarity is primarily a “team sport.”⁴
- The range of disciplines involved in a project – from closely related disciplines such as anthropology and sociology to the “gap” between natural and social sciences. On the one hand, it is presumed that disciplines which are close to each other work more constructively together; on the other, there are claims that cooperation may be easiest when there are clear dividing lines between the participants’ fields of expertise and when participants do not profess to have expert knowledge within the same area. Another distinction that is often made in this connection is between *hard* and *soft* sciences: Economists may consider it easier to cooperate with natural scientists than with anthropologists. While multi- and interdisciplinary cooperation across the “gap” is always regarded as an ambitious and high-risk endeavour, there is great potential in its ability to generate innovation in terms of theory and methodology and to find the solutions to complex problems. In its commentary to this action plan, the Nansen Environmental and Remote Sensing Centre maintains that an interdisciplinary approach towards disciplines other than the natural sciences is becoming increasingly important in projects related to problems involving climate and the environment. The example given below on technology choice and the genetic resource conflict also illustrates this point clearly. Yet another example can be found in the Biological Diversity Programme’s initiative to encourage a dialogue in the interface between human behaviour and scientifically defined environmental challenges.⁵

⁴ Forum for Development Studies 2/00: op cit.

⁵ *Managing the environment requires managing human nature*. Research conference organized 24 October 2000 by the Programme Committee for the Norwegian research programme on Biological Diversity - Dynamics, Threats and Management.

- Level of ambition – as regards degree of integration: multidisciplinary, interdisciplinary, transdisciplinarity. The level of ambition will depend on the problem.
- Underlying motivation – whether the initiative originates within the field of research itself (researcher-initiated/bottom-up impetus) or from the outside as a result of external societal needs (societally motivated/top-down impetus)
- Level of aggregation – whether the initiative involves interdisciplinarity within a single project, a series of individual projects, an overall programme or cooperation across programmes.

Technology choice and genetic resource conflicts

Professor Trygve Berg, Agricultural University of Norway

When the project was launched the conflict regarding agricultural genetic resources had become so heated that it was referred to as the “gene wars.” We assumed that the debate was generated by the interplay between three development trends: (1) intense commercialization and globalization of the seed industry, (2) developments in the field of intellectual property rights permitting patents on biological material, and (3) technological developments within plant breeding, with greater investment in capital and knowledge-intensive methods in biotechnology. We also assumed that developments related to globalization and patenting would be difficult to curb, but that alternatives and genuine choices were to be found in the area of technology. The question was: Did alternative technologies exist that could satisfy the current and future production demands without creating a situation in which resources were commandeered and monopolized by industry?

To find the answer to this question, we assembled a group consisting of a geneticist who specialized in quantitative genetics (Skrøppa), a plant breeder who specialized in biotechnological methods (Bjørnstad), a sociologist who specialized in intellectual property rights and international conflicts involving access to resources

(Fowler), and an agronomist who specialized in the agricultural systems of developing countries (Berg).

.....

In relation to many others who were exploring the same questions at that time, we arrived at clearer, more complete answers because our group encompassed expertise from both technical and social sciences. Both the sociologist (Fowler) and the expert on developing country agricultural systems (Berg) possessed sufficient technical insight into genetics and plant breeding to be able to ask questions and communicate with the two others. Nonetheless, the divergence between our different disciplinary cultures was apparent and, at times, very frustrating to me as the project manager. In the end, however, we ultimately managed to reach a conclusion that I found rewarding in terms of further follow-up. Within the local research community our report was considered provocative (some of the reactions were surprisingly strong), but internationally it received positive acclaim, and has helped to promote new thinking and further development.

When a scientific topic appears to call for an interdisciplinary approach, there are a number of elements that must be assessed during the planning and implementation stages, including: Who has initiated the research? Who is the user group? How should the project be organized? Which disciplines are involved? Which epistemological traditions are involved? What is the level of ambition?

The most important conclusion is that there are no fixed rules for dealing with “interdisciplinarity”. The range of interdisciplinary activities is extensive, and different types of activities will require different types of approaches.

3.2 The Relationship Between Interdisciplinarity and the Individual Disciplines

Interdisciplinary research does not exist in isolation from the ordinary, monodisciplinary activities at the various institutions, but takes place in the interface between several fields or disciplines. It is possible to view interdisciplinary research activities as a stage in the development of one or more

disciplines; a discipline is not an entity that has been delimited once and for all, but is constantly evolving. The next stage of the process may be the establishment of a new, independent discipline, split off from or a combination of several established disciplines. There are many examples of this: biotechnology, environmental and resource economics, physical chemistry, etc.

The Norwegian University of Science and Technology (NTNU) states as follows⁶: *In our view, the greatest potential of cooperation across disciplinary boundaries may well reside in the development of the individual fields of study and disciplines themselves. Strongly established, quality-conscious disciplines are necessary to achieve successful interdisciplinarity. At the same time, interdisciplinary cooperation may have a positive impact on the disciplines by providing new perspectives and methodological approaches. Thus, interdisciplinarity can augment the value of the various disciplines, enhancing their adaptability in the light of changing requirements due to development over time.*

Norwegian research activities are subject to increasingly stringent demands for enhanced quality at all levels. This applies to monodisciplinary and interdisciplinary research alike. In both cases, researchers need to have solid qualifications within their basic disciplines. This raises a number of pertinent questions: Can the same quality criteria be employed for interdisciplinary and monodisciplinary research? Given that researchers engaged in interdisciplinary cooperation must be well qualified within their own disciplines, how much knowledge do they need to have about “the other sciences” to take part in the cooperative effort? And given that a researcher’s interdisciplinarity requires broad insight into other fields while remaining rooted in a specific discipline, when in the course of the educational process is it most appropriate to learn to navigate across scientific boundaries? Questions such as these do not have straightforward answers, but require different approaches depending on the type of interdisciplinary research activity involved.

The most important conclusion here is that monodisciplinary and interdisciplinary research represent two aspects of the same issue. Interdisciplinary research is important both as a tool for problem solving and as a constructive contribution to the development of the disciplines.

⁶ Et foregangsuniversitet for samspill og samarbeid?. Rapport fra delprosjekt C i NTNUs strategiprosess. (A Pioneering Institution for Interaction and Cooperation? Report from sub-project C in NTNU’s strategy process) 2 June 1998.

4 What Are the Most Important Problems and Issues Related to Interdisciplinary Research?

Empirical studies on interdisciplinary activities commonly differentiate between scientific or “cultural” barriers on the one side, and obstacles of a more practical, organizational or financial nature on the other. The following provides a brief commentary on certain issues on which the Research Council wishes to focus its future efforts.

4.1 Institutional, Organizational and Financial Issues

Organization of Interdisciplinary Activities

Institutional Issues

It is in the common interests of the Research Council and the research community to ensure that the institutional configuration and organization of research activity in Norway is compatible with the scientific and educational challenges faced by the nation at all times. This applies to the higher education sector as well as the research institute sector. When it comes to interdisciplinary research, it could be said that, until now, the users of research results and research funders have comprised a “fan club” for interdisciplinarity, while the educational institutions continue to view this type of research activity with somewhat greater scepticism. While such a portrayal clearly comprises an oversimplification of reality, it serves to underline the joint challenge implicit in establishing positive framework conditions for the type of research that crosses traditional disciplinary boundaries.

The impact of organizational models and physical structures on patterns of cooperation has been well established. Contact and communication diminish with an increase in the physical distance and number of organizational divides such as institute boundaries at the universities and the delineation of divisions at the Research Council. The report of the Norwegian Institute for Studies in Research and Higher Education (NIFU) on interdisciplinary research in the Nordic countries contains a number

of examples that illustrate this.⁷ As educational institutions and as the “mother” institution for the various disciplines, the universities have a key role to play in disciplinary development, and thus in interdisciplinary research as well. In Norway, a major portion of the institutional interdisciplinary activity has been organized through separate centres or programmes, and has primarily taken place on the outer edges of conventional scientific circles without any clearly defined strategic foundation in the main activities of the various institutions. The establishment of such entities has often been controversial, and has been perceived as channelling funding away from discipline-based communities.

There are signs that this situation is changing. As a result of reforms in the university sector, the disciplines are increasingly becoming more open to input from other disciplines. And university researchers are cooperating across traditional dividing lines with a basis in their own disciplines, sometimes driven exclusively by internal scientific challenges, and other times motivated by new financing opportunities, for example from the EU. There is still a lack of interdisciplinary study programmes in Norway, although a few do exist. At NTNU, for example, a new programme linking energy and the environment has been launched. New approaches to problems are being identified, and this may in turn lead to a multi- or interdisciplinary focus in relation to research projects. Interdisciplinary Master’s degree courses are also becoming more common. Nonetheless, it should be noted that Norway lags far behind its neighbouring countries in this respect. Since 1989, Göteborg University and Chalmers University of Technology in Sweden have offered interdisciplinary degree programmes in environmental sciences from the undergraduate to the doctoral level. As a direct result of such programmes, interdisciplinary education and research have been given academic legitimacy and status on a par with discipline-oriented activities – an important point in terms of career advancement issues.

NTNU occupies a unique position when it comes to interdisciplinary activities. The institution’s strategy documents explicitly set out the objective of being an innovative university as regards cooperation and interaction across disciplinary boundaries.⁸ Experience from NTNU

⁷ *Tverrfaglig forskning i Norden: barrierer og forskningspolitiske virkemidler.* (Interdisciplinary Research in the Nordic Countries: Barriers and Research Policy Instruments.) NIFU 1995

⁸ Creative, Constructive, Critical. Strategy for NTNU towards 2010.

On interdisciplinary degree programmes in environmental sciences
Professor Eva Selin Lindgren, Göteborg University and Chalmers University of Technology:

In Sweden, the efforts of the former Swedish National Board for Industrial and Technical Development and the Swedish Business Development Agency (NUTEK) have demonstrated that new knowledge is acquired most quickly when several types of expertise are used together in reciprocal interaction. This process also generates new areas of science, which gradually emerge as individual new fields, such as biotechnology, environmental medicine, environmental economics, natural resource management, etc. In the Swedish model, a doctoral degree requires post-graduate courses both within an established area of science and new courses within the programme areas. The new environmental studies courses are designed and held by researchers, associate professors and professors of environmental sciences. The designation of the new doctoral degree is either *Doctor of Environmental Sciences* or *Doctor of Environmental Sciences with an emphasis on, e.g. organic chemistry*.

indicates that there are a myriad of ways to work within an interdisciplinary context, and that no single organizational solution or model can be identified as most suitable for this type of activity. The various models exhibit differing strengths and limitations. And the members of the science community have divergent ideas as to what interdisciplinarity entails. No clear distinction is made between multidisciplinary and interdisciplinarity. While some view interdisciplinarity as a process and a way of working, others believe that multidisciplinary approaches to shared problems may lead to new knowledge, and still others believe that enhanced methodological and theoretical interaction may have a synergetic effect on research, leading to new fields of study.

The integration of new and unfamiliar activities into ordinary structures takes time, and it will continue to be necessary to earmark resources for interdisciplinary research through centres, institutes and programmes. In addition, the institutions need to create a better framework for interdisciplinary study and research programmes that bridge the boundaries of individual centres and research institutes, as stipulated in the *Environmental Action Plan (2000)*

issued by the former Ministry of Education, Research and Church Affairs. Clearly, one of the most serious obstacles to the development of interdisciplinary cooperation is posed by a lack of communication as well as a lack of mutual understanding and professional respect across disciplinary borders. It is therefore of the utmost importance that effective professional fora for such communication be created.

The situation for the independent research institutes is somewhat simpler. These institutes deal with societal problems, and the delineation of disciplines is of interest only insofar as it contributes to resolving these problems. At the same time, the staffs of these institutes represent such a wealth of interdisciplinary experience that they could assume a significant role in initiating new interdisciplinary study programmes and doctoral courses.

At the Research Council, the focus on interdisciplinarity revolves primarily around its role as a necessary tool for solving defined research tasks, most often realized through the topic-oriented research programmes.⁹ Research programmes often fulfil an important recruitment function through the financing of doctoral fellowships that expose participants to interdisciplinary research cooperation. Within the Research Council, it is the Environment and Development Division that has the most to gain from the institutions' treatment of interdisciplinary activities in education and research, since the field of environment and development in itself is interdisciplinary and cross-sectoral. The establishment of centres for environment and development at the universities and the Center for International Climate and Environmental Research (CICERO) in the wake of the report *Our Common Future* by the World Commission on Environment and Development exemplifies the high degree of shared interests between the Research Council and institutions within this field of research. More recently, such shared interests have given rise to funding of research groups at top international level and the launching of the special Centres of Excellence in a wide range of fields.

⁹ When assessing applications for independent projects, the Research Council only processes applications on the basis of their scientific motivation.

The Organization of Research Programmes – How Broad Should They Be?

The establishment of larger-scale research programmes with a relatively broad thematic and scientific scope comprises the Environment and Development Division's principal mechanism for promoting multi- and interdisciplinary research where it is needed. The research programmes play a central role in creating meeting places for researchers and representatives of divergent scientific communities. While the greatest challenge lies in enhancing cooperation across the great "gap" between the natural sciences and the social sciences/humanities, important tasks also remain as regards strengthening cooperation between more closely related fields. There is no straightforward strategy for how the Division should proceed. For example, should climatic issues within the natural sciences be organized in a purely natural science programme, while the social issues are dealt with by social scientists in another programme? Should research on the framework conditions, management and other requirements for sustainable development be relegated to the social sciences alone, or should the natural sciences be integrated into the efforts?

There are many good reasons to choose any of a variety of organizational models. Numerous considerations must be taken into account – funding opportunities, the distance between disciplines, parties involved, etc. There is no consensus regarding which strategy is best, neither within the Research Council nor the various scientific communities. The MILDRI research programme at the Agricultural University of Norway found the matrix model utilized in its efforts to be very constructive.

MILDRI – a 5-year (1996-2001) research programme in Environmental Management in Agriculture at the Agricultural University of Norway in cooperation with The Norwegian Centre for Soil and Environmental Research (Jordforsk) and The Norwegian Crop Research Institute (Planteforsk).

Professor Arild Vatn

The purpose of the programme was in part to develop an analysis tool for studying measures and policy instruments that can in a cost-effective manner reduce nutrient loss and erosion as well as diminish the use of pesticides in agriculture. An additional objective was to

coordinate ongoing research in the field and enhance expertise in the area of mathematic modelling.

MILDRI is an example of bottom-up research, i.e. a group of researchers from different circles at the Agricultural University together came up with the underlying concept. The idea gained the support of the university administration, and funding was shared by the Research Council of Norway, the Ministry of Agriculture, the Ministry of the Environment, and allocations over the national Agricultural Agreement.

....

Organizationally, the programme followed the matrix principle. For the most part, participants remained in their various institutes and devoted part of their working time to MILDRI. This solution was selected both to utilize the best researchers, and to create a dialogue that fed back into the various disciplines. This kind of organization requires a very clear-cut administrative structure and it is in our view also advisable to try to bring all participants together under one roof for some portion of the collaborative effort. It should be noted that the physical distances at the Agricultural University of Norway are minimal.

The benefits of MILDRI have been manifold. To begin with, an operative analysis tool has been developed in accordance with the plans. The research has received widespread international recognition. The interdisciplinary approach has served to enhance the relevance and quality of the research substantially.(...) The cooperative effort has also provided the spark for the formation of new theory within environmental economic analysis, which is a direct result of greater insight into the natural sciences on the part of the economists.

....

The programme was first and foremost a researcher initiative, which has undoubtedly enhanced our ability to implement it. However, the reverse side of the coin is a weaker foundation within the formal responsibility structures of the institution as a whole. It takes time and training for all parties to integrate a matrix organization into a system in which activities have historically been confined to the various institutes.

The key issue here is not which organizational form should be chosen, but rather how the overarching questions and problems should be defined and how a framework may be created to enable various types of multi- and interdisciplinary projects to contribute to the overall research process. This requires flexible solutions that are also valid for research schemes that span several programmes, and that are therefore more difficult to cope with both scientifically and administratively. In the autumn of 2001, the research programme SAMSTEMT (Social Science Research in Energy, Environment and Technology) announced a call for proposals in cooperation with the Industry and Energy Division. The programme committee is also reviewing potential interdisciplinary challenges in the interface between SAMSTEMT and the research programme RAMBU (Towards Sustainable Development: Strategies, Opportunities and Challenges). This represents an interesting attempt to overcome this type of interdisciplinary challenge:

“Top expertise with communication skills is a generated characteristic on which successful multi- and interdisciplinarity must be founded”

The Programme Committee of SAMSTEMT

The Programme Committee of SAMSTEMT maintains that interdisciplinarity must be fostered from top disciplinary expertise. *Top expertise with communication skills* is a generated characteristic on which successful multi- and interdisciplinarity must be founded. A key notion in this regard is respect across disciplinary boundaries. One of the essential tasks of the programmes is to create meeting places for groups with different scientific starting points.

At NTNU, a new study programme linking energy and the environment has been launched. New approaches to problems are being identified, and this may in turn lead to a multi- or interdisciplinary focus in relation to research projects. At other institutions as well we are seeing that traditional disciplines are opening up as a result of reforms in the university sector. It is important that initiatives to encourage interdisciplinarity come from the institutions themselves, but the Research Council is also responsible for promoting such cooperation.

SAMSTEMT's coming call for proposals in cooperation with the Industry and Energy Division is interdisciplinary by definition. The Programme Committee will also assess whether there are potential interdisciplinary challenges in the interface between SAMSTEMT and RAMBU.

The Planning Phase is Crucial

An important point that the various groups of researchers often bring up in their discussions with the Research Council needs to be mentioned here. This concerns the way the research programme is developed, i.e. the set of problems and research challenges that is identified during the planning phase. This is again dependent on the individuals and fields that are represented in the planning group appointed by the relevant division's research board. In a broader perspective, this really boils down to a question of who helps to set the research agenda. The prioritization process preceding each programme at the Environment and Development Division is long and complicated. It involves many stakeholders, including the ministries, whose role as commissioners of research affords them substantial influence.

Thus, when the research board appoints a planning group for a new effort, the choice is based on a number of underlying guiding principles that the board must take into account. At the same time, it is at this point in time that the foundation for the scientific profile of the programme is laid – including the questions to which the programme seeks answers, and the programme's inherent potential for interdisciplinarity. The questions that are posed play a crucial role in delimiting the answers that can be provided by the research. It is essential that an openness to interdisciplinary thinking be incorporated into the process from the earliest planning stages in order to ensure that the criteria and guidelines set out for dealing with interdisciplinary research in the next phase will function successfully. It may therefore be necessary to focus more specifically on the planning phases of new research programmes both in terms of ensuring that the necessary academic and scientific scope is achieved, and in relation to user groups in cases where these may be particularly affected by the research to be carried out. The International Peace Research Institute, Oslo (PRIO) has drawn the following conclusions from its experience with the planning and implementation of multi- and interdisciplinary research:

PRIO: Conclusions from experiences so far

Research advisor Martha Snodgrass:

- It is indeed difficult to design a truly interdisciplinary project; the key to success is a team of researchers each of whom possesses sufficient familiarity with the others' disciplinary background.
- The greatest challenge for a multidisciplinary team is to find a common language with which to frame the actual concepts and phenomena under investigation (part of project is thus negotiating, among the disciplines, a common understanding of the research questions as well as the anticipated results).
- Some multidisciplinary collaborations do not coalesce to the degree that they produce theoretical innovation or improved methodologies – although they may be very effective in focusing on or highlighting a particular set of research problems. One likely reason for this is the lack of support for sustained, personal interaction among the participating scholars beyond the initial writing of chapters/articles (one-on-one editorial discussions are insufficient).
- Academic evaluation of interdisciplinary proposals has sometimes appeared to be inadequate (the project is not seriously scrutinized because it lacks a champion on the committee), or reviewers apply inappropriate criteria.
- Exposure to challenges from, and methods of, other disciplines does indeed inspire researchers to push the boundaries of their own disciplines. This works through sustained interaction, usually not a single conference or collaborative publication.
- The composition of the review committee, and regular use of special consultants to read proposals, are the most important conditions if a funder wishes reliably to measure the quality of interdisciplinary and multidisciplinary projects.

In this context, there is also much to be learned from activities conducted under the auspices of the large-scale international environmental research programmes.¹⁰ International research on global environmental change is heading into a new phase in which top priority is being given to genuine integration between the natural and social sciences. A good example of this is the planning of new efforts involving the *carbon cycle* and *global environmental change* as well as *food production/vulnerability/adaptation/impacts*¹¹ in which the IHDP, IGBP and WCRP are joint initiative-takers and in which DIVERSITAS is also expected to participate.¹²

Implementation of Research Programmes – Requires Good Administration and Sufficient Resources

The Research Council's principal mechanism for ensuring the successful implementation of research programmes lies in the appointment of programme committees. The membership of the programme committee should reflect the scientific profile of the programme. It is not enough for an individual to possess top expertise in his or her own field; an interest in, and respect for, the professional qualifications of others is equally important. The programme committee is delegated full responsibility for selection and follow-up of projects as well as dissemination of the results of the programme, and the committee reports annually to the division board regarding the overall progress of the programme.

As a result of the assignment of interdisciplinary research to research centres or programmes, a great deal of effort must be focused on developing professional contacts and cooperation with and between other groups within the scientific community. Otherwise, there is a risk that the research will remain peripheral, lacking the opportunity to influence scientific development in general. The Research Council has found that interdisciplinary programmes are resource-intensive for all parties – for researchers, for the members of the programme committees and for the administrators. For researchers, it is primarily a question of having

¹⁰ IGBP – International Geosphere-Biosphere programme, WCRP – World Climate Research Programme, IHDP- International Human Dimensions programme on Global Environmental change, DIVERSITAS.

¹¹ GECaFS – Global Environmental Change and Food Systems.

¹² Seven "rules of engagement" for integrative research formulated on the basis of experience with the carbon cycle project:

1. Always frame the key science questions in such a way that they cannot be answered without contributions from all partners.
2. Research strategy: Focus foremost on substantive questions rather than on methods and tools.

sufficient time (and money) to engage each other in a process of mutual learning and development. For the programme committees, it is mainly a question of management and good organizational mechanisms, but here, too, the time component is central. Research Council programme committees are composed of highly skilled individuals who are in great demand. As research programmes grow in scale and scientific scope, programme committees must deal with an increasingly expanding task that is no longer limited to assessing applications and allocating grants. Even the process of assessing applications has become more complicated, with extensive use of external referees and difficult choices to be made in relation to different disciplines and ways of defining research problems. Furthermore, the role of the programme committees is becoming progressively more strategic, as they must increasingly work to promote links between fields of study and motivate efforts in areas in which the disciplines are initially unable to satisfy the programme committee's needs in an overall programme perspective. Other demanding tasks include maintaining contacts with closely related national and international programmes and synthesizing the findings within the programme.

The Research Council will examine whether it is necessary to introduce organizational and financial mechanisms extending beyond those currently applicable to large-scale interdisciplinary programmes in order to realize the full scientific potential of such programmes. The role and capabilities of the programme committees form a key element of this. It is not sufficient to provide the committees with a mandate and guidelines; they must also be given the latitude to take action, and they must be empowered to take "tough" decisions when these are called for, for example by bypassing three "normal" projects to create an opening for a large, interesting research project that bridges disciplinary boundaries. Other measures that may help to strengthen the interdisciplinary components of a programme effort include the introduction of an institutionalized advisory function or a research leader/coordinator with special qualifications in

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3. Planning: Insist on balanced participation in science planning activities and emphasize open and inclusive processes.
 4. Decision-making: Establish implementing and oversight committees with appropriate representation. Favour consensual processes.
 5. Adjust reward structures for participating scientists to increase incentives of individuals to engage in integrative science.
 6. Persuade funders to prioritize adequate resources for integrative infrastructures.
 7. Always employ a decadal perspective in assessing progress.

integration and cooperation between disciplines, and with sufficient time and financial resources to provide active follow-up. Newsletters, seminars, conferences, etc. will also be of importance in this context.

Funding – Does Today's System Work?

What about Earmarking of Funds?

Inadequate funding is often cited as a practical bottleneck that limits interdisciplinary activity. Financing of interdisciplinary research is primarily conducted through the usual channels for funding of research: allocation over the basic budgets of the institutions, through the Research Council, on commission directly from the ministries and through various international bodies, in particular the EU. It is clear that the emergence of the EU Framework Programmes has been a motivating force behind improved cooperation across disciplinary and institutional boundaries in Norway. This plainly illustrates the impact of the international research policy agenda on the contours of the Norwegian R&D landscape. The EU projects do not comprise interdisciplinary research in the strictest sense of the term. However, the initiation of cooperation between disciplines in an effort to resolve specific problems may represent a first step in the direction of more subtly-defined perspectives and knowledge, and thus greater integration within the cooperation. The competition for contracts on the international market may have a similar effect, as increasingly tough competition forces Norwegian research communities to work together in submitting proposals. In the long-term, such “forced collaboration” may evolve into promising new scientific constellations. The general point to be noted here is that money carries considerable power and can be employed strategically to stimulate burgeoning interdisciplinary cooperation.

In general, the scientific community has thus far taken a cautious view of “interdisciplinarity” supported and promoted by the Research Council. Such scepticism is due on the one hand to fear (from within the disciplines) that greater focus on interdisciplinarity implies reduced monodisciplinary funding, and, on the other, to fear (from “the interdisciplinary thinkers”) that the Council’s assessment system does not value interdisciplinarity as highly as monodisciplinary. This latter aspect will be discussed under section 4.3 of this document. As to the channelling of funds, the Research Council earmarks funding for specified problem areas (which in turn may require an interdisciplinary way of working), not to interdisciplinary activities *per se*. The tension thus lies more between the allocation of funds to independent projects versus programme funding; however, this

represents a question of research policy that will not be discussed in this document.

In short, the funding situation for interdisciplinary research can be summarized as follows: grants are primarily allocated through the usual channels and instruments in direct competition with monodisciplinary research proposals. At present, there are no plans to amend this structure, although the *Environmental Action Plan (2000)* of the former Ministry of Education, Research and Church Affairs does provide scope for introducing a certain degree of earmarking of funds for multi- and interdisciplinary projects in the environmental sector. Nonetheless, there may be reason to explore in greater detail whether the special features associated with interdisciplinary research cooperation have been sufficiently incorporated into the present criteria and guidelines for grant allocations. It is conceivable that interdisciplinary projects should be dealt with in two separate phases: a *planning phase* in which the interdisciplinary project scheme is developed, and a *project implementation phase*. It must be possible to provide longer time-frames, more generous funding for project operations, increased emphasis on the role of the project manager, increased focus on the need for advisory services, and to reward – through open competition – researchers or groups of researchers who wish to further develop promising schemes for multi- and interdisciplinary cooperation.

4.2 Education and Academic Careers

Training for Interdisciplinary Activities: At What Point During an Education – and Is What is Available Good Enough?

It is reasonable to assume that the need for expertise in interdisciplinary endeavours will only increase in the future. However, it is not apparent which strategy should be utilized to ensure adequate recruitment of this kind of knowledge. Nor is it obvious what the motivating factors will be that prompt the individual student or junior researcher to pursue an interdisciplinary research topic. Motivations will clearly vary, from personal commitment to a particular scientific or social problem to a tempting offer to participate in a project from within the individual's local research environment. The presence of experienced researchers in the local environment who are working to promote interdisciplinary thinking will clearly play a key role in this process.

The Research Council has found that divergent views exist within academic circles both concerning when during the educational process students should be exposed to interdisciplinarity, and concerning the manner in which such educational programmes should be designed. When interdisciplinarity needs a solid foundation within a specific discipline, it seems most logical to claim that schooling in interdisciplinary thinking and empirical procedures should first be introduced at the *post-doctoral* level. In contrast, when interdisciplinarity requires openness and the ability to transcend fixed ways of thinking, it is natural to conclude that elements providing a basis for later interdisciplinary-oriented choices should be introduced at the *graduate* or *post-graduate* level. With regard to researcher training programmes, programmes bridging disciplinary boundaries should be linked to multi- or interdisciplinary research projects. At the graduate level, such schemes will probably be easier to implement in a restructured system of higher education that allows greater flexibility and utilizes more modular study programmes. Indeed, more flexible study programmes with an added element of interdisciplinarity in the individual sciences and disciplines may well facilitate efforts to recruit a greater number of young scholars into research careers.

The organization and implementation of various educational programmes is the responsibility of the educational institutions themselves. There are signs of an emerging positive trend towards a greater number of interdisciplinary study programmes. One of the principal challenges facing institutions in this context is the need to find the right balance between depth and range. This is precisely the same type of challenge that the Research Council faces in its efforts to deal with interdisciplinary research schemes.

At the doctoral level, the Research Council's task vis-à-vis education involves the funding of research fellowships. Other forms of support may also be provided, such as grants for national and international researcher training courses where there may be specific need for this. The Research Council has found that, in some cases, a lack of nationally available programmes has forced research fellows wishing to work on specific interdisciplinary-oriented research topics in environment and development to seek part or all of their education at higher learning institutions abroad. The Council provides funding for a variety of such "fellowships abroad". Moreover, funding has been granted prior to a fellowship period for "interdisciplinary" candidates who were not accepted into doctoral programmes due to insufficient disciplinary knowledge of the "other"

science. Some problems may also arise in connection with advisory issues relating to interdisciplinarity, as Norwegian universities have no tradition of advising in interdisciplinary teams.

The issues of interdisciplinarity, education and knowledge development need to be discussed in collaboration between the relevant institutions and the Research Council. The Norwegian national assembly has recently confirmed that educational programmes at Norwegian teaching institutions shall continue to be based on research.¹³ This will also apply to interdisciplinary educational programmes, and it should be possible to shape such programmes around new research activities in interdisciplinary areas.

Academic Careers

According to most reports on interdisciplinary research, conditions within academia continue to create a barrier for those who would like to pursue an academic career based on interdisciplinary research. It is possible that this is due to experience that no longer reflects the current situation at Norwegian universities. Nonetheless, the work on this action plan has clearly indicated that many still view the “disciplinary straitjacket” as posing an obstacle to an interdisciplinary academic career. In this context, it is interesting to ask whether this problem is greater in certain disciplines as opposed to others, and what the potential reasons underlying this might be. Regardless, it is important to identify conditions that may promote or inhibit “interdisciplinary” career development at the various institutions, from the graduate to the professorial level.

Reward structures constitute a key aspect of career development. For the most part, reward structures remain targeted towards disciplinary achievements, as few permanent positions in interdisciplinary subjects have been established at the universities. Researchers may therefore consider it too risky to invest much time in efforts that will not give them full returns in terms of qualification for positions within their own disciplines. The issue of quality evaluation/peer review is an important point in this context, and will be dealt with under section 4.3.

¹³ *Innst.S.nr. 337 (2000-2001)* (Proposition No. 337 (2000-2001) to the Norwegian national assembly)

A Swedish report on interdisciplinarity¹⁴ operates with two models for an interdisciplinary research career, one with a discipline-oriented approach and one with a more interdisciplinary approach. In the first model, established researchers move in and out of various interdisciplinary projects, maintaining one discipline as their basis at all times. In the other model, researchers who have completed their qualifications within their own disciplines branch into interdisciplinary efforts, moving from one interdisciplinary project to the next. These researchers accumulate methodological knowledge related to the special problems of integration associated with interdisciplinary projects. The type of expertise thus generated is crucial to quality assessment (see below) and represents an important resource for the institutions and the Research Council alike in the effort to enhance and ensure the quality of interdisciplinary research and teaching activities.

Both of these models are based on a certain degree of flexibility, and it may be the case that the job structure and employment conditions at the universities are not particularly suitable for this type of “rotation.” It is important, however, to create a framework in which pertinent interdisciplinary competence can be accumulated and integrated into the ordinary teaching and research activities of the institutions. The Research Council is concerned about this issue, and wishes to examine it more closely in cooperation with the relevant institutions.

Access to publication in high-status, referee-based journals is a keystone to any researcher’s academic career. It is not yet clear whether there are sufficient non-disciplinarian journals of proven quality available to researchers in environment and development wishing to publish their work. The various science communities have different experiences in this regard. The conclusion drawn here is that the availability of journals must be examined in greater detail to ensure equal access to scientific publication for all researchers, regardless of their disciplinary or interdisciplinary orientation.

¹⁴ *Tvärvetenskap – hur, av vem og varför*. Rapport från Expertgruppen för Tvärvetenskap, Genusforskning och Jämställdhet. (Interdisciplinarity - How, Who and Why. Report of the Expert Group for Interdisciplinarity, Gender Research and Equality.) Stockholm, 2 September 1999.

4.3 Quality and Assessment of Expertise

There is a wide range of views on interdisciplinarity, and many would ask whether interdisciplinary research should be treated differently from other research. Although interdisciplinary and monodisciplinary research represent two aspects of the same issue, it is generally agreed that the routines for quality assessment, evaluation, career advancement, etc., devised with monodisciplinary research in mind, do not adequately take into account the special features associated with interdisciplinary activities. A number of challenges remain to be confronted. One possible conclusion that could be drawn is that specific routines and criteria should be devised for interdisciplinary research activity. The groups of researchers who have contributed to this action plan do not support such a conclusion. The Centre for Development and the Environment (SUM) at the University of Oslo states this as follows:

What Action Can the Research Council Take?

Anne Gjerdåker, Research Fellow, Centre for Development and the Environment

Instead of devising a specific set of criteria for quality assessment in interdisciplinary research, it may be more constructive to revise already existing quality criteria and evaluation systems to make them more applicable to all types of competing projects, including those that are interdisciplinary. This is especially important because there is no funding specifically earmarked for interdisciplinary projects. Most essential is perhaps the composition of and/or guidelines for the programme development groups. The degree to which a “checklist containing points related to multi- and interdisciplinarity” is the right path to follow is difficult to gauge beforehand, but, as previously mentioned, there is some risk that interdisciplinary *method* may be operationalized to become a *goal* in itself.

A better alternative by far would be to assess a project in relation to how well it describes a genuine research problem, and how well it outlines methods and strategies for illuminating this problem in a constructive fashion. This may make it possible to avoid questions

such as: “Can the same quality criteria be employed for inter-disciplinary and monodisciplinary research?” For one thing, there is no consensus regarding which quality criteria to employ in monodisciplinary research.... For another, it is a given that interdisciplinary projects should be subject to equally stringent quality requirements as monodisciplinary projects, insofar as it is at all possible to evaluate two dissimilar projects identically.... Again, the purpose of the interdisciplinary way of working is to enhance the quality of a research project, or to better represent the nuances of a set of problems.

How Can Good Quality in Interdisciplinary Research Be Defined and Assessed?

Research policy objectives stipulate that research resources are to be applied to high-quality R&D activities. Quality, however, cannot be objectively defined, and the criteria for *high quality* may differ greatly between disciplines and between various types of research activity. Central aspects of the quality concept, such as the element of *originality*, for example, may vary widely within the range of disciplines. In an interdisciplinary endeavour, a research project’s potential for innovation may count more than the quality and originality of the contributions of the individual disciplines on their own. The challenge for interdisciplinary research efforts will be to find an evaluation model that maintains and balances the internal quality requirements of the various disciplines as well as the specific quality requirements that need to be imposed on the integrative/interdisciplinary dimension of the project. One element that must be given consideration is that, in an interdisciplinary project, it may not be possible to identify the research problem during the proposal phase, as this may need to evolve as a result of the research process. What are the implications of this for quality assessment? Another element that must be weighed is the *risk factor*. Interdisciplinary research projects run a greater risk of failure than disciplinary research projects. What kinds of choices need to be incorporated into an assessment of the quality of innovative, high-risk activities versus solidity with substantial probability of success? Yet another important element to consider is which mechanisms have been proposed to achieve the desired degree of interdisciplinarity.

The issue of quality assessment is central to the Research Council's endeavours regarding interdisciplinary activities. It is essential to focus concerted effort on how to deal with both (i) general criteria for quality assessment of multi- and interdisciplinary projects, and (ii) criteria for determining whether a project may be characterized as multi- or interdisciplinary. The input from the programme development group for the research programme RAMBU stated this as follows:

RAMBU - Input to the development of the research programme

Knut Bjørseth, programme coordinator

How do we determine whether a project may be characterized as multi- or interdisciplinary? Although no generally accepted fundamental definition exists, it is reasonable from a pragmatic viewpoint to distinguish the following:

- Project proposals must specify what the multi- or interdisciplinary scope of the project involves. It is not sufficient merely to state that researchers from several different fields will be participating. A description should be given of how the various fields will be contributing, how the scientific cooperation will be organized and what type of products in the form of publications, seminars, advisory services, etc., can be expected.
- Project proposals should reflect consideration of the potential and problems associated with multi- and interdisciplinary research, for instance regarding the use of concepts and terminology, methodological traditions, and publication traditions.
- Project proposals should define the role of the project manager in a manner that enhances the likelihood that he or she will be able to build bridges between the differing scientific perspectives and resolve potential conflicts that may arise between them.
- Project proposals will be strengthened if they pre-identify publishing opportunities that make it possible to preserve the element of multi- or interdisciplinarity while at the same time ensuring peer review and the chance to disseminate results to relevant research circles.

The quality of a project is determined on the basis of many different components.¹⁵ The emphasis placed on each individual component may vary according to what is being evaluated. However, certain overall aspects have emerged in the debate concerning quality and interdisciplinarity. For example, the Swedish report on interdisciplinarity mentioned above identifies interdisciplinary scope and social relevance as particularly important elements in the quality assessment of interdisciplinary projects. The Swedish report was produced by a group of experts appointed by the Swedish Research Councils, and its conclusions are thus of particular interest in the context of this action plan.

The Swedish expert group found that it is not possible to decide at the outset whether a project with a wider or narrower disciplinary scope should be ranked higher or lower on a quality scale. Similarly, it is not possible to determine whether a project is better or worse based on a classification of its relevance. Only after the quality assessment provides the answer regarding what the project is relevant for, can such conclusions be drawn. For example, the assessment of relevance will differ depending on whether the reference point is the development of the disciplines or finding solutions to societal problems. In the latter case, there will be the additional question of relevance for whom – for users in public administration and political circles, for those directly affected by the research, etc. This may seem obvious, but it is still necessary to clarify such elements when evaluating the quality of a project.

According to the Swedish report, an overall quality assessment of interdisciplinary research can be based on an evaluation of the research problem, of the individual aspects of the project, of the integration or synthesis between the parts of the project and the expertise of the project team as a whole in relation to the individual parts and the integration.

The research problem, or the initial formulation of the problem, is pivotal in any interdisciplinary context. The nature of the problem determines

¹⁵ As an example: The evaluation form utilized by referees in connection with proposals to the Environment and Development Division encompasses the following 1) Scientific importance; 2) Objectives and problems; 3) Methodology and theoretical approach, proposed manner of solving the problems, data analysis; 4) Literature/references; 5) Feasibility; 6) Contribution to development of discipline and research group(s); 7) International cooperation in the project; 8) Ability of project manager/supervisor; 9) Ability of institution/research group; 10) Scholarship candidate.

whether the scientific offensive will require a broader spectrum of knowledge than can be provided under a single discipline. Quality indicators in relation to the choice of problem may include the following: If the problem is new, does the manner in which it is formulated encompass a new angle that extends beyond a typical disciplinary perspective? Is the structure of the problem such that it cannot be solved within the confines of a single discipline? Is the problem simply “begging” to be illuminated from many different angles? Is the problem one that can be formulated within a single discipline, but would gain from being addressed using methods from other disciplines as well? Is it the case that changes in the context of the problem reveal completely new aspects that raise new questions and require other scientific approaches?

The parts and the whole. The relationship between the quality of the various aspects of the project and its quality as an integrated whole is also important, and is difficult to assess for interdisciplinary research projects. On one hand, the scientific quality of the parts and the integrated whole cannot be evaluated on the basis of the same discipline-internal quality objectives; this has more often than not been found to give an inadequate picture of either the overall picture or the synthesis. On the other hand, a well-constructed synthesis based on poor-quality parts can hardly be accepted. One way around this problem is to conduct quality assessment of interdisciplinary projects in two phases. In the first phase, the various parts of the project are subjected to expert evaluation according to the usual internal procedures within each discipline. If all the parts receive a good first-phase evaluation, the project proceeds to the next phase of assessment, in which the synthesis, planned cooperation scheme, ability to implement the project, etc., are evaluated by personnel with special expertise and experience in precisely such integrating and synthesizing activities.

The use of concepts and terminology in interdisciplinary research projects poses a particular challenge to quality assessment. The use and understanding of concepts and terms may vary between disciplines, and specification of such elements is necessary to ensure that they are utilized in the same way by all project participants. The quality assessment should include an evaluation of how the concepts utilized in the project have been dealt with – is there an understanding of the potential for divergence or differing shades of meaning, or do such issues remain unrecognized or repressed?

The researchers in the team and the composition of the team must include expertise that mirrors the range of the interdisciplinary project. Individuals with special competence in integrative efforts are needed in addition to individuals with good qualifications in the various participating disciplines. The individual's level of expertise, including attitudes towards interdisciplinarity and teamwork (as the research programme SAMSTEMT puts it: top expertise with communication skills), as well as the balance between the various forms of expertise within the project play a vital role in quality assessment. The role of the project manager is especially critical within this type of project, and the ability of the relevant candidate to work across sectors must be carefully weighed. It is not uncommon to find a dynamic, highly qualified project manager behind the most successful interdisciplinary research projects.

There is tremendous variation in the frameworks established for interdisciplinary research within the different institutions. Quality assessment of the research team should therefore also include an assessment of the institutions involved – do they have a mandated wish to promote interdisciplinary research, are they organized in a manner that encourages interdisciplinarity and have they previously achieved success with this type of research cooperation?

The main conclusion of this section is that quality assessment of interdisciplinary research projects does not entail replacement of the usual discipline-internal quality criteria for the individual parts of the project. Qualitatively solid, discipline-based competence is vital to interdisciplinary projects, and must be assessed according to usual procedures. In addition to such in-depth analysis, however, the question of scope (or relevance) must also be assessed; an assessment must be made of the project as a whole, of the various levels of expertise of the participants and project leader, and of the planned cooperation. These elements require a different set of evaluative skills. Thus, the overall quality assessment of an interdisciplinary project is dependent on personnel with excellent disciplinary expertise as well as personnel with experience and competence in synthesizing efforts and interdisciplinary activities. It is particularly critical that the leader of an assessment group is in possession of this latter form of expertise.

5 What Action Can the Research Council Take?

There is every reason to believe that the need for knowledge about complex interlinkages and systems will only intensify in the future. This implies that the research and education sector will need to increase the effort to develop expertise and deliver results that reflect a composite reality. This is a challenge that must be faced by education and research institutions, the Research Council and the financing authorities in their role as research commissioners and funders.

The purpose of this action plan is to devise criteria and guidelines to ensure that multi- and interdisciplinary research is adequately incorporated into the Environment and Development Division's activities involving strategic thinking, planning, application processing (programme-related and independently funded, strategic institute and university programmes [SIP/SUP]), evaluation and recruitment.

The term "interdisciplinary research" is used to refer to the entire spectrum of research activities based on cooperation between various disciplines, ranging from multidisciplinary cooperation between disciplines working in parallel on the same problem (additive cooperation) to genuinely integrated interdisciplinary endeavours.

Interdisciplinary research is not substantively different from other types of research; requirements concerning quality and relevance must be applied just as stringently here as they are to monodisciplinary research. A positive trend regarding cooperation across disciplinary and institutional boundaries is emerging in many scientific communities. The creation and enhancement of arenas for such interdisciplinary communication at the institutions themselves is of vital importance. The Research Council wishes to promote and support this positive trend, and would like to continue its discussion with the research communities concerning suitable organizational models for disciplinary cooperation (centre, institute, core groups, "oasis," matrix, etc.).

During the process leading up to this action plan, particular attention has been focused on the relationship between quality and interdisciplinarity, the criteria for assessment of interdisciplinary research and the earmarking of funding for this type of research activity. The Division has reached the conclusion that it would not be constructive to devise a specific set of criteria to assess the quality of interdisciplinary research, but that there is a need to revise the existing quality criteria and evaluation systems to make them more applicable to all types of competing projects.

Other important keywords in the context of this action plan are planning of research activities and flexible organizational and funding models. Greater emphasis must be given to the planning phase of new research programmes, as it is during this phase that the foundation for the future research activity is laid.

The question of special earmarking of funding for interdisciplinary research is controversial. In practical terms, the Division earmarks allocations for sets of problems or special topics, not for interdisciplinary research as such. This system will be maintained. In addition, the Division will make more active use of incentives that call for and encourage multi- and interdisciplinary cooperation.

Based on previous experience and input from the representatives of the research environments, the Division will introduce the following measures to enhance the incorporation of multi- and interdisciplinary research into its activities:

5.1 The Relationship between Quality and Interdisciplinarity

The Environment and Development Division will

- Revise existing quality criteria and evaluation systems and devise new guidelines, referee templates, etc., in cooperation with researchers and scientists, to ensure that such documents and systems are suitable for use by the Division's programme committees, peer review committees, etc. in assessing all types of mono-, multi- and interdisciplinary research.
- Establish a resource group/panel of recognized experts in multi- and interdisciplinary cooperation/integration that can be utilized in the processing of applications for multi- and interdisciplinary activities.

- Request that the Culture and Society Division examine more closely whether there is a need to conduct further study into epistemological aspects of the interdisciplinary approach.

5.2 Special Focus on Interdisciplinarity in the Planning, Organization and Implementation of Research Activities

The Environment and Development Division will

- Devise a “checklist” containing points related to multi- and inter-disciplinarity that should be kept in mind when appointing programme development groups, programme committees, etc.
(For example: Which questions need to be elucidated? How should the questions be formulated? Which disciplines must be included to answer these questions? What type of expertise is needed [academic, user group]?)
- Incorporate special points relating to interdisciplinarity into the mandates of the programme development groups, programme committees, etc. (problems, objectives, risks/potential for innovation, incentives, mechanisms/measures etc.)
- Examine the potential of the programme committees to function as strategic bodies, including their ability to take the initiative and promote multi- and interdisciplinary research when this is required within the profile of the programme.
- Devise mechanisms to strengthen cooperation across the boundaries between programmes and divisions within the Research Council, and across dividing lines between independent research institutes, and between research institutes and teaching institutions.

5.3 Special Focus on Interdisciplinarity in Research Funding

The Environment and Development Division will

- Maintain its practice of earmarking allocations to multi- and interdisciplinary problems and topics.

- Actively employ incentives that encourage multi- and interdisciplinary cooperation where this is necessary. Such incentives include competition for funding set aside for further development of promising multi- and interdisciplinary cooperation schemes; funding for research coordinators and project managers; long-term, generous basic allocations to promote constructive processes within research communities that achieve successful interdisciplinary cooperation; post-doctoral fellowships for outstanding younger researchers who are seeking to qualify themselves and advance in interdisciplinary research activities; support to network-building measures and establishment of new arenas/meeting places for enhancing communication and understanding across disciplinary boundaries, etc.
- Request that programme committees, peer review committees, etc., actively follow-up the instruments outlined in the *Strategic Plan for Research on Environment and Development* and the *Action Plan for Environment and Development – Time to Take Action*, and submit annual reports to the Research Board on the application of such instruments.

5.4 Interdisciplinarity and Education

The Environment and Development Division will

- Invite educational institutions to participate in a dialogue on issues concerning interdisciplinarity, education and knowledge development.
- Provide grants for national and international researcher training courses where a special need for this arises.
- Provide supplementary funding for fellowship holders who need additional expertise from other fields in connection with their work on a doctoral degree.

5.5 Interdisciplinarity and Reward Structures

The Environment and Development Division will

- Take a closer look at the situation regarding academic journals in multi- and interdisciplinary research on environment and development. The objective is to gain equal access to scientific publication in periodicals of proven quality for researchers in all fields of study, regardless of their disciplinary and/or interdisciplinary orientation.



**The Research Council
of Norway**

Street address: Stensberggt. 26
P.O.Box 2700 St. Hanshaugen, N-0131 OSLO
Tel: +47 22 03 70 00 Fax: +47 22 03 70 01
www.forskningsradet.no
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