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Finnish Global Change Research Programme (FIGARE)

EVALUATION REPORT



ACADEMY OF FINLAND

Finnish Global
Change Research
Programme
(FIGARE)
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Preface

In 1999 the Academy of Finland established the Finnish Global Change Research Programme (FIGARE) to support and encourage high quality research on issues of global change (GC) in the natural and social sciences, economics and technology. The overarching objectives of the Programme were to analyse and understand changes in the global system and their underlying causes and effects, as well as prevention of and adaptation to change. Research in the Programme aimed at a broader, integrative approach, and at facilitating co-operation between researchers in the various disciplines.

FIGARE was conducted over a period of three years (end 1999-2002). It consisted of 18 research projects and consortia that covered a wide range of topics and disciplines, including climate change and atmospheric research, biodiversity, scenario development, economic and energy aspects, and human dimensions issues. The total funding for the three-year period amounted to around 6.7 million euros (approx. 40 million Finnish marks).

In May 2003, the Academy of Finland convened an international evaluation panel to review the Programme. The members of the Panel were: Dr. Wolfgang Cramer (Germany), Dr. Leen Hordijk, (The Netherlands), Dr. Jill Jäger (UK), who chaired the panel, and Dr. Jose Sarukhan (Mexico). Elisabeth Dyck (Austria) served as scientific secretary (see Annex 1).

The Evaluation Panel was asked to assess the following aspects of FIGARE:

- Scientific quality of the Programme
- Success of the implementation of the Programme goals and objectives
- Contribution to training of researchers and experts
- Collaboration and networking
- Applicability of research and importance to the users
- Recommendations for the future (including the justification for the recommendations).

This report presents the findings of the Evaluation Panel. Further information about FIGARE can be found at <http://figare.utu.fi>.

June 2003

Dr. Jill Jäger
Chair, Evaluation Panel

1 Global Change Research

Today, human activities have begun to match and exceed nature in terms of changing the biosphere and impacting other aspects of the functioning of the Earth System. The magnitude, spatial scale and pace of human-induced change are unprecedented¹:

- In a few generations fossil fuel reserves that were generated over several hundred million years are being exhausted.
- Human action has transformed nearly 50 percent of the land surface, with significant consequences for biodiversity, nutrient cycling, soil structure and biology, and climate.
- More nitrogen is now fixed synthetically and applied as fertilizers than is fixed naturally in terrestrial ecosystems.
- More than half of all accessible freshwater is used directly or indirectly by humans, and groundwater resources are being depleted rapidly in many areas.
- The atmospheric concentrations of several “greenhouse gases” have increased substantially, with measurable consequences for the climate system.
- Coastal and marine habitats have been dramatically altered, with 50 percent of the mangroves removed and wetlands shrunk by half.
- Many marine fisheries are over-exploited or at the threshold of over-exploitation.
- Extinction rates are increasing sharply in marine and terrestrial ecosystems around the world.

Global change research looks at the causes and consequences of all of these changes to the Earth System, as well as the human responses to change. As such, global change research is inherently interdisciplinary, requiring integrated studies of the human-environment system.

At the international level, global change research is co-ordinated by four Programmes: the International Geosphere-Biosphere Programme (IGBP), which aims to describe and understand the interactive physical, chemical and biological processes that regulate the total Earth System, the unique environment that it provides for life, the changes that are occurring in this system, and the manner in which they are influenced by human actions; the International Human Dimensions Programme on Global Environmental Change (IHDP), which promotes and coordinates research aimed at describing, analysing and understanding the human dimensions of global environmental change, focusing on the causes and consequences of people’s individual and collective actions; the World Climate Research Programme (WCRP), which aims to determine the extent to which climate can be predicted and the extent of human influence on climate through a quantitative understanding of the physical climate system; and DIVERSITAS, the

¹ Further information is provided, e.g., in “Global Change and the Earth System: A planet under pressure. IGBP Science 4, International Geosphere-Biosphere Programme, Stockholm. <http://www.igbp.kva.se>

International Programme on Biodiversity Science, which aims to unify into a coherent international framework the various approaches to the study of biodiversity from the role of biodiversity in ecosystem functioning to the socio-economic aspects.

In July 2001, at about the middle point of the FIGARE Programme, IGBP, IHDP, WCRP and DIVERSITAS convened the Global Change Open Science Conference² in Amsterdam, the Netherlands. The Amsterdam Declaration emphasises that basic goods and services supplied by the planetary life support system, such as food, water, clean air and an environment conducive to human health are being threatened increasingly by global change. The statement is quite clear that “global change is real and is happening *now*”. As a consequence, the need for global change research is stronger than ever – this will involve the co-ordination from the international programmes as well as the existing and disciplinary-based global change research on a national level, integration across disciplines, environment and development issues and the natural and social sciences, collaboration across national boundaries and intensification of efforts to enable the full involvement of developing country scientists. The FIGARE Evaluation Panel welcomes the efforts that FIGARE has made to achieve these goals, while noting that there is still much more to be done to understand and deal with the challenges of global change.

² Steffen, W., Jäger, J., Carson D.J., and Bradshaw, C., 2002: Challenges of a Changing Earth. Proceedings of the Global Change Open Science Conference, Amsterdam, The Netherlands, 10-13 July, Springer-Verlag, Berlin.

2 The FIGARE Programme

2.1 Background

The idea to launch a Programme on global change research in Finland initially came from the Finnish Global Change Research Support Group (FIGSU), which was appointed by the Board of the Academy of Finland in 1997. Based on a memorandum prepared by FIGSU, the need for such a programme was discussed on a wider platform during the spring of 1998. Representatives of research organisations, ministries and funding organisations, who met in April 1998, supported the initiative. In view of this consensus, and following a proposal by the Research Council for the Environment and Natural Resources, on 9 June 1998 the Board of the Academy of Finland decided to set up a Global Change Research Programme for a period of three years (1999-2002). The Research Council for Culture and Society and the Research Council for Natural Sciences and Engineering³ of the Academy were also involved in the Programme.

2.2 Organisation

At its meeting on 15 September 1998, the Board of the Academy of Finland appointed a working group, chaired by Lea Kauppi (Director General of the Finnish Environment Institute and a member of the Research Council for the Environment and Natural Resources) to prepare the Programme. The twelve members of the committee represented the Academy's Research Councils, five ministries and two funding organisations. In addition, several scientists contributed to the group as expert consultants (see Annex 2). This working group then became the Programme's Steering Committee, which guided the research for the duration of the Programme. The composition of the Steering Committee changed considerably over time. At the end of the Programme, only four members of the initial Steering Committee were still involved (see Annex 3). The Steering Committee held twenty-two meetings between 1999 and 2002.

Following an open competition, the Department of Geography of the University of Turku was selected among five applicants to carry out the scientific and administrative co-ordination of the Programme. Dr. Jukka Käyhkö, teaching assistant in geography at the University of Turku, was appointed as full-time Programme Co-ordinator and started his assignment in November 1998. He remained in this position until the end of the Programme. The co-ordination of the Programme was managed in collaboration with the Finnish Biodiversity Research Programme (FIBRE). A Programme secretary, who also served FIBRE, supported the co-ordinator's work on a 50 percent basis from the beginning of 1999.

³ In 2001 the names of the Academy's Research Councils were changed to: Research Council for Biosciences and Environment, Research Council for Culture and Society, and Research Council for Natural Sciences and Engineering.

2.3 Programme Funding

The total funding for FIGARE amounted to around 6.7 million euros, of which 4.2 million euros (62.5%) were provided by the Academy of Finland. Further funding came from the Ministry for Foreign Affairs, the Ministry of the Environment, the Ministry of Agriculture and Forestry, the Ministry of Trade and Industry and the Ministry of Transport and Communications (see Annex 4).

Due to the relatively high number of projects and consortia selected, the available funds were not sufficient to match the projects' financial needs. Hence funds for individual projects/consortia had to be cut by a third on average (and up to 50 % in some cases), compared to the requested budgets.

2.4 Research Projects and Consortia

FIGARE aimed at supporting and encouraging high-quality research in the natural sciences, the social sciences, economics and technology. The main objectives of the research programme were:

- to analyse the processes of global change and their underlying causes and impacts at different temporal and spatial scales;
- to analyse and forecast the interactions between environmental and socio-economic changes using methods such as scenario analysis;
- to find social, cultural, economic and technological solutions that could help to intervene in the process of global change or adapt to the changes;
- to support education and training.

From a total of 145 applications, 18 research projects and research consortia (consisting of two or more projects) were selected in a two-phase process to form the Finnish Global Change Research Programme (see Annex 5).

3 Evaluation Procedure

The evaluation took place during a three day meeting in Helsinki on May 14-16, 2003. During the meeting, the Panel met with the Chair of the FIGARE Steering Committee, Dr. Lea Kauppi, five of the scientists involved in the Programme, the Project Co-ordinator, Dr. Jukka Käyhkö, and the Director of Research of the Academy of Finland, Dr. Anneli Pauli.

As input to the deliberations of the Panel, the following material was available prior to the Panel meeting, in addition to general information about the Programme:

Jukka Käyhkö and Sami Markkanen, 2003: Technical Report, Finnish Global Change Research Programme, FIGARE 1999-2002. May 2003.

Jukka Käyhkö and Linda Talve (Eds.), 2002: Understanding the Global System: The Finnish Perspective.

A range of project publications was tabled during the meeting.

The Evaluation Panel agreed that not enough information was available in the Technical Report to carry out a well-founded evaluation of the scientific quality of the projects and consortia on an individual basis. Such an evaluation would have required, in particular, earlier access to the publications from the projects and consortia. However, these were made available during the meeting only. The report from 2002 on “Understanding the Global System” did provide very useful input to the deliberations of the Panel, but general information on networking, functioning of projects and consortia and the general applicability of the results in the “user community” could not be derived reliably from that publication or the Technical Report.

In retrospect, it would have helped the Panel considerably, if the Technical Report had provided the information needed to address the questions raised in the Panel’s Term of Reference. Furthermore, in the short time available for the evaluation, the Panel was unable to establish extensive contacts with the “users” of the output of the FIGARE Programme or with the “young scientists” involved in the Programme, both of which would have enhanced the possibility of evaluation of the Programme as a whole. Finally, the Panel found it virtually impossible on the basis of the material available to determine the extent to which FIGARE funding had advanced research, publications and capacity building. For example, many publications were listed, but the extent to which they relied on FIGARE funding was unclear.

Because of the diversity of the projects and consortia, the Evaluation Panel decided to assess the Programme as an entity, illustrating their findings with examples from individual projects and consortia as presented in the Technical Report, other documentation and verbal information that was provided to the Panel. In addition,

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the Panel noted that since FIGARE was only a three-year Programme, many publications by the projects were still under preparation or submitted for publication. Also, the number of researchers trained in the Programme (PhD, MSc, BA) is expected to be higher than reported, as several student-researchers will complete their theses in the near future. In summary, it was very difficult to determine the exact extent to which the FIGARE Programme contributed to publications and the education and training of researchers.

3.1 Suggestions for Future Evaluation Processes

On the basis of the experience with the above procedure, the Evaluation Panel felt that more resources should have been set aside for co-ordinating the final evaluation, including reporting, preparation of reports, etc. Basically this implies that the Programme Co-ordinator should be fully involved in the process until the evaluation takes place and is completed. Incentives to the projects and consortia to contribute effectively to the final technical report would also be of value. This can be achieved, for example, by withholding part of the project funding until final input to the Programme is received. Finally, a closer collaboration between the Chair of the Panel and the Programme Co-ordinator during the preparation of the review will produce information that is better suited to the Panel's need.

4 Overall Evaluation of FIGARE and of the Projects/Consortia

4.1 Introduction

The FIGARE Programme consisted, as noted above, of 18 projects and consortia. The Panel noted that the funding level for the Programme as a whole was not high for the ambitious agenda of research proposed for the three-year period. Moreover, the funding level was not clear at the time when the projects were selected. As a result the funding of the individual projects and consortia that were selected was lower than in the proposal (by 34% on average, but as much as 50% in some cases). In the Technical Report, most of the projects and consortia reported that certain activities from the original proposals could not be carried out because the funding was less than originally anticipated.

According to the Technical Report, FIGARE aimed at “accomplishing a holistic view of the global problems” and thus it was decided not to form any sub-programmes. However, as is noted below, this meant that collaboration between projects and consortia was limited. The lack of sub-programmes also made the overall evaluation more difficult. The Evaluation Panel concluded that in view of the fact that less money was available than had been requested, the Programme would have been more effective, if the number of projects had been reduced, rather than reducing the funding of each project. Furthermore, as far as funding was concerned, the Panel felt strongly that it was certainly beneficial to fund the Programme Co-ordinator before the Programme started, but the funding should have been continued until the time of the Programme evaluation.

The Programme Memorandum, which essentially acted as the call for proposals, was extremely broad. This led to a broad spectrum of projects, which, as noted below, had few interdisciplinary or integrated approaches. The Memorandum and the funding structure did not provide a strong motivation for integrative and/or interdisciplinary approaches. The Panel felt strongly that in some cases, the researchers did not fully understand what is meant by “global change research”.

It was difficult to evaluate the extent to which the results of the research were used in subsequent policy discussions. The Panel noted, however, that the Programme might have benefited from a more structured approach towards linking “science” and “policy”, as was provided, for example in the Finnish Biodiversity Research Programme⁴, in which BITUMI was an integration and synthesis project to promote the applicability and use of research results. The broad spectrum of projects also makes a general synthesis of the results very difficult.

The network of Finnish scientists from the natural sciences, involved in global change research, has been established through earlier research programmes, such as those on climatic change and acid deposition. The Panel was less confident that

⁴ Finnish Biodiversity Research Programme FIBRE 1997 – 2002. Evaluation Report. Academy of Finland, 2003.

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the “human dimensions” researchers – through three years’ support – had become sufficiently established that they could now collaborate on an equal basis with the natural scientists and in international networks. For the young scientists, who successfully participated in the Programme from both the natural and social sciences and thus became introduced global change research, the Panel wondered whether enough support would be available, both financially and institutionally, to continue in this line of research after the end of the three years of the FIGARE Programme.

4.2. Scientific Evaluation of the Programme

On the basis of the input to the discussion, the Evaluation Panel agreed that the Programme did not have, from the moment of its conception, a structure that would allow it to achieve some of the goals, such as to 1) analyse and predict environmental and socio-economic impacts of global change, and 2) try to find social, economic and technological solutions that could help intervene in the process of global change or adapt to the changes. The Programme consisted of 18 disparate projects and consortia, several of which were not clearly related to the issues of global change. Programme integration in order to respond to the main goals was hindered by the lack of initial co-ordination of projects and consortia.

Only in some particular cases was it possible to see that some of the information generated in the projects could be used for decision-making, both at national and international levels, which was a specific goal of the Programme. Along the same lines, the exchange of information between the researchers and the various potential users of the information was seldom achieved, although it was considered “of paramount importance” in the Programme Memorandum.

However, the Panel concluded that the Programme was successful in various ways. First, in advancing different lines of research that have a very high scientific standing internationally; second, in attracting young scientists to an area of prime importance for science and for the future of humankind, giving them a closer perception of what kind of interdisciplinary research, particularly linking the basic natural and social sciences, is necessary for global change research. Finally, projects addressing the climatic component of global change advanced their understanding of various phenomena, at the national, regional and international levels.

There was also adequate coverage, given the circumstances of the budgetary support to the projects, of those issues and areas that were considered of special significance to Finland, including Arctic issues, Finnish technological know-how and global change questions relating to developing countries

On the basis of the Technical Report it was difficult to assess the quality and innovativeness of the projects on a project-by-project basis. However, considering the publications, interviews and other information made available, the Panel agreed that most of the individual projects and sub-projects demonstrated good scientific quality, but the degree of innovativeness varied considerably.

While many of the groups of scientists participating in the individual projects or in the consortia are well known internationally in terms of their scientific competence, the information provided to the Evaluation Panel did not permit a thorough assessment of this factor.

As noted above, the nature of the problems in global change research implies a high degree of interaction among disciplines within and between the natural and social sciences. This was clearly recognized by the Academy, and consequently defined as one of the central aims of the FIGARE Programme, i.e., “to analyse and understand the changes taking place in the global system and the underlying causes and impacts of those changes”. An adequate understanding of those processes was considered to “require a close knowledge of the social, economic, political, cultural and technological processes and impacts involved in global change”.

However, because of reasons that are discussed elsewhere in this evaluation report, relatively few of the projects/consortia approached the goal of true interdisciplinarity, where different disciplines work with the same question and generate a common response to it, generating new visions of the problems and answers to them. In many cases, the Panel evaluated good quality climate-change projects, or socio-economic studies of the human-environment system, which stopped short of becoming “global change” projects, because they lacked the interaction and complementarities with other disciplines. The interviews with some scientists, who participated in FIGARE, illustrated the difficulties encountered in achieving a reasonable degree of interaction and communication on conceptual issues between scientists from the natural and social sciences. To achieve such interdisciplinarity it would be necessary to break the methodological and conceptual barriers at a very basic level, providing means of training that will be attractive to social and natural scientists, particularly to young scholars who are seriously interested in carrying out interdisciplinary research. The Evaluation Panel concluded that the lack of interdisciplinarity was a deficit of the FIGARE Programme.

Assessing the number of publications from the projects and consortia produced as a result of the FIGARE Programme support was a good example of the difficulty the Panel had in carrying out a satisfactory scientific evaluation. The information included in the Technical Report about the number of publications by projects provided an incomplete and/or distorted view of this issue. The actual number of publications occurring as a result of the FIGARE support in some cases did not seem to match those reported by researchers or summarized in the Appendices of the Technical Report. For example, for a group of projects (LUCCAM, Boreal Forests, Subarctic Forests, CLIMA-X, Solar UV-B and Silver Birch studies), in some cases no publications were reported in the summarizing table, when some actually were produced. In other cases, publications were listed that must have been at least partly the result of earlier research, concluded within the FIGARE Programme. In general, publications generated during the three-year period of the Programme (2000-2002) oscillated between two and six.

4.3 Contribution to the Implementation of FIGARE's Goals and Objectives

FIGARE was designed to analyse and predict global change impacts, find ways in which to mitigate or adapt to these changes, and train researchers and experts in the field. To this end, one of its key objectives was to "...take a broader, integrative approach [than its related predecessor, SILMU] and to facilitate co-operation between research in the natural sciences, economics and technology".

The Panel assessed the fulfilment of FIGARE's objectives with particular reference to:

- the contribution to global change science,
- the development and application of a "broader, integrative approach",
- the training of researchers and experts in the field (of integrative global change science).

Since, in a number of cases, the information given for each individual project was insufficient for a balanced and precise project-by-project assessment, the Panel agreed to provide conclusions, as summaries, across groups of projects and draw conclusions for the Programme as a whole. It should be noted that particular projects are mentioned only as examples here, rather than as exhaustive lists in any given category.

4.3.1 Contribution to Global Change Science

With few exceptions, the projects have made contributions to global change science. Their results are either directly applicable to the assessment of global change phenomena (e.g., AGROGAS, CARBO, FINSKEN, UV-B) or they attempt to provide ways towards solutions (e.g., LUCCAM). Some projects, however, did not, in the opinion of the Panel, document specific relevance to global change science (e.g., "Global change in subarctic environment").⁵

4.3.2 Development and Application of a "Broader, Integrative Approach"

The Evaluation Panel noted and appreciated that the Programme Memorandum claimed strong support for the basic Programme objectives, and in particular the integrative and interdisciplinary nature of the expected research. The actual implementation of the Programme and its basic sub-units (projects/consortia), however, does not appear to have provided specific conceptual or structural assistance for the fulfilment of this goal. For example, the memorandum stated that "[It] is expected that the [projects] shall examine and interpret the subjects they tackle from their own vantage points ...". It was the Panel's impression that this sentence may have been read by many project investigators as an invitation to continue to pursue their previous research doctrines, i.e., they had a "carte blanche" for the avoidance of the integrative and interdisciplinary nature of the global change problem.

⁵ In the opinion of the Panel, advancement of understanding in basic natural or social sciences, even if potentially applicable to global change problems, does not *per se* represent a contribution to global change science

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Only a small minority of projects have, in the material provided to the Evaluation Panel, documented a “broader, integrative approach” appropriate for the goals of the FIGARE Programme. The projects and consortia also differed greatly in the degree of acknowledgment of the fundamental FIGARE goals as goals of their own: many simply seem to have ignored them and chosen to explore some issue at stake from “their own vantage-point”, making no visible effort towards integrative approaches (CORE, SAFIR and “Climate change and decision making” can be seen as examples of many more projects in this group). In some cases, this mono-disciplinarity was combined with strong claims to the contrary. Still others (e.g., ARCTICA) expressed a very broad openness to the integrative goal but then seemed to be unable to tackle the methodological challenges associated with the integration. They ended up “stapling results together”, in the apparent hope that users themselves might later provide some integration. Lastly, a few projects approached the integrative challenge in a constructive and goal-oriented way (e.g., “boreal forests”, which simultaneously addressed ecological and management issues in forestry sustainability, or FINSKEN, where the problems of interdisciplinary scenario development were addressed in a highly competent way).

4.3.3 Training of Researchers and Experts in the Field

This was interpreted by the Panel primarily as the training of researchers and experts for integrative global change science. Unfortunately, the fulfilment of this objective could not be assessed in detail, using the information given. Most projects/consortia appear to have trained scientists/experts at various academic levels, but the extent to which these now have specific competence in global change science is impossible to measure (see also Section 5. below).

4.3.4 Functioning of Projects and Consortia

Individual projects and consortia list specific obstacles to the achievement of specific goals of the Programme. Overall, most of the individual sub-projects seem to have functioned in acceptable, good or excellent ways. The project documentation, and some of the interviews, revealed however that, at the consortium level, communication between partners was limited. Across the Programme, the diverse contributions have not, despite the apparently heroic effort of the Programme Co-ordinator, achieved a noticeable coherence or identity.

4.3.5 Added Value of the Projects/Consortia

Most projects/consortia have, as a result of the FIGARE Programme, succeeded in producing additional knowledge and, hence, added value for the scientific literature. The contributions to climate aspects of global change science are significant and in some cases excellent. Probably, a greater number of Finnish scientists have, through FIGARE, become aware of the research challenges posed by global change, and they have made efforts to tackle them; this will influence their efforts in subsequent projects.

4.3.6 Contribution to Enhancing Inter- and Multidisciplinarity in Research

As noted above, the Evaluation Panel concluded that the majority of FIGARE projects/consortia did not contribute to inter- or multidisciplinarity in research.

4.3.7 Scientific and Administrative Co-ordination

On a comparatively low co-ordination personnel budget (1.5 positions), the Programme appears to have been remarkably well co-ordinated. Dr Käyhkö has received positive evaluations from all FIGARE researchers the Panel has been in contact with, and his own assessment of the Programme (both in terms of its achievements and in its self-critical parts) appeared to be extremely thoughtful and balanced. No negative reports were received about the administrative co-ordination. It was evident, however, that the preparation of the Technical Report for the evaluation suffered from a severe lack of resources.

5 Contribution to Training of Researchers and Experts

FIGARE also includes an objective to train researchers and experts in the field. The Panel looked at the way in which projects and consortia approached this objective. Because the Programme Memorandum does not contain specific training goals, the Panel takes numbers of students as an indicator for having achieved this FIGARE objective.

In the FIGARE Programme more than 30 PhD students participated and more than twenty received their degree before the end of the Programme. The research programme also included MSc students, of which more than 40 graduated during the course of the Programme.⁶ The Panel noted that within the co-operation between FIGARE and FIBRE (Finnish Biodiversity Research Programme 1997-2002) a “PhD Club” was formed at the University of Turku for the postgraduate students of the two Programmes. The group met frequently and exchanged experiences. Within this initiative, FIGARE and FIBRE also organised three courses for PhD students, one on the International Conventions on Climate Change and Biodiversity (2000), one on science writing (2001) and a course on oral presentations (2002). The Panel did not have information about the number of students that attended these courses. Another noteworthy point is that a consortium (LUCCAM) operating in a developing country organised training courses for persons influencing policies.

The Panel noted with some regret that FIGARE has not organised PhD courses on relevant global change topics. Examples of courses given elsewhere include concepts for interdisciplinary collaboration, human dimensions of global change, and interaction between element cycles and ecosystems. Joint Programme activities for training MSc students were not reported.

The Panel considered the duration of FIGARE, viz. three years, to be too short for the purpose of obtaining a PhD degree. If programmes like FIGARE should play a role in increasing the number of PhD degrees, the length of such programmes should at least be equal to the average time it takes in Finland to obtain the degree.

As noted above, FIGARE could have benefited from having fewer projects with higher budgets. One such benefit could have been that groups of PhD students in related subjects could have been formed.

⁶ It has to be stressed that the numbers given above are derived from the Technical Report, in which it was not always clear whether students were totally or partially funded by FIGARE. Example: a PhD degree that was granted in 1999 was most probably only partially funded by FIGARE, which started in 1999.

6 Collaboration and Networking

The FIGARE Programme Memorandum states as one of the Programme's objectives that "the exchange of information among researchers and the various agents using the research results is of paramount importance." The Programme also "aims to promote the participation of Finnish scientists in international research work." FIGARE's Programme Memorandum set a very ambitious goal for itself: "Combining as it does information from many different specialisms, the Programme will also cover the various interfaces between different disciplines and aim to develop a systemic synergism."

The selection process of projects in FIGARE led to 18 projects and consortia. The Panel noted that coherence within a consortium was not great in quite a few cases. The short descriptions of consortia in the Technical Report do not frequently cross-reference between projects within one consortium.

The Panel observed that collaboration within a multi-institute project like FINSKEN worked well.

The Technical Report did not reveal much collaboration between projects or consortia sponsored by FIGARE. The Panel noted one such collaboration during an interview with a leader of a consortium.

Very few consortia had a natural and a social science component. Most consortia were either total natural science or total social science. A few consortia and projects have intentionally integrated natural and social science components (FINSKEN, LUCCAM).

The Panel noted that during the years that FIGARE was in operation, the Academy spent an additional 3-5 million euros on Global Change research. It is supposed that this led to contacts between FIGARE researchers and others but there was no information in the Technical Report to support this hypothesis.

Some consortia reported on international collaboration. These included EU COST actions, lake studies in other European countries and North America, European air pollution studies, the Intergovernmental Panel on Climate Change, and a number of EU-funded projects.

Some consortia had international collaboration as a priority, or maybe even their *raison d'être*. Examples are LUCCAM in Costa Rica and CLIMA-X in Asia. In one case (ARCTICA) the scientists state in the Technical Report that they planned to have a circumpolar network. It is not known whether these plans became reality. On the other hand, the Panel noted that options for international contacts in international law were used in a limited way.

For FIGARE as a whole, collaboration was not very intensive. Notwithstanding several meetings, consortia and projects acted as separate units. Possible

explanations for this observation include the budget cuts that took place after approval of the projects (up to 55%), the relatively short duration of FIGARE, and the lack of an integration effort in the programme as a whole. Especially the latter is worth noting because the Evaluation Panel of the FIBRE Programme noted with high appreciation the BITUMI activity in FIBRE that was aimed at integration and synthesis. The Panel regrets that such an activity was not included in FIGARE, especially given one of the Programme's objectives that stresses integration and even suggest developing "systemic synergism."

The FIGARE Co-ordinator organised 18 meetings. Some meetings were focused on training PhD candidates (see above) while others were to encourage scientific exchanges. Of the 18 meetings, 11 were targeted at the scientific community. The Panel is positive about having these various meetings, but notices a missed opportunity by not devoting at least one meeting to issues of interdisciplinarity.

7 Applicability of Research and Importance to Users

The Evaluation Panel had only limited opportunity to meet and discuss with some users or potential users of the FIGARE research. Potential users include negotiators of global change agreements, Ministries, international global change research programmes, and a broad range of other actors. It is therefore difficult to provide an evaluation in any depth of the relevance and importance of the research to users.

Some of the projects document the relevance of their research to certain users. For example, several projects have produced knowledge that has been of use to the Intergovernmental Panel on Climate Change (IPCC). Others have produced information of use to negotiators of international agreements. For example, the consortium on “Global Policies and Finland”, reports that the findings of one sub-project are to be used for development of national reporting of forest carbon sinks and is also contributing to the IPCC work on developing Good Practice Guidance for greenhouse gas inventories of the land-use change and forestry sector. The NICABO project concludes that it has contributed to the understanding of national scale stores and fluxes of carbon and nitrogen in Finnish forest systems. The results are of relevance for national policies in relation to the UN Framework Convention on Climate Change and national and international air pollution strategies (United Nations Economic Commission for Europe; European Union). They point out that the government research institutes involved in the project have direct links to the relevant policy work in these fields. This is the case for some other projects and suggests the importance of such institutional links for the transfer of knowledge from projects into actions.

Information from the research projects has not been widely disseminated, other than in scientific publications. One exception is the consortium on “Arctic snow, sea ice and glaciers in a changing climate”, which demonstrated its scientific results in an exhibition – Frozen Assets – with about 100 square meters of scientific results, multi-media shows and scientific field and living equipment.

The number of “popular articles” from each project/sub-project varies between 0 and 6, but only 11 projects/sub-projects in total have produced such articles. Only three scientists reported that they had been interviewed on television. Very few projects reported on the development of websites or the production of newsletters, brochures or posters.

For the Programme as a whole, the Programme Co-ordinator reports that he gave five television and radio interviews. Furthermore, a series of seminars and meetings was organised by the Co-ordinator for stakeholders (e.g., “Ecosystems and global change seminar”, November 2002, Helsinki), and for researcher training (e.g., a PhD course on scientific writing in September 2001). In addition a website was created for the Programme as a whole.

8 Recommendations for the Future

- The lack of inter- and intra-project collaboration was, in the view of the Evaluation Panel a serious deficit of the FIGARE Programme. The Panel therefore suggests that more incentives should be provided for such collaboration, for example, through joint workshops. It could also be supported through specific budget allocations for projects that can demonstrate that they are making serious attempts to improve such collaboration through project meetings and training. Furthermore extra budget allocations could be assigned to projects that include a clear plan in their proposal for building up collaborative research during the project.
- Given that several projects clearly did not realise the importance of interdisciplinarity and integration for global change research, the Panel suggests that there is a need for courses on global change research and “Earth System Science” in general and on the design and implementation of integrated, interdisciplinary research.
- In order to enhance the use of Programme results, some form of “bridging institution” is needed to connect “science” and “policy” or “knowledge” and “action”. In the Finnish Biodiversity Research Programme (FIBRE) the BITUMI Project performed this function. The Panel suggests that the user community must be actively involved at the beginning of a project, to ensure that the questions addressed in the project are relevant to the potential users and the interaction between the science and policy communities must be maintained throughout the project
- As documented throughout this Evaluation Report, the Panel found that the Technical Report was not adequate for an in-depth scientific review of the Programme. In order to avoid this problem in the future, the questionnaire provided to the projects at the end of the Programme should closely correspond to the Terms of Reference of the Evaluation Panel. Furthermore, there should be a clear incentive to the projects for writing an accurate and valuable Technical Report. The latter could be achieved, for example, by withholding part of the grant (say 10%) until a satisfactory final report has been submitted.
- For important societal issues like global change, dissemination of the results should be an integral part of the projects. The Panel therefore suggests that a dissemination plan should be requested at the project proposal stage. Development of websites, brochures, newsletters, exhibitions, and media interviews are all important for the broad dissemination of research results.
- The FIGARE Programme consisted of 18 quite disparate projects and consortia. This makes collaboration, synthesis and evaluation difficult. Clearly the scientific community of a country the size of Finland cannot be expected to cover ALL aspects of global change in a three-year research programme. The Panel agreed that a more structured programme, with sub-programmes

focusing on particular areas of global change research would have enhanced the collaboration between projects and offered more opportunities for collaboration between the young scientists in the Programme. A more structured approach, with the possibility of sub-programme meetings, could also contribute to the creation of a sense of belonging to a programme. The Panel got a strong impression that the projects and consortia did not associate strongly with FIGARE as such.

- Especially in times when research budgets are under pressure and being cut, the funding aspects of research programmes must be given serious attention. The Panel felt strongly that the decision to keep the same number of projects but reduce their budgets did not enhance the value of the Programme. Fewer projects with more funding per project would most likely have contributed more to the success of the Programme. Furthermore, it seems as if the goals of many of the consortia and projects were not adjusted after the budgets had been cut. This suggests that some applicants for FIGARE funding had already built in their proposal an expected cut in funding. The Panel is not in favour of such a maximizing behaviour in granting systems. If a project receives less money than it applied for, a negotiation and readjustment of the goals of the project must be carried out. Such a negotiation is essential to ensure the overall achievement of the objectives of the Programme.
- Global change is a complex issue requiring in-depth, interdisciplinary research. The training of young researchers in this area, as well as the establishment of truly collaborative initiatives, takes longer than three years. Other programmes of the Academy of Finland were set up for a longer period of time and took advantage of an interim evaluation to readjust the programme on the basis of experience in the first few years. The Panel suggests that this approach is more effective in achieving the ambitious goals of such programmes and that three years is too short.
- The coordination of research programmes, such as FIGARE, is extremely important. The Panel was impressed by the efforts of the FIGARE Co-ordinator, especially given the disparate set of projects and consortia, the modest amount of funding and the need to complete the Programme in three years. The fact that the Co-ordinator was hired before the start of the Programme was certainly beneficial. The Panel suggests, however, that the Co-ordinator needs strong support even after the Programme has officially ended in order to prepare for the Programme evaluation.
- As important as the role of the Co-ordinator is the role of the Steering Committee accompanying the establishment, implementation and evaluation of the Programme. In the case of the FIGARE Committee, the Evaluation Panel felt that the many changes in membership over time meant that the commitment to and understanding of the Programme decreased considerably towards the end of the Programme. In order to maintain a strong steering group, the Panel suggests that the initial membership of the group should be kept as stable as possible for the duration of the Programme, even if members

change jobs. Moreover, the Steering Committee plays the most essential role in outlining the structure of the Programme and the issues to be addressed. The members must be made aware of this role from the outset, since it is critical to the success of the Programme. The Steering Committee should also be closely involved in the Programme evaluation process. It would be useful if the Committee reviewed the Technical Report and other documentation before these are made available to the Evaluation Panel. Sufficient time should also be planned for a meeting of the entire Steering Committee and the Evaluation Panel, so that the Committee's views would be included in the evaluation. The Panel recognises, however, that during the evaluation meeting the Chair of the Committee provided an overview of FIGARE and responded to the Panel's questions, and individual Committee members sent comments by e-mail during the meeting. A stronger involvement would be in the interest of the Committee, i.e., to find out whether the Programme funds were spent well and whether the Programme goal has been achieved.

- There was little evidence in the material presented to the Panel that FIGARE had contributed substantially to enhancing the links between the Finnish research community and the international global change research programmes, IGBP, IHDP, WCRP and DIVERSITAS. The Programme Co-ordinator did make huge efforts in this regard, but at the research level the contacts remained minimal. The Panel suggests that a more pro-active position of the Academy of Finland would be required to strengthen these linkages. The participation of representatives of the international programmes in national meetings would also enhance information exchange and collaboration.
- On the basis of the successes of the FIGARE Programme, the Evaluation Panel suggests that the Academy of Finland consider the funding of a Centre of Excellence for global change research, in which conceptualisation and interdisciplinarity are key elements. In particular, this would provide an opportunity for young scholars and the "human dimensions" community to continue to build on the progress made during the FIGARE Programme.
- Global change and not just climate change is real and is happening now. The FIGARE Programme has resulted in a resource of researchers in Finland, especially young researchers but also others who are willing to embark on interdisciplinary research on the complex issues of global change. Long-term and stable funding in this research area will be necessary in order to maintain this resource and contribute to meeting the worldwide challenges of global change.

Annex 1

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Dr. Jill Jäger is Co-ordinator of the Initiative on Science and Technology for Sustainability (ISTS: <http://sustainabilityscience.org>). She received her B.Sc. degree in environmental sciences from the University of East Anglia (UK) in 1971 and was awarded her Ph.D. in geography (climatology) by the University of Colorado (USA) in 1974. Dr. Jäger has worked as a consultant on energy, environment, and climate for numerous national and international organisations. In September 1994, she joined the International Institute for Applied Systems Analysis (IIASA, Laxenburg) as Deputy Director for Programs, where she was responsible for the implementation and co-ordination of the research programme. From October 1996 till May 1998 she was Deputy Director of IIASA. From April 1999 till October 2002, Dr. Jäger was Executive Director of the International Human Dimensions Programme on Global Environmental Change (IHDP: www.ihdp.org). Her main field of interest is in the linkages between science and policy in the development of responses to global environmental issues.

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Environmental Geography at Trondheim University, Norway. In 1992 he was appointed to the “Brundtland-Chair” of Energy, Environment and Society there. He also was a visiting scientist to the Biosphere Project at the International Institute for Applied Systems Analysis, Laxenburg, Austria, in 1990 and 1991. Prof. Cramer has published about 70 papers, mostly on biospheric processes at various scales, but also chapters in reports of the Intergovernmental Panel on Climatic Change (IPCC). His international activities have been associated with the International Geosphere-Biosphere Programme (IGBP) since 1992, and he now is deputy chair of its Task Force “Global Analysis, Integration and Modelling” (GAIM).

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Annex 2

Working Group set up by the Board of the Academy of Finland in September 1998

- **Lea Kauppi**, Director General (Finnish Environment Institute), Chair
- **Marja Järvelä**, Professor (Research Council for the Environment and Natural Resources)
- **Risto Pellinen**, Professor (Research Council for Natural Sciences and Engineering), Vice Chair
- **Paavo Okko**, Professor (Research Council for Culture and Society)
- **Heikki Uusi-Honko**, Research Director (National Technology Agency Tekes)
- **Annukka Lehtonen**, Ministerial Adviser (Ministry of Trade and Industry)
- **Raisa Valli**, Ministerial Adviser (Ministry of Transport and Communications)
- **Risto Timonen**, Unit Manager (Ministry of Agriculture and Forestry)
- **Kalevi Ahti**, Deputy Director-General (Ministry for Foreign Affairs)
- **Pirkko Heikinheimo**, Senior Advisor (Ministry of the Environment)
- **Kaisa Kononen**, Head of Research (Maj and Tor Nessling Foundation)
- **Antti Hautamäki**, Research Director (Finnish National Fund for Research and Development, Sitra)

Other members:

- **Jaana Roos** and **Eeva Ikonen**, Senior Advisors (Academy of Finland)
- **Tiina Forsman**, Senior Advisor (Academy of Finland)
- **Jukka Käyhkö**, Programme Co-ordinator (University of Turku)

In addition, the following persons served as expert consultants to the working group:

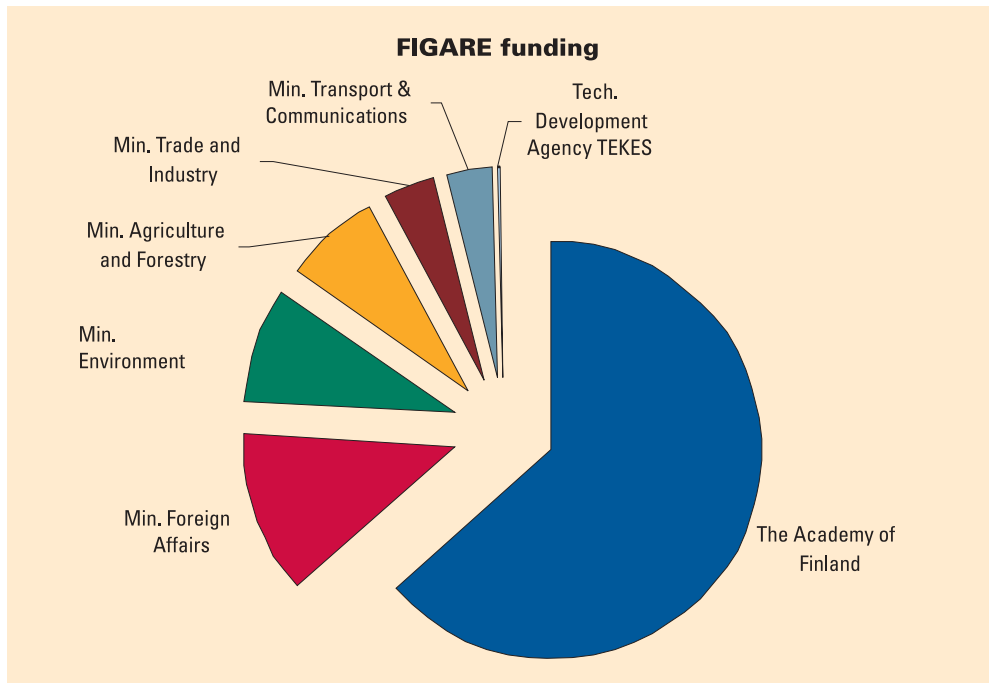
- **Matti Pohjola**, Professor (World Institute for Development Economics Research)
- **Olli Tahvonen**, Professor (Finnish Forest Research Institute)
- **Harri Kuosa**, Senior Researcher (Finnish Marine Research Institute)
- **Mikko Kara**, Research Director (Technical Research Centre of Finland)
- **Juha Honkatukia**, Doctor of Science in Economics and Business Administration (Research Institute of the Finnish Economy)

Annex 3

FIGURE Steering Committee at the End of the Programme (2002)

- **Lea Kauppi**, Chair, Research Council for Biosciences and Environment
- **Marja Järvelä**, Vice-Chair, Research Council for Culture and Society
- **Heikki Granholm**, Ministry of Agriculture and Forestry
- **Teemu Virtanen**, Ministry of the Environment
- **Jorma Kangas**, Research Council for Natural Sciences and Engineering
- **Laura Kansikas-Debraise**, Ministry for Foreign Affairs
- **Markku Löytönen**, Research Council for Biosciences and the Environment
- **Pekka Mäkelä**, Ministry of Trade and Industry
- **Raija Pikku-Pyhältö**, National Technology Agency Tekes
- **Raisa Valli**, Ministry of Transport and Communications
- **Kaisa Kononen**, Programme Manager, Academy of Finland
- **Jukka Käyhkö**, Programme Co-ordinator, Secretary

Annex 4



FIGARE Funding

Institutions funding the FIGARE Programme:

FIGARE funding	M FIM	M €	%
Academy of Finland	25.0	4.20	62.1
Ministry of Agriculture and Forestry	3.7	0.62	9.2
Min. of the Environment	3.5	0.59	8.7
Min. for Foreign Affairs	5.0	0.84	12.4
Min. of Trade and Industry	1.5	0.25	3.7
Min. of Transport and Communications	1.4	0.24	3.5
National Technology Agency Tekes	0.15	0.03	0.4
Total funding	40.25	6.77	100

Financial contributions of funding institutions in million Finnish marks (FIM), euros (€) and percentage of overall funding.

Annex 5

FIGARE Research Projects

Eighteen research projects/consortia were selected to form the Programme; they are listed below in alphabetical order by project leader. Where a consortium consisted of several sub-projects, these are listed following the consortium title.

1. Lauri Arvola: Carbon pathways through boreal lakes: a multi-scale approach (CARBO) (consortium)

Lauri Arvola: Finnish lakes as a source of greenhouse gases and as a sink of carbon: local-scale and intermediate-scale ecosystem studies

Pirkko Kortelainen: Finnish lakes as a source of greenhouse gases and as a sink of carbon: regional extrapolation

2. Timothy Carter: Developing consistent global change scenarios for Finland (FINSKEN)

3. Pertti Haaparanta: Global policies and Finland: environment, energy markets, and forest sector (consortium)

Pertti Haaparanta: Global policy modelling

Juha Honkatukia: Global change and energy markets

Matti Liski: Economic issues in climate change

Raisa Mäkipää: Implications of carbon sinks to economic costs of Kyoto protocol

4. Harto Hakovirta: Global problems, knowledge, institutions and policies (SAFIR) (consortium)

Harto Hakovirta: Global problems, knowledge, institutions and policies

Juhani Pietarinen: Human rights, justice and the global change

Monica Tennberg: Global change in the arctic and institutional responses

5. Erkki Hollo: Climate change and decision-making (consortium)

Erkki Hollo: Global change and the choice of legal instruments for balancing atmospheric and national interests (GLOLIBA)

Kari Kuusiniemi: Kyoto mechanisms and the changing position of sovereign states

Markku Wilenius: International politics of climate and national decision-making: tracing political responses

6. Hannu Ilvesniemi: Nitrogen and Carbon storages in boreal soils and fluxes to water courses: present status and changes in relation to global change (NICABO)

7. Markku Kanninen: Land-use changes and carbon flows in Central America: options for carbon management (LUCCAM)

8. Seppo Kellomäki: Climate change impacts on the dynamics of functioning and structure of boreal forests with implications for the sustainability of forest production and carbon sequestration

9. Peter Kuhry: Arctic feedbacks to global warming: a circumpolar assessment (ARCTICA)

10. Markku Kulmala: Climate – biosphere interactions (CORE) (consortium)

Hannu Savijärvi: Sub-project I

Ari Laaksonen: Sub-project II

Yrjö Viisanen: Sub-project III

11. Kari Laine: Global change in subarctic environment: physiological and ecological stress responses and recovery of wild plants

12. Matti Leppäranta: Arctic snow, sea ice and glaciers in a changing climate (consortium)

Matti Leppäranta/Jari Haapala: Sea ice research

John Moore: The impact on snow and ice of rapid changes in the arctic

13. Jyrki Luukkanen: Conditioning global and local climate, biodiversity and development policies – changing institutional and environmental contexts of tropical forests (CLIMA-X) (consortium)

Eero Palmujoki: The regional and local policy impacts of global environment and climate regimes

Olli Saastamoinen: Local and national forestry impacts of global climate and biodiversity policies in the Philippines and Laos

14. Pertti Martikainen: Agricultural soils as sinks and sources for greenhouse gases in Finland (AGROGAS) (consortium)

Pertti Martikainen: Regulation of microbial nitrous oxide and nitric oxide production: processes at low temperature

Martti Esala: Fluxes of nitrous oxide, nitric oxide and methane from agricultural soils *in situ*

Jukka Peltola: Mitigation of greenhouse gas emissions from agricultural soils in Finland: cost-effectiveness and socio-economic impacts of selected mitigation measures

Tuomas Laurila: Carbon dioxide exchange from agricultural soils – a micrometeorological study

Jouko Silvola: Effects of elevated carbon dioxide concentration on the nitrogen and carbon dynamics of agricultural soils

15. Aimo Oikari: Solar UV-B actions on aquatic ecosystems

16. Matti Saarnisto: Modelling past global change – forecasting the future


17. Petteri Taalas: Long-term ozone and UV estimates (LOUVRE)

18. Elina Vapaavuori: Responses of silver birch (*Betula pendula* Roth) to environmental change (consortium)

Elina Vapaavuori: Responses of silver birch (*Betula pendula* Roth) to environmental change

Toini Holopainen: Below ground carbon allocation of CO₂ and O₃ exposed birch; significance of mycorrhizas and extramatrical mycelium in carbon allocation and nitrogen storage

Marja Poteri: Effect of increased carbon dioxide and ozone on the host-pathogen interaction in birch (*Betula pendula*) leaves.



The Finnish Global Change Research Programme (FIGARE) was established to support and encourage high-quality research on issues of global change in the natural and social sciences, economics and technology. The programme was carried out during 1999-2002 and comprised 18 projects covering a wide range of disciplines.

The report of an international evaluation panel, appointed by the Academy of Finland, addresses questions of the strengths and weaknesses of FIGARE, evaluates its contribution to global change science and makes recommendations for the future.

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