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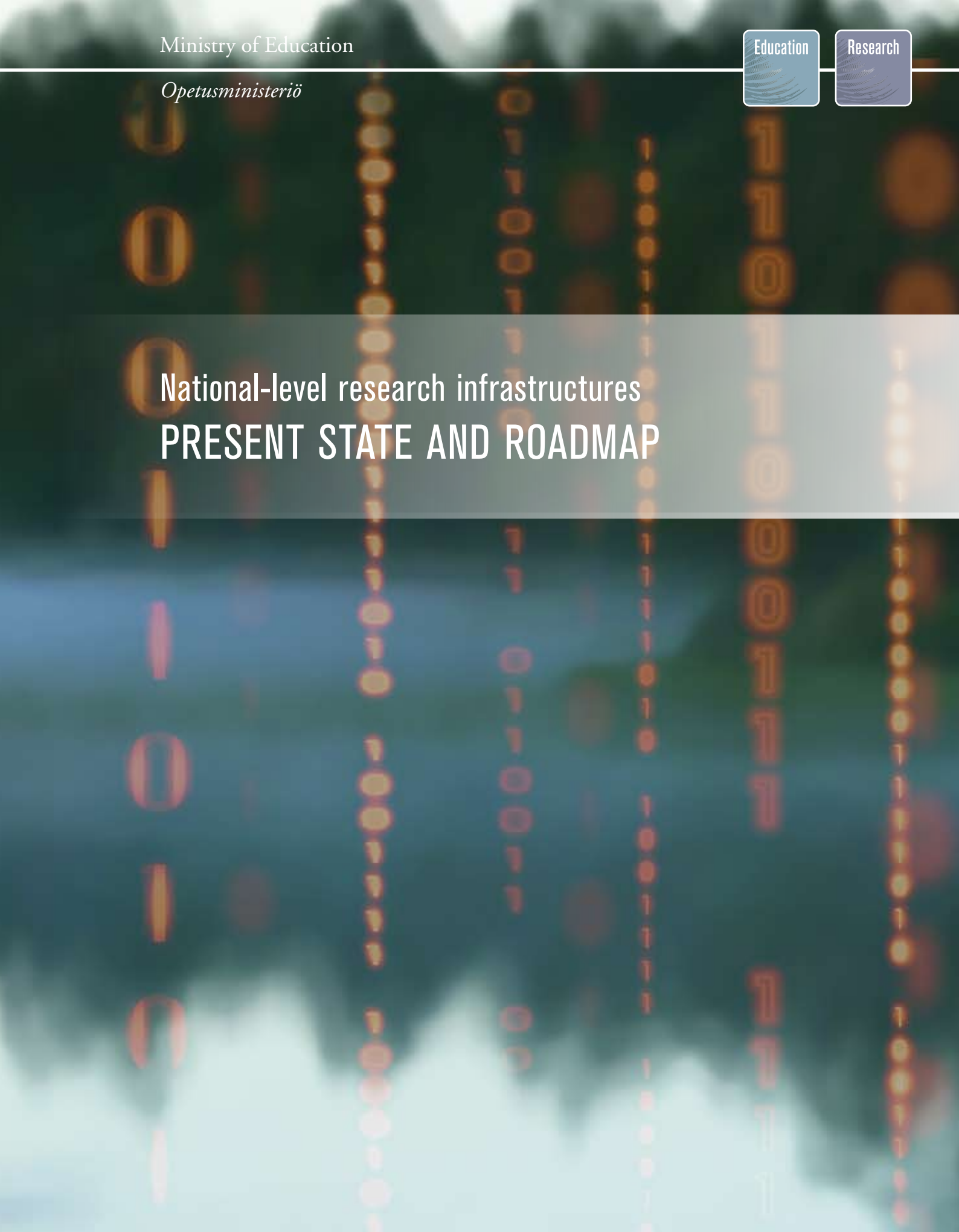

National-level research infrastructures
PRESENT STATE AND ROADMAP

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NATIONAL-LEVEL RESEARCH INFRASTRUCTURES: PRESENT STATE AND ROADMAP

Ministry of Education
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Abstract

One of the priorities of European research policy is to develop research infrastructures. The European Strategy Forum on Infrastructures (ESFRI) has drawn up a plan – a roadmap – for European research infrastructures. The EU Competitiveness Council has urged member countries to prepare national roadmaps of research infrastructures.

Finland's Ministry of Education provided funds for the Federation of Finnish Learned Societies in 2008 for the mapping of research infrastructures at the national level and appointed a wide-based Steering Group for the purpose. This work concerned research infrastructures in all sectors of administration, and as a result 20 projects are proposed for the roadmap of new infrastructures or ones that are to be significantly developed. Thirteen of them are associated with European researched infrastructures proposed by ESFRI.

In addition to proposals for the roadmap, twelve recommendations for developing infrastructures in specific disciplines are presented along with thirteen general recommendations concerning 1) the establishment of infrastructural entities and the improved utilization of infrastructures, 2) Finnish participation in international research infrastructures and ESFRI projects, 3) funding, and 4) research infrastructure policy.

The project estimates that the additional costs of implementing the roadmap will total approximately €30 million per year, while the costs of current national and international research infrastructures are around €160 million a year. Funding will also be needed for local research infrastructures. The present project reiterates the proposals of earlier working groups concerning the need for an organ at the national level, a research infrastructure council, to prepare and implement research infrastructure policy and its funding.

Photo: Eeva Konen

Sammandrag

Att utveckla forskningsinfrastrukturer är en av prioriteringarna för den europeiska forskningspolitiken. Det europeiska forumet för forskningsinfrastruktur ESFRI har utarbetat en plan, en så kallad vägvisare, som gäller paneuropeiska forskningsinfrastrukturer. Europeiska unionens råd för konkurrenskraft har uppmanat medlemsländerna att utarbeta nationella planer för sina forskningsinfrastrukturer.

För att kartlägga de finländska forskningsinfrastrukturerna på nationell nivå och för att utarbeta en samlad överblick över forskiningens långsiktiga behov av infrastruktur beviljade undervisningsministeriet de Vetenskapliga samfundens delegation ett anslag år 2008. Ministeriet tillsatte en bred ledningsgrupp för projektet. Projektet skall täcka forskningsinfrastrukturerna inom alla förvaltningsområden. En vägvisare för nya infrastrukturer eller sådana som behöver utvecklas betydligt föreslås omfatta sammanlagt 20 projekt, varav 13 hänför sig till forskningsinfrastrukturer föreslagna av ESFRI.

Utom de förslag som gäller vägvisaren gav projektet 12 rekommendationer för utvecklingen av infrastrukturen på olika vetenskapliga områden samt 13 allmänna rekommendationer med temat 1) att bilda infrastrukturella helheter och att effektivisera infrastrukturernas användning, 2) finländskt deltagande i internationella forskningsinfrastrukturer och ESFRI -projekt, 3) finansieringen för infrastrukturer samt 4) politiken för forskningsinfrastrukturerna.

Forskningens långsiktiga behov av infrastrukturer uppskattas i projektet kostar ytterligare omkring 30 milj. euro per år, medan utgifterna för nuvarande nationella och internationella forskningsinfrastrukturer uppgår till totalt omkring 160 milj. euro per år. Finansiering behövs dessutom för de lokala forskningsinfrastrukturerna. Projektet upprepar tidigare arbetsgruppers förslag, dvs. ett organ på nationell nivå, en kommitté för forskningens infrastrukturer, behövs för att bereda och genomföra politiken och finansieringen.

Tiivistelmä

Tutkimusinfrastruktuurien kehittäminen on eräs Euroopan tutkimuspolitiikan prioriteeteista. Euroopan tutkimusinfrastruktuuristrategiafoorumi ESFRI on laatinut suunnitelman, ns. tiekartan, yhteiseurooppalaisista tutkimusinfrastruktuureista. Euroopan unionin kilpailukykyneuvosto on kehoittanut jäsenmaita laatimaan kansalliset tutkimusinfrastruktuurien tiekartat.

Suomen kansallisen tason tutkimusinfrastruktuurien kartoitusta ja tiekartan laatimista varten opetusministeriö myönsi määrärahan Tieteellisten seurain valtuuskunnalle vuodeksi 2008 sekä asetti hankkeelle laaja-alaisen johtoryhmän. Projektin tehtävä kattoi kaikkien hallinnonalojen tutkimusinfrastruktuurit. Uusien tai merkittävästi kehitettävien infrastruktuurien tiekartalle projekti ehdottaa yhteensä 20 hanketta, joista 13 liittyy ESFRIn ehdottamiin eurooppalaisiin tutkimusinfrastruktuureihin.

Tiekarttaa koskevien ehdotuksen lisäksi projekti esitti 12 suositusta eri tieteenalojen infrastruktuurien kehittämisestä ja 13 yleistä suositusta, joiden aiheina ovat 1) infrastruktuurikokonaisuuksien muodostaminen ja infrastruktuurien käytön tehostaminen, 2) Suomen osallistuminen kansainvälisiin tutkimusinfrastruktuureihin ja ESFRI-hankkeisiin, 3) rahoitus sekä 4) tutkimusinfrastruktuuripolitiikka.

Projekti on arvioinut, että tiekartan toteuttamisesta aiheutuvat lisäkustannukset ovat yhteensä noin 30 milj. euroa vuodessa, kun nykyisten kansallisten ja kansainvälisten tutkimusinfrastruktuurien kulut ovat yhteensä noin 160 milj. euroa vuodessa. Lisäksi tarvitaan rahoitusta paikallisiin tutkimusinfrastruktuureihin. Projekti toistaa aiempien työryhmien ehdotuksen, että tarvitaan kansallisen tason toimielin, tutkimusinfrastruktuuritoimikunta, valmistelemaan ja toteuttamaan tutkimusinfrastruktuuripolitiikkaa ja sen rahoitusta.

Preface

In 2006, ESFRI, the European Strategy Forum on Research Infrastructure published its plan, the so-called roadmap, on the needs to construct and update research infrastructures at the European level. Updating the ESFRI roadmap is currently under way. The EU's Competitiveness Council has recommended the preparation of national-level roadmaps to the Member States. The Research Infrastructure Committee appointed by the Finnish Ministry of Education proposed in its Report (Ministry of Education publications 2007:36) the mapping of national-level research infrastructures in Finland and the preparation of a roadmap of new needs. Statements received on the report noted the importance and urgency of mapping and preparing a roadmap.

The Ministry of Education granted funds to the Federation of Finnish Learned Societies for the mapping work and preparation of the roadmap during 2008. The Federation instituted a project for the purpose to which Senior Science Adviser Eeva Ikonen and Project Secretary Katri Mäkinen were appointed, along with Project Coordinator Marjut Nyman from 20 August to 19 November 2008.

The Ministry appointed a project Steering Group chaired by Counsellor of Education Mirja Arajärvi of the Ministry of Education. The invited members of the group were Director Mika Aalto of Tekes – The Finnish Funding Agency for Technology and Innovation, Professor Mikael Hildén of the Finnish Environment Institute, Professor Juhani Keinonen of the Federation of Finnish Learned Societies, Vice President (Research) Riitta Mustonen of the Academy of Finland, Senior Adviser, R&D, Martti Mäkelä of the Ministry of Transport and Communications, Counsellor of Education Marja-Liisa Niemi of the Ministry of Education, Head of Division Paula Nybergh of the Ministry of Employment and the Economy, Chief Planning Officer Tuomas Parkkari of the Science and Technology Policy

Council, Director of Research Mikko Peltonen of the Ministry of Agriculture and Forestry, and Director of Research and Development Kari Vinni of the Ministry of Social Affairs and Health.

Invited permanent experts of the Steering Group were Vice-Rector Outi Krause (Helsinki University of Technology) as a representative of the Finnish Council of University Rectors, Rector Tapio Varmola (Seinäjoki University of Applied Sciences) as a representative of the Rectors Conference of Finnish Universities of Applied Sciences, Secretary General Sari Löytökorpi of the Advisory Board for Sectoral Research, Adviser Janica Ylikarjula of the Confederation of Finnish Industries EK, and Programme Director Pekka Tolonen of the Finpro organization.

The secretary of the Steering Group was Senior Science Adviser Eeva Ikonen.

Owing to changes in professional tasks the Ministry of Employment and the Economy changed its representative to Director, Innovation Policy, Sakari Immonen and the Finpro organization changed its representative to Programme Director Markus Ranne.

The Steering Group invited an independent national group of experts and three international panels of experts to evaluate the infrastructure proposals. The Steering Group held two public seminars for information and discussion during the process.

The Steering Group held nine meetings.

The Steering Group extends its warmest thanks to the staff and experts of the project and to the Federation of Finnish Learned Societies.

Helsinki, 2 December 2008

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Summary

Research infrastructure policy has to be an integral part of national research and innovation policy. We need a national process for infrastructure policy, which has to involve all actors, from researchers to decision-making bodies, in matters of research and innovation policies. The importance of dialogue is emphasized when seeking joint benefits of synergy. The reports of the two earlier Committees on these matters (Ministry of Education publications 2007:36; Science and Technology Policy Council Report 2006: *Strategic Centres of Excellence in STI*) propose the founding of a permanent body with sound resources for the preparation and implementation of research infrastructure policy. These proposals have received support in statements given on the reports.

The tasks of the body would include the preparation of strategy, follow-up, evaluation and the coordination of international participation. The work would also include reports on infrastructure, statements, the updating of the roadmap, preparation of funding decisions and to some degree funding decisions. The infrastructure council could also make proposals for solutions in the case of two or several competing coordinating bodies at the national level. These demanding and extensive tasks require permanent structures and personnel with expertise.

The national-level roadmap is to be evaluated on a continuous basis and updated at approximately 3-year intervals. The planning of the schedule for the national roadmap requires accommodation to the European roadmap process. Applications for the funding of infrastructures and related decision-making should proceed apace with the European ESFRI (European Strategy Forum on Research Infrastructures) process. Solutions and decisions of even a quick nature will be needed with regard to the present ESFRI roadmap projects.

The various levels (local, national and international) and types (single-sited, distributed and virtual) of infrastructure should be taken into account in the planning and organization of funding. New infrastructure needs at the national level may also emerge in the areas of so-called Strategic Centres for Science, Technology and Innovation (CSTI). It is therefore important to provide critical reviews and plans specific to disciplines to develop infrastructures or plans for a different kind of closer cooperation following the nature of the field in question.

National-level research infrastructures in 2008 and roadmap projects

The Steering Group identified 24 projects as significant national-level infrastructures in Finland. Twenty proposals were accepted for the roadmap, thirteen of which are associated with ESFRI roadmap projects at the European level.

The Steering Group maintains that decisions should be made as soon as possible concerning funding for the following seven national or international projects that have been accepted for the roadmap:

- Linguistic materials and technology
- Data archives in the social sciences
- Infrastructures of environmental and atmospheric sciences
- Infrastructures of the biomedical and life sciences
- The renewal of European synchrotron radiation equipment
- European infrastructure for nuclear and particle physics
- The project entity of the IT Center for Science

These projects are linked to European research infrastructure projects, of which the planning stage has begun and the construction stage will take place in 2009–2011. Therefore, decisions are needed as soon as possible concerning Finnish commitment to infrastructures in these fields.

Funding and budgeting

According to the preliminary estimate provided by the present mapping, Finland spends approximately €130 million per year in public appropriations for the upkeep of the national infrastructures presented in Table 1[1] and some €30 million for the membership fees of international infrastructures (Tables 2 and 3). In addition to membership fees there can be other costs of membership both abroad and in Finland. As noted by the International Expert Panels in their recommendations, participation in major international projects requires investment and the coordination of activity also at the national level for the most efficient utilization possible of international infrastructure.

The construction costs of the projects chosen for the roadmap will be approximately €230 million over the period 2008–2020, with annual costs for Finland amounting to approximately €30 million (Table 4). The schedule for implementing the projects and the focuses of funding needs are highly different in different fields, which means that a funding instrument is needed for directing funding to projects on the basis of detailed funding proposals and plans.

Finland needs a centralized funding system for renewing the existing research infrastructures and for funding new projects at the national level. A centralized funding system should also take into account the needs for managing research infrastructure policy and the preparation of long-term international commitments. The Steering Group estimates that already in 2009 approximately €9 million will be needed to promote the most urgent projects. Between 2010 and 2016 over €200 million will be needed as a whole for carrying out the most urgent projects. This rough estimate partly includes use-related costs.

1 The data in Tables 1–4 is based on information given by the proposing parties to the Steering Group.

The recommendations of the Steering Group

Recommendation 1. The usability of national registers and the availability of materials should be improved and costs to the user should be reduced, where necessary by amending related legislation. Valuable bodies of material collected in Finland should be made available for broader international use by increased digitization of materials and by implementing uniform collection procedures in accordance with international standards.

Recommendation 2. Finland requires a shared vision of the kind of e-infrastructure that will best serve excellent research.

Recommendation 3. Resources in the social sciences and the humanities should be concentrated and free access for researchers should be promoted for the utilization of valuable materials.

Recommendation 4. The consolidation of cooperation among memory institutions[2] that has been instituted with support from the Ministry of Education is to be continued. The core material of the cultural heritage is to be digitized.

Recommendation 5. By pooling resources and through the further development of research infrastructures Finland should seek a leading international role in the fields of environmental sciences in which it already has solid national expertise, significant data resources and research infrastructure.

Recommendation 6. Biocenter Finland should use its position and responsibility for coordination in developing national-level research infrastructures.

Recommendation 7. Finland is to ensure a broad scale of expertise and research in the energy sector, investments in research and development in renewable and non-emissive energy as required by involvement in international cooperation, and the utilization of international research infrastructures.

Recommendation 8. Extensive multi- and cross-disciplinary research conducted with the aid of synchrotron radiation should be developed on the basis of nationally coordinated cooperation.

Recommendation 9. Finland is to reinforce national coordination and division of tasks in nanoscience and nanotechnology and the utilization of international research infrastructures.

Recommendation 10. The Finnish scientific community should draw up a joint plan for a project to develop astronomy, including existing national and international infrastructures and their utilization.

Recommendation 11. In order to maximize research carried out in major international infrastructures and related benefits, Finland needs to attend to domestic research infrastructures that support this work.

Recommendation 12. The main tasks of CSC should be scientific computing services, IT network services and services related to the storage and use of large bodies of data. The work should be expanded towards increased service also for research institutions. CSC should continue its work of developing infrastructures in collaboration with users and parties producing information.

Recommendation 13. The scientific community should be organized to prepare developed plans and for more efficient utilization of existing research infrastructures. This concerns infrastructures at both the national and local levels.

Recommendation 14. Cooperation in constructing and using infrastructures is to be improved among units of the same field and especially by establishing multidisciplinary infrastructure entities focusing on research in specific problem areas.

Recommendation 15. Finnish researchers and experts should seek positions of responsibility in international research infrastructures in the fields in which there is significant Finnish expertise.

Recommendation 16. International investments should aim at employing in-kind contributions, which promotes the development of domestic skills and cooperation with the corporate sector.

2 The term memory institution or organization applies to museums, archives and libraries.

Recommendation 17. Finnish research organizations should make better use of membership in international research infrastructures. Existing international commitments and research infrastructures at the national level should be utilized efficiently for the mobility of researchers, researcher training and the planning of the work of researcher training schemes.

Recommendation 18. In preparations for very large and expensive international projects joint arrangements, for example with other Nordic countries, should be considered.

Recommendation 19. The development of national-level research infrastructures and research carried out in new international research infrastructures are to be supported with an additional appropriation in keeping with the needs for developing research and international cooperation in research.

Recommendation 20. The funding of infrastructures should be increased as part of the funding of universities and research institutions and on a centralized basis as competed funding for national-level infrastructures. In addition, there is a need to preparation for the membership fees of international infrastructures and the coordination of related national activities.

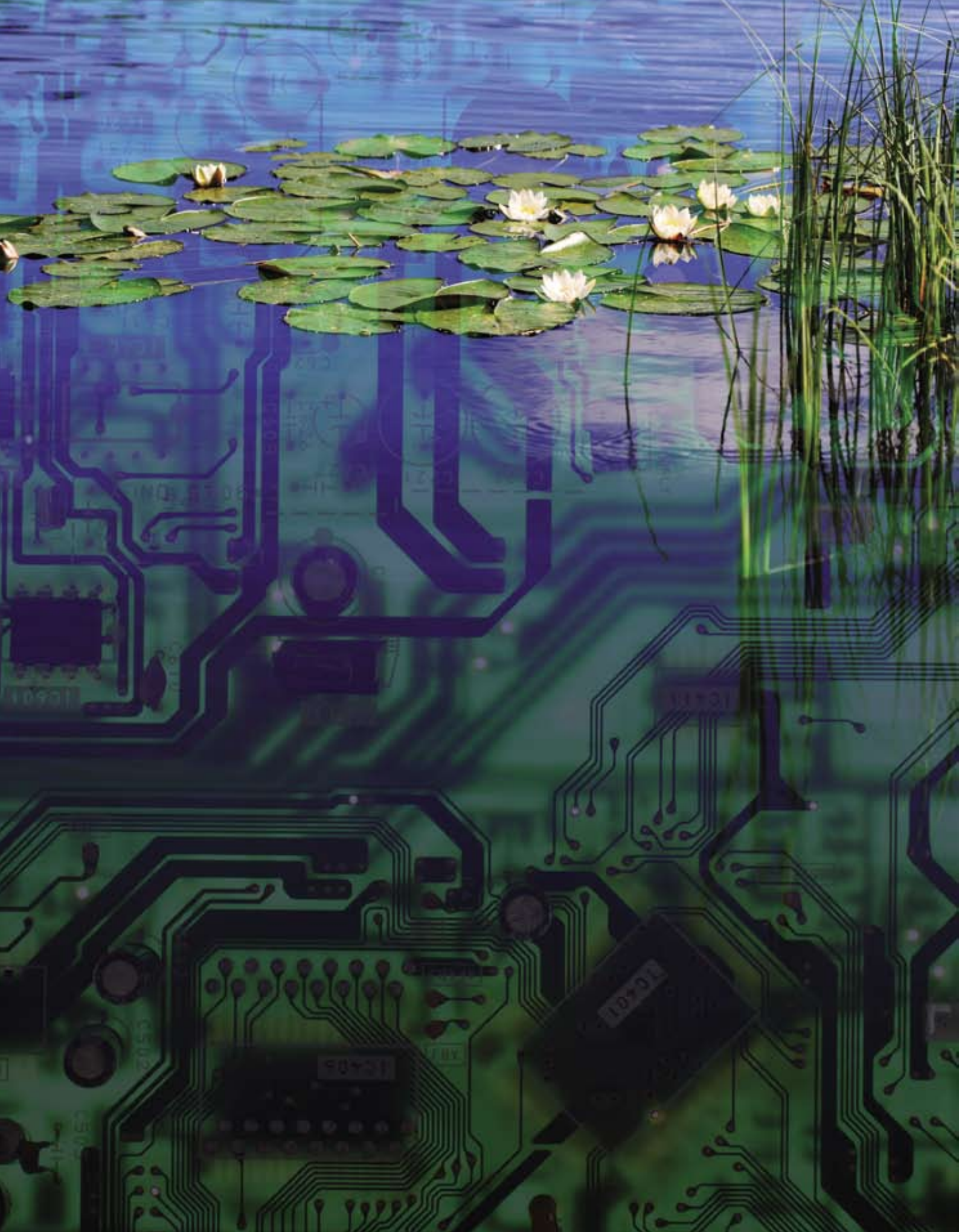
Recommendation 21. Research infrastructure policy should be an integral part of research and innovation policy and it should be implemented according to a consistent and well-planned model of action. For the purposes of implementation a research infrastructure council needs to be founded with ensured operating conditions, including a permanent secretariat.

Recommendation 22. The purpose of the infrastructure council is to compile the views of researcher communities and other actors regarding the future needs of national-level research infrastructures and to arrange the evaluation of project proposals, taking into account the needs of society and the economy, and to draw up plans for the realization of infrastructures on the basis of evaluations.

Recommendation 23. The national-level roadmap is to be evaluated on a continuous basis and updated at approximately 3-year intervals.

Recommendation 24. Universities, research institutions and other maintaining bodies should take into account research infrastructures as part of their own strategy work. It should include the upkeep of existing infrastructures, improved joint use, new infrastructure needs, and a plan for funding. The planning should take into account situations where closer networking is more efficient than the implementation of a new infrastructure.

Recommendation 25. Ministries, parties funding research and the host organizations of infrastructures should prepare their own long-term plans for the use, development and funding of their infrastructures.



1. Introduction

High-standard and up-to-date research infrastructures are a precondition for successful research. They are also highly significant for the international competitiveness of the research system and for interest in it.

Following the recommendation given in the Science and Technology Policy Council's report of 2006, the Finnish Ministry of Education in association with the Ministry of Trade and Industry appointed a Committee which was entrusted with the following tasks:

1. To draw up a proposal for procedures for identifying and evaluating the need for establishing significant new research infrastructures at the national level or for developing existing infrastructures, and for the procedures of prioritizing projects;
2. To prepare a proposal for a system for funding research infrastructures and for a division of tasks among financing parties, taking particular note of significant common infrastructures of several organizations or different sectors of administration as well as international infrastructures; and
3. To carry out a preliminary mapping in collaboration with the Research Councils of the Academy of Finland and Tekes of significant national research infrastructures and to make proposals on their renewal and development.

The purpose was to prepare a so-called national roadmap to be updated at intervals of 2–3 years concerning the infrastructures that will be needed over following 10–15 years with regard to national needs and developments at the international level. The mapping work was noted to be such an extensive and time-consuming task that the Committee felt that it could not carry it out with its own resources. In a report presented in 2007, the Committee proposed that the national-level infrastructures and participation in international infrastructures were to be mapped and a roadmap of new needs was to be drawn up. This proposal was widely supported in related comments.

In January 2008, the mapping of national-level research infrastructures in Finland was launched, with funding from the Ministry of Education. On the 16th of January 2008, the Ministry appointed a Steering Group for this work, representing various sectors of administration, scientific and scholarly communities, funding parties, and the private sector. The mapping was carried out by the Federation of Finnish Learned Societies. In connection with the project parties involved in the survey were able to make proposals regarding participation in present or future international infrastructures.

2. The Concept of Research Infrastructure

Research infrastructures (hereinafter infrastructures) are resources of research facilities, equipment, materials and services permitting research and development at different stages of innovation, supporting organized research, and maintaining and developing research capacity.

A single-sited research infrastructure is appropriate in fields requiring major investments in expensive research equipment. Single-sited infrastructure may include satellite units, and it may also permit remote use.

A distributed research infrastructure is suited to fields in which the available resources are geographically dispersed. A distributed infrastructure may also produce shared, centralized services.

Virtual research infrastructures are, for example, databases, archives etc. that can be used by researchers from their own workstations.

Many countries have drawn up their own strategies, roadmaps and surveys of existing infrastructure. Strategic plans and roadmaps have in many contexts led to the channelling of funding into investment in nationally significant infrastructures. In Denmark, for example, the immediate needs for funding for the renewal of national-level infrastructure are estimated at approximately €40 million and roughly €269 million for establishing new infrastructures (Danish Council for Strategic Research 2005). According to Norway's infrastructure strategy (Norges Forskningsråd – The Research Council of Norway 2008) the country will invest some €88 million per year in research infrastructure over the next ten years. In Sweden, the funding requirements of the roadmap that was revised in 2007 (Vetenskapsrådet – The Swedish Research Council 2007) will be approximately €272 million until 2012, which means roughly €53 million in public additional funding at the annual level. Many foundations in Sweden are also significant funding parties of research infrastructures.

Finland has a long tradition, especially in the natural sciences, of utilizing the infrastructures and large-scale experimental arrangements of other countries, since Finland has not had the funds for major investments in research infrastructures. Individual Finnish researchers or research teams have succeeded in becoming users of the leading international infrastructures by offering their expertise on an in-kind basis and through payment of small user fees. The formal participation of Finland as a member of international research infrastructures began in the 1980s, because participation on the basis of personal contacts was no longer possible in large research institutions. Research plans and international recognition are still decisive factors when seeking to utilize high-level research en-

vironments outside Finland through bilateral project-based agreements.

The European Strategy Forum on Research Infrastructures (ESFRI) was established in 2002. ESFRI is a cooperative body for EU member countries and associated countries for the preparation of research infrastructure policy. It consists of representatives of research ministries and parties funding research. ESFRI does not fund research or research infrastructures.

The ESFRI roadmap is a continuously specified and updated document. The needs of the future are estimated for the next 10 to 20 years. The principle here is that projects moving on to the construction stage will be dropped from the roadmap list.

The ESFRI roadmap published in 2006 (European Strategy Forum on Research Infrastructures 2006*)* contains 35 projects in seven key areas (social sciences and the humanities, environmental sciences, energy, material sciences, astrophysics, astronomy, nuclear and particle physics, biomedical and life sciences and e-infrastructures). ESFRI has accepted 10 new projects for its roadmap updated in 2008, and notes that six of the projects on the first roadmap have come under way and the constructions plans for 11 have made significant progress.

The funding of 34 ESFRI roadmap projects in the preparation phase began in 2008. The purpose of the preparatory phase is primarily to investigate administrative, legal and technical solution before the construction stage. Finland has participated in the preparatory phase of 14 projects on the ESFRI roadmap. Funding has come from the EU's Seventh Framework Programme and from national sources. Owing to its international memberships, Finland is involved in three other ESFRI roadmap projects.

Each Nordic country has its own strategies of research policy and specific research infrastructure needs. There has been successful cooperation between the Nordic countries in participation in some European research infrastructures. Examples include the joint Nordic Nordsync consortium within the European Synchrotron Radiation Facility (ESRF) infrastructure. Finland is currently participating in the Facility for Antiproton and Ion Research (FAIR) project in association with Sweden.

An example of joint Nordic investment in research infrastructure in astronomy is the Nordic Optical Telescope (NOT), and of other joint projects the Nordunet data network and the distributed Nordic DataGrid Facility (NDGF) for high performance computing in the sector of information technology.

3. Criteria and Procedures for Choosing Research Infrastructures

The project for mapping national-level research infrastructures in Finland was launched in February 2008 with a seminar aimed at involved groups on the theme of "Finland and European research infrastructure projects". The seminar featured presentations on Finnish interest in participating in European research infrastructure projects taken up by ESFRI, and the launched national mapping work was also presented. The mapping project was made known through the Internet pages of the Academy of Finland, Tekes and the Finnish Science and Technology Information Service (www.research.fi) and in newspaper and magazine articles. Separate webpages for the mapping project were established on the server of the Federation of Finnish Learned Societies at www.tsv.fi/tik.

The webpages of the mapping project have operated at all stages of the work (Fig. 1) as a channel of information for interested parties. Some of the information was also available in Swedish and English on the Internet pages. The process description of the mapping project is given in Annex 12.

The mapping of national-level research infrastructure and new infrastructure needs was carried out with the aid of an open Internet-based survey. The mapping was divided into two parts, the first of which focused on existing national research infrastructures and commitments to international research infrastructures (inter-governmental agreements, memberships in international research infrastructures).

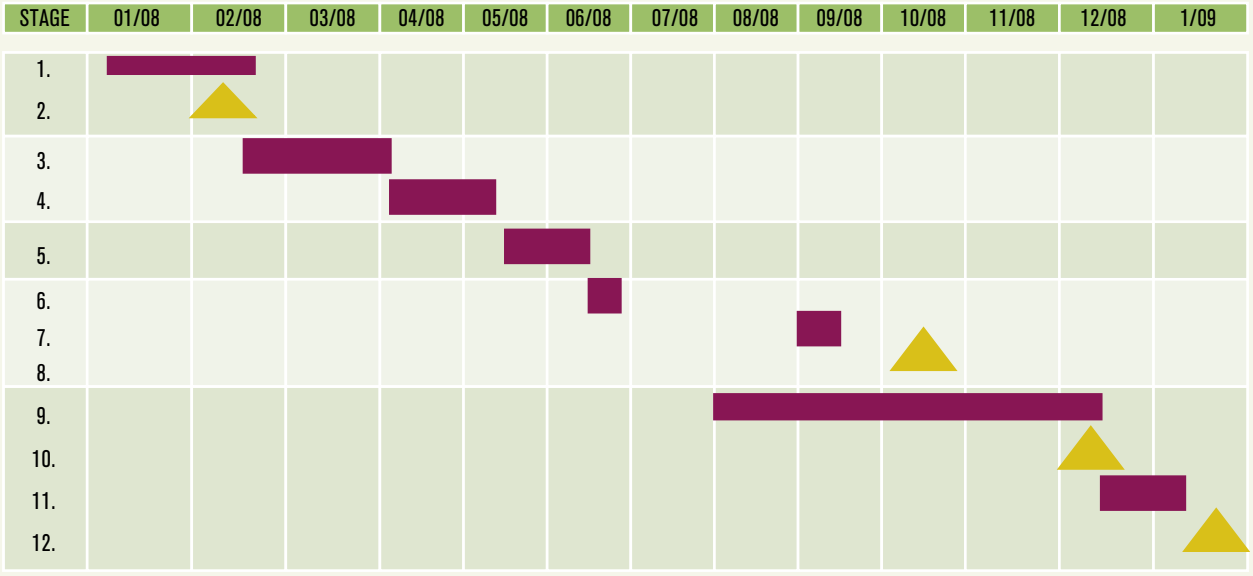
In the second part of the charting proposals were received for the significant renewal of research infrastructures, new research infrastructures, and for participation in new international projects.

Specific instructions and questionnaire forms were prepared for both parts, which had to be responded to separately. A separate form was filled in for each infrastructure project (Annexes 10 and 11).

The survey was open to participants for over a month during the spring of 2008. It also provided an opportunity for proposals concerning national research infrastructure needs or participation in international research infrastructures. An Internet link for replies was automatically sent to the pre-defined target group (Annex 7). Universities were asked to provide information on the survey to their respective university hospitals and units that were not mentioned separately among the target group of respondents (Annex 7). It was also possible to respond to the survey without being separately invited.

Respondents to the survey were asked to study carefully the provided information and instructions for responding, which were available on the mapping project's Internet pages. The practical aspects of the Internet survey were attended to by the Neteffect company using the Webropol system. Each respondent was given an individual code name and a reply link for responding on the Internet. The secretariat forwarded reply link requests from actors to Neteffect, which provided the necessary code names and reply links in addition to providing technical assistance.

A total of 297 replies were received, 116 of which were proposals for the national roadmap (Annexes 8



1. Planning/Steering Group
2. 9.2. Seminar "Finland and European Research Infrastructure Projects"
3. Preparing the Online Questionnaire
4. Online Questionnaire open 2.4.-9.5.
5. Analysing the Online Questionnaire data
6. Independent National Expert Group 18.-19.6. and 24.6.
7. International Expert Panels work period in Finland
8. Open Information and Discussion Seminar 15.10.
9. Preparation of the Final Report of the Steering Group
10. Steering Group approved the Final Report 2.12.
11. Analysing the Online Questionnaire data
12. Publishing of the Final Report

Fig. 1. Timetable of the research infrastructure mapping project

and 9). Experiences and feedback from the technical procedures of the survey will be presented to the Ministry of Education for the future planning of the update of the roadmap.

The Steering Group established the criteria listed below for national-level infrastructures. Respondents to the survey were to take into account these criteria of national-level infrastructures that had been published beforehand. The criteria were available on the mapping project's own Internet pages.

Fulfilment of most of the following criteria is required of national-level infrastructure and plans for the roadmap:

1. Demonstrable administrative structures and responsible personnel for the upkeep and services of the infrastructure;
2. An annual report or similar account of the infrastructure's activities showing its degree of use and effectiveness, for example in the form of scientific output, new applications, patents, new products, or generated business activities;
3. The infrastructure participates in the training of researchers or is utilized for these purposes;
4. The research infrastructure is of scientific significance and its work provides added value at the national or international level;
5. The infrastructure is continuously used by a significant number of Finnish or foreign researchers;
6. The infrastructure provides its users with services for its utilization;
7. In principle free access for utilization of the infrastructure. This, however, may require approval of a research plan and reasonable compensation for user fees, guidance and services;
8. The investment costs of the infrastructure in question are relatively high in comparison with other infrastructures in the same field;
9. The annual budget of the infrastructure is relatively high in comparison with other infrastructures in the same field;
10. The infrastructure has added value in industrial-commercial terms or for the common good either in the short (e.g. construction stage) or long term (e.g. utilization of results).

In addition, the following points were to be elucidated with regard to participation in an existing international research infrastructure:

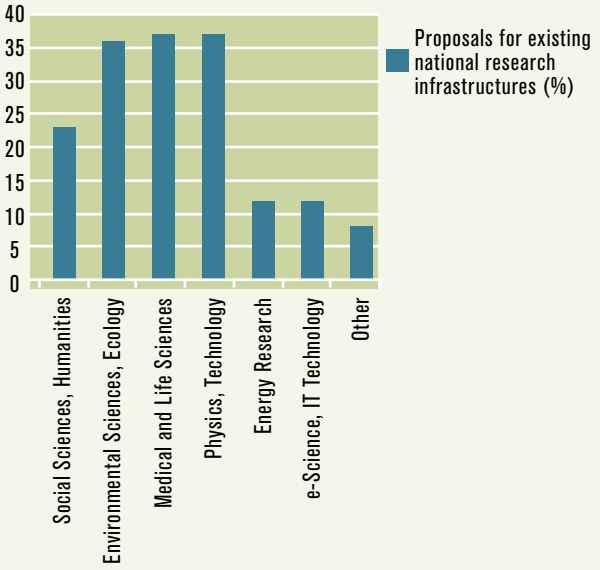


Fig. 2. Distribution of domestic research infrastructures by discipline in the replies of the mapping survey. The total of the given percentages exceeds 100, because many of the respondents stated that their projects involved several disciplines.

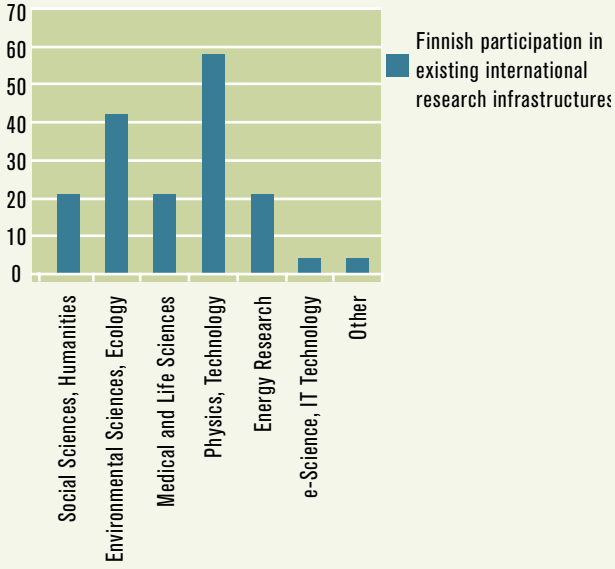


Fig. 3. International commitments by discipline. The total of the given percentages exceeds 100, because many of the respondents stated that their projects involve several disciplines.

1. The scientific significance of the infrastructure for Finland;
2. Other utilization of the infrastructure in Finland;
3. Annual membership fees payable by Finnish parties;
4. User fees payable by Finnish researchers for the utilization of the infrastructure;
5. The degree to which Finnish researchers utilize the infrastructure;
6. The participation of Finnish doctoral students in courses and professional guidance provided by the infrastructure.

The mapping section of the survey provided a picture of the kinds of research infrastructures existing in Finland and the international research infrastructures to which Finland is committed as a member through inter-governmental agreements or other procedures.

The roadmap section produced material on plans that the respondents wished to propose for the national roadmap. The national roadmap is a plan for new national research infrastructures that will be needed over the next 10 to 20 years or for the renewal of significant existing infrastructures, but it also contains participation in new international projects or significant renewal of existing infrastructure.

Of all the replies to the mapping section of the survey, 179 could be analysed in further detail. Of these, 156 were domestic proposals and 24 were international projects. The Neteffect company analysed the material of the replies for the use of the secretariat of the mapping project.

The largest number of proposals for national-level infrastructures came from the fields of environmental science, biomedical and life sciences, physics and technology (Fig. 2).

The largest numbers of international commitments were in the environmental sciences, physics and technology (Fig. 3).

Forty-six percent of the domestic research infrastructure proposals were single-site infrastructures. Research infrastructures in the social sciences are typically virtual while in technology they are typically single-sited. The proportions of single-sited, distributed and virtual research infrastructures were of almost the same level in other disciplines.

Over half of the proposed domestic research infrastructures or international commitments are over ten years old. The oldest infrastructures at the national level are in the social sciences and humanities.

The open mapping procedure resulted in a large number of replies and their uneven quality. Many of the replies overlapped or the projects were of a local nature. The same unit could have parallel proposals for the roadmap or the list of existing national-level infrastructures. As a result the Steering Group invited an independent national group of experts (see below) to evaluate which projects met the minimum criteria of research projects at the national level.

The Independent Expert Group convened behind closed doors. It had the use of copies of the original replies and special forms for their evaluation. The proposals and recommendations of the expert group were recorded and presented to the Steering Group by the secretariat. Based on the proposals of the Independent Expert Group the Steering Group decided which project proposals could then be given to be evaluated by the three International Expert Panels appointed by the Steering Group. The members of the three International Expert Panels were mostly foreign experts (see below).

There were cases where the same unit could make parallel proposals for the roadmap or the list of existing national-level infrastructures. The Independent Expert Group recommended that the units operating at the Helsinki Biomedicum should collaborate in drawing up only a few joint proposals. A similar recommendation was given concerning the units of the Biocenter at Viikki in Helsinki. The roadmap list contains several projects that can be regarded as falling under the cooperation agreement between Biocenter Finland and the Finnish Institute of Molecular Medicine (FIMM).

The Steering Group invited three International Expert Panels:

- **Life Sciences & Medicine and Environmental sciences, (LME),**
- **Physical Sciences, e-Science and Engineering, (PSE)**
- **Social Sciences and the Humanities, (SSH).**

The Independent Expert Group:

Professor Emeritus Jorma Hattula

Adjunct Professor Johanna Ikävalko, Environment Director, Central Union of Agricultural Producers and Forest Owners (MTK)

Professor Emerita Lea Pulkkinen, University of Jyväskylä

Professor Emeritus Reijo Vihko

Members of the International Expert Panels: Life Sciences & Medicine and Environmental sciences – LME:

Chief Executive Dr. Ruth Barrington (chair), Molecular Medicine Ireland, Ireland.

Prof. Stephen Emmott, Microsoft Research Cambridge, United Kingdom

Prof. Anthony E. Fallick, University of Glasgow, United Kingdom

Dr. Elisabeth Koch (vice-chair), Zentral Anstalt für Meteorologie und Geodynamik, Austria

Prof. Brian Moss, University of Liverpool, United Kingdom

Prof. Anders Lindroth, Lunds Universitet, Sweden

Prof. Inger Lundkvist, Karolinska Institutet, Sweden

Adjunct Professor Mervi Sibakov, the Centenary Foundation of the Technology Industry

Physical Sciences, e-Science and Engineering – PSE:

Director Kerstin Eliasson, Utbildingsdepartementet, Sweden

Dr. Kari-Pekka Estola, private investor, Finland

Dr. Rainer Koepke (chair), Bundesministerium für Bildung und Forschung, Germany

Prof. Poul Erik Lindelof, Niels Bohr Institutet, Københavns Universitet, Denmark

Prof. Rector Ove Poulsen (vice-chair), Ingeniørhøjskolen i Århus, Denmark

Prof. Dany Vandromme, Le Réseau National de télécommunications pour la Technologie l'Enseignement et la Recherche, France

Prof. John Womersley, Science and Technology Policy Council, United Kingdom

Social Sciences and Humanities – SSH:

Dr. Maurice Bric (chair), University College Dublin, Ireland

Prof. Merle Horne, Lunds Universitet, Sweden

Prof. Jan O. Jonsson, Stockholms Universitet, Sweden

Prof. Max Kaase, Jacobs University Bremen, Germany

Prof Elizabeth Lanza (vice-chair), Universitetet i Oslo, Norway

Prof. Arto Mustajoki, University of Helsinki, Finland

Prof. Lea Rojola, University of Turku, Finland

Project-specific peer evaluations by international experts in the disciplines concerned were a necessary stage in preparing decisions concerning the selection of projects for the roadmap and identifying existing national-level research infrastructures. The international panels followed the working and evaluation instructions given by the Steering Group. The members of the panels had the use of their own restricted webpages. All the discussions conducted between the panel members were confidential. Where issues of conflict of interest arose, related Finnish regulations were followed. Evaluation also considered Finnish commitment to significant international research infrastructures.

In late July 2008 the secretariat sent the 110 project proposals and information on 9 international memberships selected by the Steering Group upon the recommendations of the Independent Expert Group to be evaluated by the International Expert Panels. Fourteen of the projects to be evaluated were submitted to be jointly addressed by the expert panels. Evaluations of these jointly handled proposals were accommodated to each other by the chairs and vice-chairs of the panels before the final decision. The chairs of the panels had the use of the initial evaluations of the projects by each panel members. The International Expert Panels met in September 2008. Each panel spent three working days in Finland, during which a total of 61 hearings were held. The hearings were meant to clarify to panel members matters that had remained unclear in the Internet-based replies.

Following a joint decision, a statement was drawn up on each project. In addition to statements on specific projects, each panel prepared a final report containing general recommendations (Annexes 1–3) and the results of evaluation.

The recommendations of the International Expert Panels were addressed at an information and feedback seminar held in October 2008, to which large numbers of the parties involved in the mapping were invited. The discussions in which the participants engaged and subsequent feedback were taken into account in drawing up the final proposals of the Steering Group.

4. Research Infrastructures at the National Level and the Roadmap

The Steering Group lists the following 24 projects as significant national-level infrastructures in Finland (Table 1 [3]):

- National Board of Antiquities (NBA)
- National Archives Service of Finland (NARC)
- The collections of the National Library of Finland (NLF)
- The National Electronic Library (FinElib)
- Finnish Social Science Data Archive (FSD)
- Finnish Information Centre for Register Research (ReTki)
- Archives and Collections of Linguistic Corpora/Collections of Electronic Linguistic Corpora (ACLC/CELC)
- Finnish Long-Term Socio-Ecological Research network (FinLTSER)
- Finnish Museum of Natural History (FMNH)
- Stations for Measuring forest Ecosystem - Atmosphere Relationships (SMEAR)
- Pallas-Sodankylä Super Site (Pallas-Sod.)
- National Biobanks of Finland (FIMMDNA)
- Helsinki Functional Imaging Center (HFIC)
- National Virus Vector Laboratory (AIV Vector Core)
- Finnish Infrastructure Network for Structural Biology (NSB)
- Genome-wide and High-Throughput methods, Biocenter Finland infrastructure network (GWHT)
- Finnish Genome Center (FIMM-FGC)
- Turku Bioimaging (TBI)
- Center for Systems Neuroimaging (NEUROIMAGING)
- Micronova Centre for Micro- and nanotechnology (Micronova)
- Low Temperature Laboratory (CRYOHALL)
- Accelerator Laboratory of the Department of Physics, University of Jyväskylä (JYFL-ACCLAB)
- Finnish University and Research Network (CSC-Funet)
- Services of the IT Centre for Science (CSC-Services)

3 The data in Tables 1–4 is based on information supplied by the proposing parties to the Steering Group.

Listed in Tables 2–3 are the international infrastructures in which Finland already participates and are significant for research. In addition, Finland has other significant international commitments that are important for research conducted in the country, international cooperation in other sectors, and indirectly for political decision-making. Individual organizations may also have agreements with and memberships in infrastructures that were not charted here.

The Steering Group has accepted the following 20 proposals for the roadmap. Thirteen of them are associated with ESFRI's roadmap projects (Table 4):

- System Architecture for Memory Institutions
- Finnish Language Resource Consortium (FIN-CLARIN), ESFRI
- European Social Survey (ESS), ESFRI
- Council of European Social Science Data Archives (CESSDA), ESFRI
- Environmental Data System (EnviData)
- e-Science and technology infrastructure for biodiversity data and observatories (LIFEWATCH), ESFRI
- Finnish Long-Term Socio-Ecological Research Network (Fin LTSER)
- Environmental and Atmospheric Sciences: Integrated Carbon Observation System (ICOS), ESFRI, SMEAR Stations (SMEAR) and Pallas-Sodankylä
- The European Infrastructure for phenotyping and archiving of model mammalian genomes (Infrafrontier), ESFRI
- European Advanced Translational Research Infrastructure (EATRIS), ESFRI
- European Life Science Infrastructure for Biological Information (ELIXIR), ESFRI
- Biobanking and Biomolecular Resources Research Infrastructure (BBMRI), ESFRI
- National Virus Vector Laboratory (AIV Vector Core)
- Jules Horowitz Materials Testing Reactor (JHR MTR), ESFRI
- European Synchrotron Radiation Facility (ESRF), ESFRI
- Micronova Centre for Micro- and Nanotechnology (Micronova)
- Facility for Antiproton and Ion Research (FAIR), ESFRI
- Upgrade of Cryohall (CRYOHALL)
- CSC, Funet roadmap to the next decades (Funet), Finnish Grid Infrastructure for mid-range computing (FGI)
- Partnership for Advanced Computing in Europe (PRACE), ESFRI

The Steering Group maintains that decisions should be made as soon as possible concerning funding for the following seven national or international projects that have been accepted for the roadmap:

- Linguistic materials and technology
- Data archives in the social sciences
- Infrastructures of the environmental and atmospheric sciences
- Infrastructures of the biomedical and life sciences
- The renewal of European synchrotron radiation equipment
- European infrastructure for nuclear and particle physics
- Project entity of the IT Center for Science

These projects are linked to European research infrastructure projects, of which the planning stage has begun and the construction stage will take place in 2009–2011. Therefore, decisions are needed as soon as possible on Finnish commitment to infrastructures in these fields.

Table 1. Existing national research infrastructures, estimated operating costs in 2007, and numbers of users in 2007.

Existing national-level research infrastructures	Operating costs (2007) M€	Users (2007)
Social Sciences and Humanities	**63.0**	
National Board of Antiquities (NBA)	20.0	4,600
National Archives Service of Finland (NARC)	15.5	1,550
The collections of the National Library (NLF)	10.0	200,000
The National Electronic Library (FinElib)	16.1	415,000
Finnish Social Science Data Archive (FSD)	0.8	1,000
Finnish Information Centre for Register Research (ReTki)	0.2	10,000
Archives and Collections of Linguistic Corpora/Collections of Electronic Linguistic Corpora (ACLC/CELC)	0.4	1,500
Environmental Sciences	**20.2**	
Finnish Long-Term Socio-Ecological Research network (FinLTSER)	7.5	2,000
Finnish Museum of Natural History (FMNH)	7.0	550
Stations for Measuring forest Ecosystem - Atmosphere Relationships (SMEAR)	2.5	530
Pallas-Sodankylä Super Site (Pallas-Sod.)	3.2	320
Biomedical and Life Sciences	**20.7**	
National Biobanks of Finland (FIMMDNA)**	1.0	60
Helsinki Functional Imaging Center (HFIC)	2.8	730
National Virus Vector Laboratory (AIV Vector Core)*	0.5	80
Finnish Infrastructure Network for Structural Biology (NSB)*	3.0	550
Genome-wide and High-Throughput methods, BF infrastructure network (GWHT)*	1.8	510
Finnish Genome Center (FIMM-FGC)**	1.5	1,050
Turku Bioimaging (TBI)	8.5	400
Center for Systems Neuroimaging (NEUROIMAGING)	1.6	170
Materials Science and Analytics	**9.0**	
Micronova Centre for Micro- and nanotechnology (Micronova)	9.0	260
Physics and Technology	**3.7**	
Low Temperature Laboratory (CRYOHALL)	0.7	60
Accelerator Laboratory of the Department of Physics, University of Jyväskylä (JYFL-ACCLAB)	3.0	370
e-Infrastructures	**17.0**	
Finnish University and Research Network (CSC-Funet)	7.0	380,000
Services of the IT Centre for Science (CSC-Services)	10.0	3,050
Total	**133.6**	

*Biocenter Finland

**Collaboration agreement between Biocenter Finland and FIMM

Photo: Katri Mäkinen

Table 2. Finnish involvement in significant international infrastructures, membership fees in 2007 and year of affiliation.

International research infrastructure	Membership fee (2007) k€	Year of affiliation
Biomedical and Life Sciences		
European Molecular Biology Laboratory (EMBL)	1,100*	1984
Energy Research		
Joint European Torus (EFDA-JET)	93*	1995
International Thermonuclear Experimental Reactor (ITER)	26*	2007
Materials Science and Analytics		
MAX Synchrotron Radiation Facility (MAX-lab)	9	1991
European Synchrotron Radiation Facility (ESRF)	520	1989
Space Research and Astronomy		
European Space Agency (ESA)	14,300**	1995
European Southern Observatory (ESO)	1,900	2004
Nordic Optical Telescope (NOT)	439	1984
European Incoherent Scatter Association (EISCAT)	310	1983
Physics and Technology		
European Organization for Nuclear Research (CERN)	8,900	1991
Total	**27,597**	

*Membership fee in 2008

**Including membership fees, mandatory participation fees, technology programmes and Earth Observation Programme

Table 3. Other memberships in international research infrastructures, membership fees in 2007 and year of affiliation.

International research infrastructure	Membership fee (2007) k€	Year of affiliation
International Continental Scientific Drilling Program (ICDP)	23.7	2005
Integrated Ocean Drilling Program (IODP) / European Consortium for Ocean Research Drilling (ECORD)	52.5	1986
Global Biodiversity Information Facility (GBIF)	79.5	2003
European Social Survey (ESS)	240.0*	2003
The International Institute for Applied Systems Analysis (IIASA)	600.0	1976
International Neuroinformatics Coordination Facility	84.0	2005
Total	**1,079.7**	

* No membership fees, all the costs are operational.

Table 4. National-level research infrastructures for the roadmap, time of construction stage[4] and estimates of construction-stage costs and annual use costs for Finland.

Proposal for the Roadmap	Construction Stage	Construction Costs M€	Operational Costs M€/year	national/ ESFRI
Social Sciences and Humanities		**21.1**	**4.3**	
System Architecture for Memory Institutions	2008–2012	15.0	3.7	national
Finnish Language Resource Consortium (FIN-CLARIN)	2009–2020	5.0	0.2	ESFRI
European Social Survey (ESS)	2007 –	not existent	0.3	ESFRI
Council of European Social Science Data Archives (CESSDA)	2010–2014	1.1	0.1	ESFRI
Environmental Sciences		**24.1**	**9.4**	
Environmental Data System (EnviData)	2010–2011	1.0	0.5	national
LIFEWATCH and Fin LTSER	2010–2019	15.6	3.4	national/ESFRI
Environmental and Atmospheric Sciences	2009–2011	7.5	5.5	national/ESFRI
Biomedical and Life Sciences		**48.6**	**2.9**	
The European infrastructure for phenotyping and archiving of model mammalian genomes (Infrafrontier)*	2011–2014	5.1	0.4	ESFRI
European Advanced Translational Research Infrastructure (EATRIS)**	2010–2012	10.0	NA ***	ESFRI
European Life Science Infrastructure for Biological Information (ELIXIR)	2010–2013	16.5	1.0	ESFRI
Biobanking and Biomolecular Resources Research Infrastructure (BBMRI)**	2010–2013	17.0	1.0	ESFRI
National Virus Vector Laboratory (AIVVectorCore)*	2009–	not existent	0.5	national
Energy Research		**10.0**	**0.5**	
Jules Horowitz Materials Testing Reactor (JHR MTR)	2008–2014	10.0	0.5	ESFRI
Materials Science and Analytics		**44.6**	**4.06**	
European Synchrotron Radiation Facility (ESRF)	2008–2017	0.6	0.06	ESFRI
Micronova Centre for Micro- and nanotechnology (Micronova)	2009–2016	44.0	4.0	national
Physics and Technology		**8.2**	**1.6**	
Facility for Antiproton and Ion Research (FAIR)	2008–2017	5.5	0.8	ESFRI
Upgrade of cryohall (CRYOHALL)	2009–2012	2.7	0.8	national
e-Infrastructures		**73.0**	**9.7**	
CSC, Funet roadmap to the next decades (Funet), Finnish Grid Infrastructure for mid-range computing (FGI)	2009–2012	57.0	6.7	national
Partnership for Advanced Computing in Europe (PRACE)	2010–2013	16.0	3.0	ESFRI
Total		**229.6**	**32.5**	

* Biocenter Finland

** Collaboration agreement between Biocenter Finland and FIMM

*** NA=data not available

4 The lifespan of a research infrastructure can be divided into the following stages: planning, construction, use, further development and decommissioning.

In addition, the Steering Group identified from among the roadmap proposals the following 13 national or international proposals that could have possibilities to develop into significant national research infrastructures. This may require, among other factors, the merging of certain projects in order to reinforce the national infrastructure capacity of the fields in question. Projects having such potential are:

- Micro Data Remote Access System (MIDRAS)
- Upgrade of the Data Services of the Finnish Social Science Data Archive (FSD)
- Community heavy-Payload Long endurance Instrumented Aircraft for tropospheric research in Environmental and Geo-Sciences (COPAL), ESFRI
- Finnish Integrated Network for Structural Biology (FinnStruct)
- Integrated Structural Biology Infrastructure Proposal (INSTRUCT), ESFRI
- Cluster of Biomedical Imaging (TBI&NEUROIMAGING&BIU)
- Geoinformatics Research Infrastructure Network (GRIN)
- Finnish Stem Cell Bank (FinnStem)
- European Extremely Large Telescope (E-ELT), ESFRI
- MAX IV synchrotron and free electron laser facility
- Infrastructure of processing biomaterials (BIOMATINFRA)
- Metsähovi Radio Observatory (MRO-2: Building Finnish Radio Astronomy's Future)
- European next generation Incoherent Scatter Radar (EISCAT_3D), ESFRI

5. Recommendations for Specific Fields of Research

5.1. General remarks

In many fields Finland has unique registers, bodies of material and collections that could be the basis of strong research infrastructures serving a wide body of users. The results of research and information resources in numerous fields are utilized by other actors in society than the scientists and scholars of the fields concerned.

Recommendation 1. The usability of national registers and the availability of materials should be improved and costs to the user should be reduced, where necessary by amending related legislation. Valuable bodies of material collected in Finland should be made available for broader international use by increased digitization of materials and by implementing uniform collection procedures in accordance with international standards.

An urgent task at present is to digitize materials of importance for research and to ensure the preservation of original materials for efficient utilization by future generations. The availability of information resources, their user-friendliness and shared use should be subjects of particular attention in all fields. In practice, this means the development of material (data) policies in a more open direction than previously, the minimization of fee-based use of national bodies of material, increased mobility of researchers and receiving researchers from other countries. The high standard of mobility services and reception of foreign researchers can help promote the European infrastructures to be located in Finland.

The growing amount of information and materials, and the development of information technology and methods for the management of materials have revolutionized research work in almost all fields. As a result, the importance of the so-called e-infrastructure has also grown.

Recommendation 2. Finland requires a shared vision of the kind of e-infrastructure that will best serve excellent research.

The operating concepts of certain sectoral research institutes and separate institutes are largely based on the utilization of a wide range of research facilities and field observation networks and/or the creation and upkeep of comprehensive databases. These are to be found in agriculture and forestry, among other fields. In the present mapping work, however, whole research institutes have not been regarded as research infrastructures, although they provide services necessary for society and produce and preserve materials of importance for research. A further requirement of national-level research infrastructure is free access for researchers to utilize materials. The condition is not met, or cannot be met, for example for security reasons in many separate institutions that are necessary for society.

Photo: Katri Mäkinen

Photo: Eeva Ikonen

5.2. Social Sciences and Humanities

Entities consisting of memory institutions, materials related to the social sciences and linguistic materials can be indicated in the social sciences and the humanities. According to the International Expert Panel, the proposals are in many cases incomplete and poorly arranged as infrastructures of the national level.

Recommendation 3. Resources in the social sciences and the humanities should be concentrated and free access for researchers should be promoted for the utilization of valuable materials.

The development of infrastructure services may considerably expand the bodies of their users in this field from their present extent.

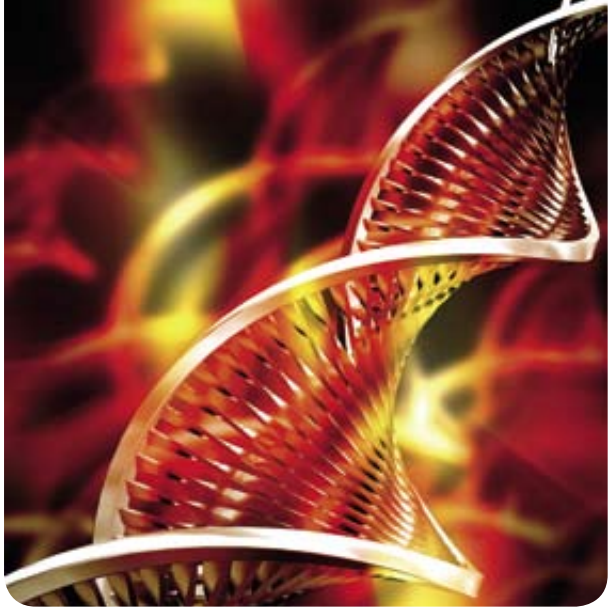
Recommendation 4. The consolidation of cooperation among memory institutions[5] that has been instituted with support from the Ministry of Education is to be continued. The core material of the cultural heritage is to be digitized.

5.3. Environmental Sciences

Like the other Nordic countries, Finland devotes significant resources and effort into the environmental sciences. Finland has unique long-term bodies of material and high-standard observation stations serving environmental research. Especially in the atmospheric sciences and in the ecosystem studies discussion aiming at increased cooperation has already begun in Finland, as well as the organization of researcher groups, which serves the identification of the needs of national-level infrastructures and related planning.

Recommendation 5. By pooling resources and through the further development of research infrastructures Finland should seek a leading international role in the fields of environmental sciences in which it already has solid national expertise, significant data resources and research infrastructure.

5 The term memory institution or organization applies to museums, archives and libraries



Photos: Rodeo

5.4. Biomedical and Life Sciences

According to the International Expert Panel, Finland has numerous strong areas in the biomedical and life sciences. The country has the opportunity to be a host to or have a leading role in some new European research infrastructures.

The biomedical and life sciences typically have a very large group of users, and the infrastructures of these fields are of major impact on society. In many cases research has direct applications in work with patients and preventive health care. The International Expert Panel felt that the biomedical and life sciences sector should focus more on the commercialization of results. Research is making increasing use of resources of information that require a developed e-infrastructure and the services that it offers.

The biocentres of six Finnish universities have established the Biocenter Finland cooperation network coordinating the infrastructures of the centres and their use. For the time being, however, coordination has been insufficient. This was also evident in the fact that these universities submitted a large number of proposals that had not been assembled into national-level research infrastructures.

Recommendation 6. Biocenter Finland should use its position and responsibility for coordination in developing national-level research infrastructures.

5.5. Energy

Europe is seeking to adopt energy production in accordance with sustainable development. In order to achieve its set goals in combating climate change and in energy production, Europe needs to invest in research in renewable non-emission energy and technological development work in association with industry.

In Finland, a significant portion of electricity is produced with nuclear energy, the production capacity of which may increase markedly. The safe and reliable use of nuclear energy and maintained skills require that we have the use of research and testing facilities needed to support of research and development of technology, either in Finland or elsewhere, and of other technological infrastructure. As a member of the EU, Finland is also involved in the ITER project for the construction of the next-generation fusion test reactor, which will require considerable funding from the EU Member States and other participating countries over the decades to come.

Finland is expected to participate in combating climate change and in international research and development in energy production that is required for sustainable development.

Recommendation 7. Finland is to ensure a broad scale of expertise and research in the energy sector, investments in research and development in renewable and non-emissive energy as required by involvement in international cooperation, and the utilization of international research infrastructures.

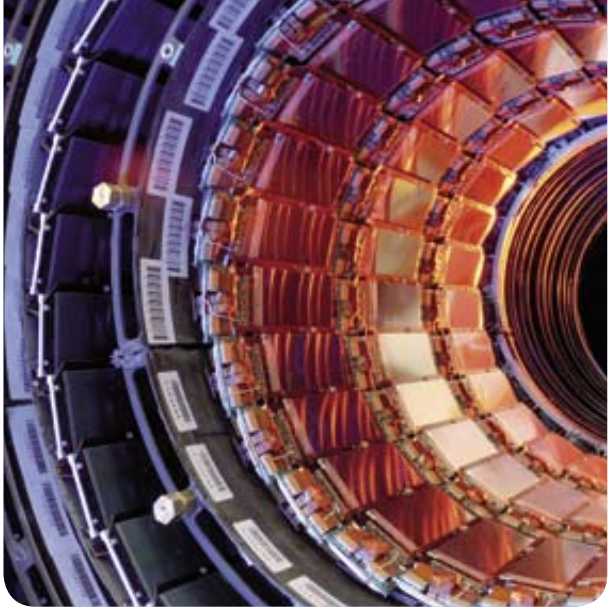


Photo: CERN

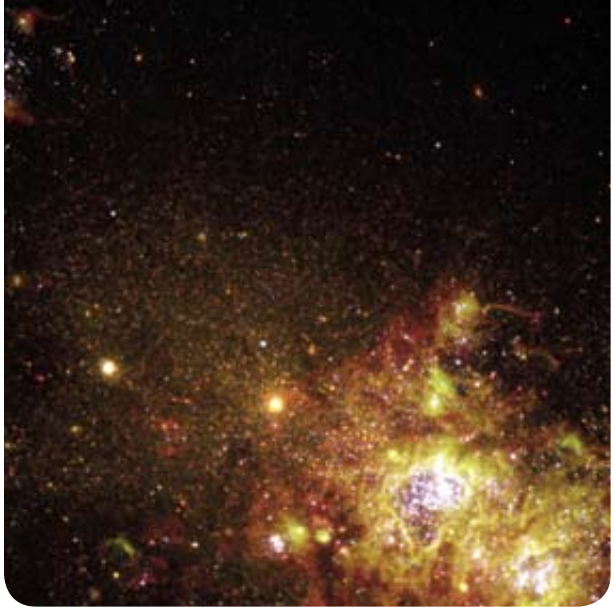


Photo: Rodeo

5.6. Materials Science and Analytics

Finland is a member of the Nordic consortium of the European Synchrotron Facility (ESRF), located in Grenoble. Synchrotron radiation is used in multidisciplinary studies of materials. For example, a significant proportion of the users of the ESRF are representatives of the biosciences. Finland has also made use of the Swedish Max Laboratory in Lund through a bilateral agreement since 1991.

Recommendation 8. Extensive multi- and cross-disciplinary research conducted with the aid of synchrotron radiation should be developed on the basis of nationally coordinated cooperation.

The applications of nanoscience and nanotechnology are rapidly expanding from electronics and new materials to the bio sector. At the same time, however, requirements for evaluating the security risks of applications are growing. Therefore, broad collaboration among different researchers is necessary in research in this field. Nano-level research requires high-standard clean rooms and special laboratories, which are worth concentrating in larger units.

Recommendation 9. Finland is to reinforce national coordination and division of tasks in nanoscience and nanotechnology and the utilization of international research infrastructures

5.7. Space Research and Astronomy

European space research and astronomy have influenced related research in Finland through the international cooperation of Finnish researchers and later through memberships in the ESA and ESO organizations. Challenges of research policy for the Finnish scientific community are how to benefit as much as possible from existing memberships, and the kinds of infrastructures needed in Finland for utilizing international memberships.

Recommendation 10. The Finnish scientific community should draw up a joint plan for a project to develop astronomy, including existing national and international infrastructures and their utilization.

Photo: CERN

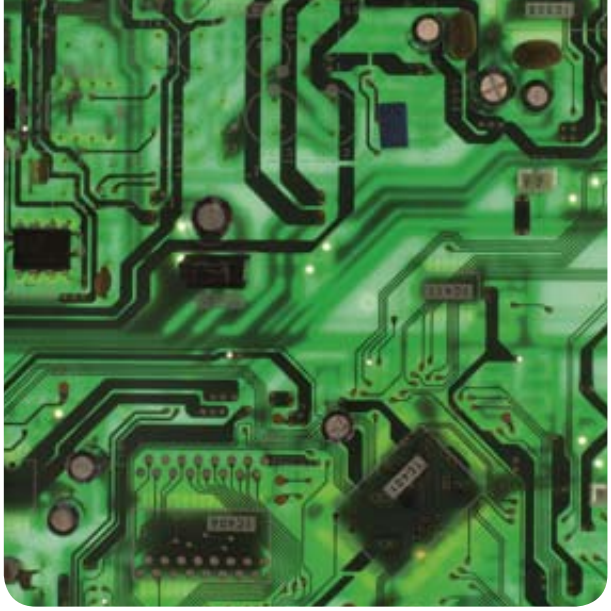


Photo: Rodeo

5.8. Physics and Technology

Large infrastructures are necessary for solving scientific problems in physics. On their own, small countries such as Finland, and most other countries as well, have very limited opportunities to host major research arrangements and infrastructures at the international level. Finland is involved in some significant infrastructures in support of research in physics (Table 2). The most important international research institute in physics is CERN. The organization of Finnish activity related to CERN is a good example of national support for the wide use of an international research organization.

Recommendation 11. In order to maximize research carried out in major international infrastructures and related benefits, Finland needs to attend to domestic research infrastructures that support this work.

Infrastructures or arrangements of this kind include test laboratories, laboratories of instrument technology, theoretical research, graduate schools, training for experts and for international tasks, and cooperation with industry.

Research infrastructures in physics typically serve many other fields, an example being the above-mentioned ESRF. The infrastructures of physics also serve the development of technology, as in information technology, instrumentation and material technologies.

5.9. Information Technology and e-Infrastructures

A considerable challenge for large research infrastructures consists of the management and storage of produced information and making it available to researchers in a user-friendly manner. This calls for good information management, centralized services, grid environments and a well-functioning information network. Resources that are distributed and planned well are a major challenge for e-infrastructures.

In Finland the CSC centre provides scientific computational services for universities and research institutes, maintains and develops an IT network for science, and is in charge of storage, maintenance and user support for large bodies of material in some fields of research. These tasks are of core importance for science in Finland. CSC is also prominently involved in Nordic and European cooperation to develop data networks, scientific computing and the use of data.

CSC submitted several project-type proposals to the national survey. The International Expert Panel recommended the creation of a national e-infrastructure strategy with CSC as its main actor.

Recommendation 12. The main tasks of CSC should be scientific computing services, IT network services and services related to the storage and use of large bodies of data. The work should be expanded towards increased service also for research institutions. CSC should continue its work of developing infrastructures in collaboration with users and parties producing information.

6. Conclusions and General Recommendations

The concept of national-level infrastructure needs to be clarified among scientific and scholarly communities. The quality of conducted research or the excellence of infrastructure as such do not yet indicate an infrastructure of the national level. The infrastructure also has to provide opportunities for use and service for users beyond its own organization, and outside use has to be of a significant degree. The use of infrastructure in many different disciplines, multidisciplinary projects and problem-based approaches is to be promoted.

6.1. Forming Infrastructure Entities and More Efficient Use of Infrastructures

The mapping of nationally significant infrastructures and the preparation of the roadmap pointed to a definite need to reinforce the international aspects of the Finnish research system and to assemble the dispersed infrastructure into national-level infrastructures serving a broader scientific community. In the future the research community is required to engage in closer cooperation and joint strategic planning.

Recommendation 13. The scientific community should be organized to prepare developed plans and for more efficient utilization of existing research infrastructures. This concerns infrastructures at both the national and local levels.

Recommendation 14. Cooperation in constructing and using infrastructures is to be improved among units of the same field and especially by establishing multidisciplinary infrastructure entities focusing on research in specific problem areas.

Actors noted as infrastructures of the national level, core groups chosen for the roadmap or those that have gained a position in them are to be regarded mainly as bearers of responsibility for cooperation. This role as such does not entitle funding. The quality and opportunities of a national infrastructure depend on the cooperation of all parties concerned.

For a small country such as Finland it is essential to maintain research infrastructures of the national level and to develop new ones through extensive cooperation between the public and private sectors.

In practice, the joint use of research infrastructures will lead to at least some degree of increased mobility for researchers, as well as receiving researches from other countries. Universities and research institutions need to improve services for mobile researchers. Services are generally one of the factors influencing the criteria of placement for European infrastructures.

Parties responsible for infrastructures should also take into account communications and international visibility. This work can utilize existing European services and the scientific community's own channels of communication.

6.2. Finnish Participation in International Research Infrastructures and ESFRI Projects

Membership in central international infrastructures is often necessary for carrying out high-standard research. The other services improving conditions for research that are provided by infrastructures are also an important factor.

The efficient use of international infrastructures requires good national coordination. This has to encompass not only research as such but researcher training, information on science, utilization of results and any technological development and corporate cooperation associated with developing the infrastructure.

The goals of internationalization require the development of critical mass and the creation of infrastructures in Finland that offer broader services. Strong, wide-ranging national infrastructures could be a way towards international recognition and attraction. Finnish researchers need to participate more than at present in coordinating and ambitious roles in the infrastructure schemes of EU Framework Programmes. The projects of the ESFRI roadmap provide important opportunities to operate at a national level as hosts for realizing jointly agreed plans or as the host of a unit of a dispersed international infrastructure. Finnish researchers have been actively involved in the preparation of several ESFRI projects.

Recommendation 15. Finnish researchers and experts should seek positions of responsibility in international research infrastructures in the fields in which there is significant Finnish expertise.

Finland is involved in several international and multinational infrastructure projects and programmes (Tables 2–3). Their total membership and participation fees amount to approximately €30 million per year. In addition to membership fees costs also arise from participation in the construction of infrastructures, in earlier investments, the work of administrative bodies and the mandatory or voluntary programmes of the organizations. Earlier investments can also be compensated through in-kind contributions.

Recommendation 16. International investments should aim at employing in-kind contributions, which promotes the development of domestic skills and cooperation with the corporate sector.

Research carried out in Finland, the development of technologies and cooperation with the business community or those who utilize the results are important in many fields. Finland's activity in CERN is a good example of the wide-ranging utilization of a large international research infrastructure.

Recommendation 17. Finnish research organizations should make better use of membership in international research infrastructures. Existing international commitments and research infrastructures at the national level should be utilized efficiently for the mobility of researchers, researcher training and the planning of the work of researcher training schemes.

Nordic consortiums have already provided good experiences in the case of some infrastructures. With regard to Finland, it is to be hoped that of the new international infrastructures, at least some significant entities or head offices would be located in the Nordic countries or regions near Finland.

Recommendation 18. In preparations for very large and expensive international projects joint arrangements for example with other Nordic countries should be considered.

6.3. Funding

According to the preliminary estimate provided by the present mapping, Finland spends approximately €130 million per year in public appropriations for the upkeep of the national infrastructures presented in Table 1. Finland uses some €30 million of public funds annually for the membership fees of international infrastructures (Tables 2 and 3). In addition to membership fees there can be other costs of membership both abroad and in Finland. As noted by the In-

ternational Expert Panels in their recommendations, participation in major international projects requires investment and the coordination of activity also at the national level for the most efficient utilization possible of international infrastructure.

The construction costs of the projects chosen for the roadmap will be approximately €230 million over the period 2008–2020, with annual costs for Finland approximately €30 million (Table 4). The schedule for implementing the projects and the focus of funding needs are highly different in different fields, which means that a funding instrument is needed for directing funding to projects on the basis of detailed funding proposals and plans.

Finland needs a centralized funding system for renewing the existing research infrastructures and for funding new projects at the national level. The centralized funding system should also take into account the needs for managing research infrastructure policy and the preparation of long-term international commitments. The Steering Group estimates that already in 2009 approximately €9 million will be needed to promote the most urgent projects. Between 2010 and 2016 over €200 million will be needed as a whole for carrying out the most urgent projects. This rough estimate partly includes use-related costs.

Recommendation 19. The development of national-level research infrastructures and research carried out in new international research infrastructures are to be supported with an additional appropriation in keeping with the needs for developing research and international cooperation in research.

Recommendation 20. The funding of infrastructures should be increased as part of the funding of universities and research institutions and on a centralized basis as competed funding for national-level infrastructures. In addition, there is a need to preparation for the membership fees of international infrastructures and the coordination of related national activities.

6.4. Research Infrastructure Policy

Research infrastructure policy should be an integral part of research and innovation policies. We need a national process for infrastructure policy. It needs to include all actors, from researchers to decision-makers in research and innovation policy. The importance of dialogue is emphasized when seeking joint synergy benefits. The reports of the two earlier Committees on these matters propose the founding of a permanent body with sound resources for the preparation and implementation of research infrastructure policy. These proposals have received support in statements given on the reports.

Recommendation 21. Research infrastructure policy should be an integral part of research and innovation policy and it should be implemented according to a consistent and well-planned model of action. For the purposes of implementation a research infrastructure council needs to be founded with ensured operating conditions, including a permanent secretariat.

The tasks of the body would include the preparation of strategy, follow-up, evaluation and the coordination of international participation. The work would also include reports on infrastructure, statements, the updating of the roadmap, preparation of funding decisions and to some degree funding decisions. The infrastructure council could also make proposals for solutions in the case of two or several competing coordinating bodies at the national level. These demanding and extensive tasks require permanent structures and personnel with expertise.

Recommendation 22. The purpose of the infrastructure council is to compile the views of researcher communities and other actors regarding the future needs of national-level research infrastructures and to arrange the evaluation of project proposals, taking into account the needs of society and the economy, and to draw up plans for the realization of infrastructures on the basis of evaluations.

Recommendation 23. The national-level roadmap is to be evaluated on a continuous basis and updated at approximately 3-year intervals.

The planning of the schedule for the national roadmap requires accommodation to the European roadmap project. Applications for the funding of infra-

Photo: Eeva Ikonen

structures and related decision-making should proceed apace with the European ESFRI project. Solutions and decision of even a quick nature will be needed with regard to the present ESFRI roadmap projects.

The various levels (local, national and international) and types (single-sited, distributed and virtual) of infrastructure should be taken into account in planning and organizing funding. New infrastructure needs at the national level may also emerge in the areas of so-called Strategic Centres for Science, Technology and Innovation (CSTI). It is therefore important to provide critical reviews and plans specific to disciplines to develop infrastructures or plans for a different kind of closer cooperation following the nature of the field in question.

Recommendation 24. Universities, research institutions and other maintaining bodies should take into account research infrastructures as part of their own strategy work. It should include the upkeep of existing infrastructures, improved joint use, new infrastructure needs, and a plan for funding. The planning should take into account situations where closer networking is more efficient than the implementation of a new infrastructure.

Recommendation 25. Ministries, parties funding research and the host organizations of infrastructures should prepare their own long-term plans for the use, development and funding of their infrastructures.

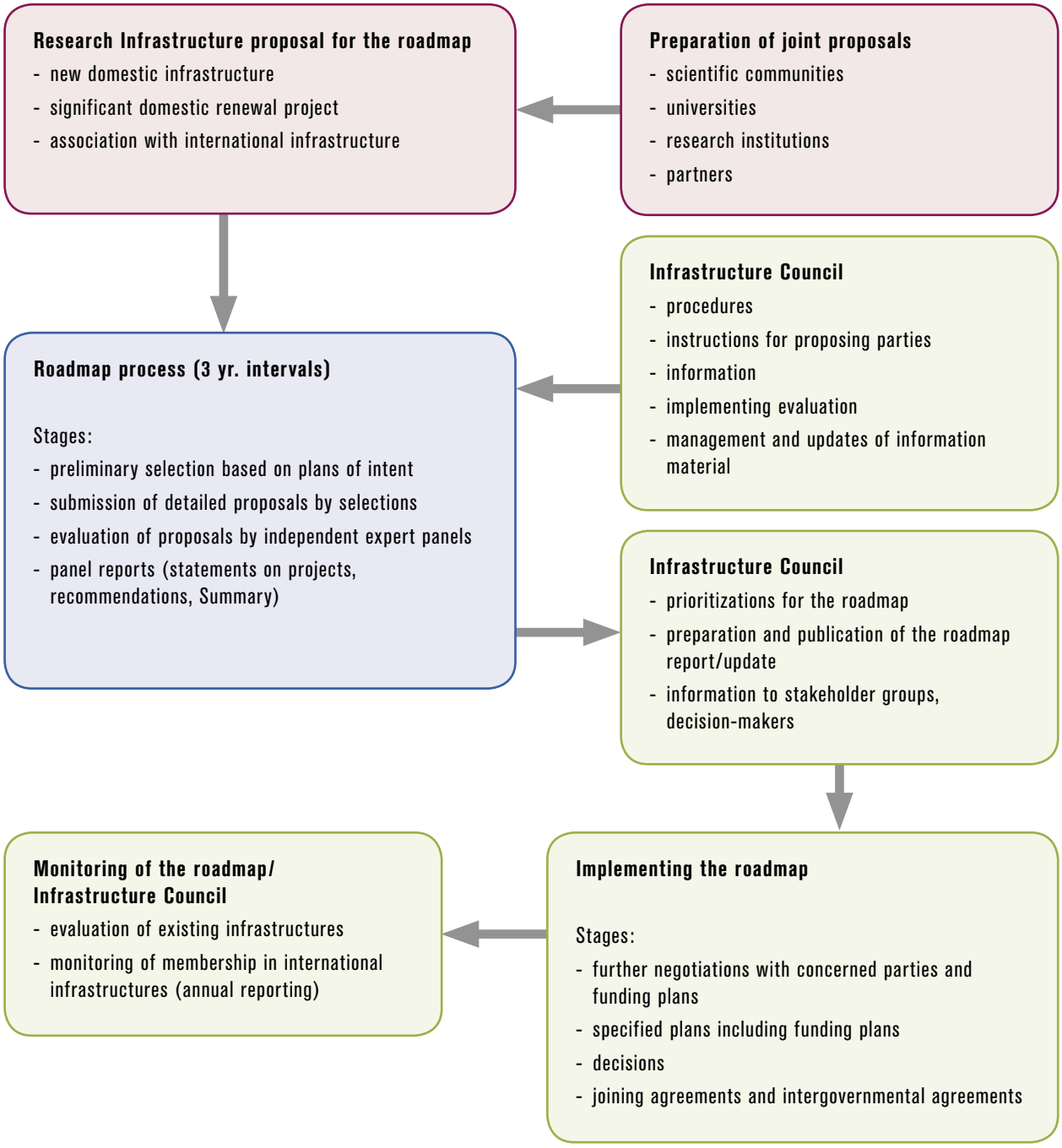


Fig. 4. Schematic presentation of the stages of preparing the roadmap

Abbreviations

ACLC/CELC Archives and Collections of Linguistic Corpora/Collections of Electronic Linguistic Corpora (KOTUS)

AIV Vector Core National Virus Vector Laboratory

BBMRI Biobanking and Biomolecular Resources Infrastructure

BIOMATINFRA Infrastructure of processing biomaterials

BIU Biomedical Imaging Unit

CERN European Organization for Nuclear Research

CESSDA Council of European Social Science Data Archives

CLARIN Common Language Resources and Technology Infrastructure

CRYOHALL Low Temperature Laboratory

COPAL Community heavy-Payload Long endurance Instrumented Aircraft for tropospheric research in Environmental and Geo-Sciences

CSC IT Centre for Science

CSTI Strategic Centre for Science, Technology and Innovation (in Finnish SHOK)

EATRIS European Advanced Translational Research Infrastructure in Medicine

ECORD European Consortium for Ocean Research Drilling

E-ELT European Extremely Large Telescope

EFDA-JET European Fusion Development Agreement-Joint European Torus

EISCAT European Incoherent Scatter Facility

ELIXIR European Life Science Infrastructure for Biological Information

EMBL European Molecular Biology Laboratory

EnviData Environmental Data System

ESFRI European Strategy Forum on Research Infrastructures

ESA European Space Agency

ESO European Southern Observatory

ESRF European Synchrotron Radiation Facility

ESS European Social Survey

EU European Union

FAIR Facility for Antiproton and Ion Research

FGI Finnish Grid Infrastructure for mid-range computing

FinnStem Finnish Stem cell bank

FinnStruct Finnish Infrastructure Network for Structural Biology

FIMMDNA National Biobanks of Finland

FIMM-FGC Finnish Genome Center

FIN-CLARIN Finnish Language Resource Consortium

FinElib National Electronic Library

FinLTSER Finnish Long-Term Socio-Ecological Research Network

FMNH Finnish Museum of Natural History

FSD Finnish Social Science Data Archive

Funet Finnish University and Research Network

GBIF Global Biodiversity Information Facility

GRIN Geoinformatics Research Infrastructure Network

GWHT Genome-wide and High-Throughput methods, Biocenter Finland infrastructure network

HFIC Helsinki Functional Imaging Center

ICDP International Continental Scientific Drilling Program

ICOS Integrated Carbon Observation System

IIASA International Institute for Applied Systems Analysis

Infafrontier European infrastructure for phenotyping and archiving of model mammalian genomes

INSTRUCT Integrated Structural Biology Infrastructure Proposal

IODP Integrated Ocean Drilling Programme

ITER International Thermonuclear Experimental Reactor

JHR-MTR Jules Horowitz Materials Testing Reactor

JYFL-ACCLAB Accelerator Laboratory of the Department of Physics, University of Jyväskylä

KOTUS Research Institute for the Languages of Finland

LifeWatch e-Science and technology infrastructure for biodiversity data and observatories

LME Life Sciences & Medicine and Environmental Sciences Panel

MAX-lab Electron Accelerator Laboratory for Synchrotron Radiation Research, Nuclear Physics and Accelerator Physics in Lund, Sweden

Micronova Micronova Centre for Micro- and nanotechnology

MIDRAS Micro Data Remote Access System

MRO-2 Metsähovi Radio Observatory, Building Finnish Radio Astronomy's Future

NARC National Archives Service of Finland

NBA National Board of Antiquities

NDGF Nordic DataGrid Facility

Neuroimaging Center for Systems Neuroimaging

NLF Collections of the National Library

Nordunet The Nordic Internet highway to research and education networks in Denmark, Finland, Iceland, Norway and Sweden

Nordsync Finland takes part into the ESRF research via **Nordsync** collaboration. The other members are Norway, Sweden and Denmark.

NOT Nordic Optical Telescope

NSB Finnish Infrastructure Network for Structural Biology

PRACE Partnership for Advanced Computing in Europe

PSE Physical Sciences, e-Science and Engineering Panel

ReTki Finnish Information Centre for Register Research

SHOK Strategic Centre for Science, Technology and Innovation

SMEAR Stations for Measuring Forest Ecosystem-Atmosphere relationships

SSH Social Sciences and Humanities Panel

TBI Turku Bioimaging

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Appendixes

Life Sciences and Medicine & Environmental Sciences
Assessment Panel Report

October 8
2008

1. Introduction

Three expert Panels were invited to evaluate the proposals for the first Finnish Roadmap on research infrastructures (RI) and survey on existing research infrastructures: Physical Sciences, e-Science and Engineering (PSE), Life Sciences & Medicine and Environmental Sciences (LME) and Social Sciences and Humanities (SSH).

This document is the Report of the LME Panel listing the existing national level research infrastructures in Finland, and recommending new research infrastructures or upgrading of them, to be included in the first Roadmap on national level research infrastructures. The infrastructures under consideration span very different types, lifetimes and costs.

The composition of the three Panels has been decided by the Steering Group of the Finnish Research Infrastructure Survey and Roadmap Project (hereafter the Steering Group). The membership of the Panels consists of both science policy and scientific experts.

In assessing proposals for the survey of existing research infrastructure and for inclusion on the Roadmap, the LME Panel was guided by the definition provided by the Steering Group:

> Research infrastructures are facilities, resources and related services, used by the scientific community for knowledge production by conductiong leading-edge research. They are important for knowledge transmission, knowledge exchanges and knowledge preservation, and have an important role in the transfer of knowledge to applications. They include major scientific equipment, scientific collections, archives and structured information, ICT based infrastructures and entities of a unique nature used for research.

The fields of research covered by the terms of Life Sciences & Medicine and Environmental Sciences are characterised by the need for distributed research infrastructures, defined by the Steering Group as

> a singular research infrastructure (in different locations), having a unique name, director, management structure, strategy and development plan, budget plan, access point for users, annual report and fiscal address.

The LME Panel also took into account the advice of the Steering Group that, in assessing proposals for distributed research infrastructure, we distinguish between such an infrastructure and a research network.

In relation to the proposals to be included in the survey of existing research infrastructures, we were asked to assess proposals against the criteria of

> scientific significance,
> added value,
> utilisation,
> training,
> structures and
> access.

In relation to those proposals to be included in the Roadmap of research infrastructures, the Panel was asked to assess

- Current significance for research and science
- Potential significance for research and science in the future
- Impact of the RI on the development of the scientific field
- Influence of the RI on new ways of doing science
- International relevance of the RI
- Added-value in industrial-commercial terms or public good

It is important to emphasise that the Panel's decision not to support a proposal as a research infrastructure in the Survey or for the Roadmap should not be seen as a reflection on the quality of the science carried out by those involved. Perhaps because this is the first exercise of its kind in Finland and because of the relatively short time in which proposers had to make submissions, some proposals failed to convince us that they met the criteria for a research infrastructure. We are aware, however, of excellent research being conducted in the centres referred to in the proposals.

Our task was to review the proposals before us against the criteria listed above. We were advised that it was not necessary to rank proposals or take into account the amount of funding that may or may not be available to support research infrastructure in Finland at a later date. We were not asked to review the fields of science in relation to their research infrastructure requirements but as a result of our review of individual proposals, we have commented elsewhere in this report on some issues that the Steering Group may wish to take into account in their wider task of developing a strategic approach to research infrastructure in Finland.

Finland is fortunate to have a number of well resourced national institutes established to provide a wide range of services necessary for a modern economy and society, including services for the research community. The approach we have taken to proposals from these institutes, in common with the PSE Panel, is that while the institutes do not meet the strict criteria for research infrastructures, the services they provide in calibration, radiation monitoring, statistical support are essential 'infrastructural' services for leading-edge research in many fields and that they should be considered as part of the wider infrastructure necessary to support research in Finland.

Some members of the Panel declared potential conflicts of interest in relation to a small number of proposals. The potential conflict of interest arose in relation to proposed ESFRI Roadmap RIs in which some members of the Panel were involved in their own member state. These members took no part in the discussion of the proposals concerned. The declared interests were:

Ruth Barrington - BBMRI and ECRIN
Anders Lindroth - ICOS
Inger Lundkvist - EATRIS

2. Comments and Suggestions on Strategic Issues for RIs

- The panel found 21 proposals to fulfil the criteria for national level RI, and recommends 20 proposals for inclusion on the RI Roadmap covering all fields in the Panel's mandate. The evaluation procedure for the proposals has been clearly documented. The group has been thorough in its evaluations using the criteria set by The Steering Group.

- The task of the Panel was to review proposals, rather than fields of science and the research infrastructures necessary to support them. The Panel is aware that the process in which we have been involved has not identified what are Finland's strategic needs in science and what support structures it requires to achieve its scientific potential. The tendency in life sciences in recent decades has been reductionist – analysing things in every smaller units in the hope that the insights gained will lead to a greater understanding of the whole. There is growing recognition of the need to take a different approach if the life sciences are to advance the understanding of life. Systems biology, for example, is recognised as an increasingly important field of science because of the potential of mathematical modelling to integrate and make sense of vast quantities of biological data. Our view is that those responsible for science policy and investment need to take a strategic view of the contribution of a field of science to advancing knowledge before investing in the necessary infrastructure.

- The Panel was impressed by the level of funding of the life and environmental sciences in Finland. The commitment to environmental sciences in particular appears to be taken more seriously than in most other European countries. The capacity for environmental monitoring is particularly impressive. However, the Panel considered that there was fragmentation of observatories, institutions and field stations required for environmental research. If Finland could join up its environmental infrastructure, linking its biotic and abiotic data, it would enable researchers in Finland to develop a more comprehensive picture of the biosphere, with its links and feedbacks, and enhance their ability to model changes to the planet. The Panel considers that there is an opportunity for Finland to be a global leader in this field.

- The Panel was impressed by the positive steps that have been taken in sharing resources between institutions through the mechanism of Biocenter Finland. Biocenter Finland has identified seven infrastructure networks for research which provide a prototype for further development and investment. However, it was clear from the proposals on biological imaging reviewed by the Panel that the process of institutional collaboration and consolidation is far from complete and that the role of Biocenter Finland as a coordinating mechanism for research infrastructure could be enhanced.

- The Panel was asked to assess the added value of proposals in industrial-commercial terms or for the public good. We were struck by the low attention to innovation in many of the proposals for research infrastructure in biomedical research. The situation in Finland appears to be in contrast to several other

countries, where patents, start-up ventures and links with pharmaceutical companies are commonplace. Although the science is strong in the applications, the innovation is weak. The Panel considers that Finland could do more in biomedical research to build the innovation chain.

- It was clear to the Panel that the best applications linking with developing ESFRI research infrastructures were matched by good existing national research infrastructures. At some stage Finland may have to prioritise its investment in ESFRI-related initiatives and our suggestion is that decisions should be made on the basis of the return or added value to Finland.

- The Panel expressed concern about the ability of some of the proposals involving ICT (Information and Communications Technology) to deliver on what they propose. Huge and expensive challenges exist in this field, which need to address at an early stage in developing any proposed infrastructure.

- The Panel recommends that any funding committed to a research infrastructure should be reviewed at regular intervals to ensure that the investment and scientific direction are aligned.

- As a result of reviewing the proposals before it, the Panel was concerned that there appeared to be too much separation between physical and life scientists. Integration is necessary to develop feedback and synergies.

- The Panel noted that it did not receive proposals from certain fields that it might have expected to see. Marine monitoring was missing, for example monitoring of the Baltic Sea or provision of data on adjacent oceans. The Finnish Institute of Marine Research was not involved in any proposals. There were no proposals in synthetic biology and only one proposal was for GIS provision.

- The Panel asked the question of how research infrastructures that did not propose an upgrade will be maintained. The Panel recommends that the Steering Group distingushes in its approach between infrastructure services provided by national institutes in the public interest that are necessary or useful to the research community and research infrastructures that are academically led and directed.

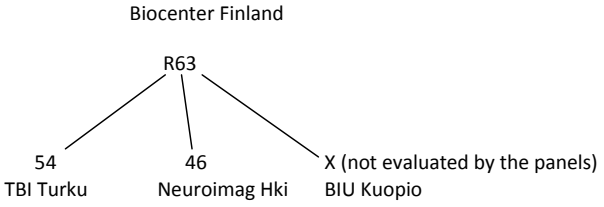
3. Results of the evaluations

The infrastructures under consideration span very different types, lifetimes and costs. The LME Panel agreed that 20 proposals for research infrastructures meet the scientific and maturity criteria for inclusion on the first Finnish RI Roadmap. There is one positive remark on a proposal on participation in an international RI, namely European Molecular Biology Laboratory - EMBL. Twenty one proposals were identified as existing national level RIs. Four proposals were recommended for a separate category (see below).

The infrastructures, which the LME Panel recommends for the national Roadmap, are those that show a strong science and technical case or a pan-European character in their potential scientific impact and in the institutional and financial requirements. The LME Panel also took into consideration the global scale of the proposals. There are 16 proposals considered by the LME Panel alone, and 4 reviewed jointly with other Panels, which according to the judgement of the LME Panel fulfil the criteria of maturity (Table 1).

Only a few of the proposals were sufficiently focused to contribute to the advancement of multidisciplinary research, or to tackle the study of complex systems. In general, the good proposals tended to have a long history of collaborative projects and cooperation efforts at national or international level allowing them to be recognized as a national level RI.

The Panel received several overlapping proposals concerning biological imaging. The Panel felt that it was rather difficult to get a clear picture on the relationships between the separate proposals on this field, and to aid thinking and decision making, outlined the relations between different proposals (Figure 1).



The proposals above are overlapping with the following:

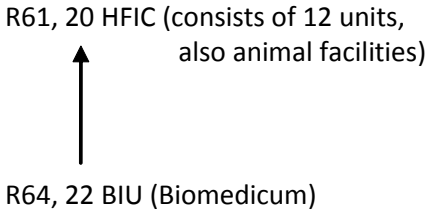


Figure 1. The panel describes the relationships between proposals from Biocenter Finland. Proposals 54 (Turku BioImaging) and 46 (Center for Systems Neuroimaging), and BIU Kuopio (no submitted proposal) represent a joint approach to form an upgraded infrastructure entity (R63, Cluster of Biomedical Imaging (TBI&NEUROIMAGING&BIU), which is seen as a positive direction by the Panel. A parallel, unconnected set of two proposals were submitted for existing RIs, and their upgrades (22, 20, and R64 Biomedicum Imaging Unit, R61 Helsinki Functional Imaging Center, respectively) (lower panel).

Table 1. LME proposals recommended for inclusion on the Roadmap (participation in international RIs with shading).

Number	Title	Acronym
*R33	COmmunity heavy-PAyload Long endurance Instrumented Aircraft for Tropospheric Research in Environmental and Geo-Sciences	COPAL (ESFRI)
*R35	Integrated Carbon Observation System	ICOS (ESFRI)
*R38	SMEAR Stations	SMEAR
*R39	European Life Science Infrastructure for Biological Information	ELIXIR CSC (ESFRI)
R44	Finnish Long-Term Socio-Ecological Research Network	FinLTSER
R43	Pallas-Sodankylä Super Site	Pallas-Sod
R45	LIFEWATCH	LIFEWATCH (ESFRI)
R46	e-science and technology infrastructure for biodiversity data and observations	EnviData
R48	Finnish Biodiversity Data Centre	FBDC
R50	Experimental Animal Centre	EAC
R51	The European Infrastructure for phenotyping and archiving of model mammalian genomes	Infrafrontier (ESFRI)
R52	European Advanced Translational Research Infrastructure	EATRIS (ESFRI)
R53	A Finnish Integrated Network for Structural Biology	FinStruct
R54	Integrated Structural Biology Infrastructure proposal	INSTRUCT (ESFRI)
R181	Biobanking and Biomolecular Resources Research Infrastructure	BBMRI (ESFRI)
R63	Cluster of Biomedical Imaging TBI & NEUROIMAGING & BIU	
R66	National Virus Vector Laboratory	AIVVectorCore
R70	Geoinformatics Research Infrastructure Network	GRIN
R80	Finnish Stem Cell Bank	FinnStem
R92	Finnish Microbial Culture Collections to the Microbiological Resource Center	MICCO

* Proposals for the list of existing RIs evaluated by the LME Panel jointly with other Panels.

The Panel recommended 21 proposals to be listed as existing national level infrastructures, and one positive remark on a proposal on participation in an international RI, namely European Molecular Biology Laboratory - EMBL (Table 2).

Table 2. Proposals recommended for inclusion on the list of existing RIs and for participation in international RIs (international participation with shading).

No	Title	Acronym
*170	Funet (Finnish University and Research Network)	CSC-Funet
*171	IT Services for Science at CSC	CSC-Services
*172	Pallas-Sodankylä Super Site	Pallas-Sod
1	Finnish Long-Term Socio-Ecological Research network	FinLTSER
5	Finnish Museum of Natural History	FMNH
11	Experimental Animal Centre	EAC
12	Biomedicum Genomics	BMGen
13	National Biobanks of Finland (DNA-logistics Core Unit, FIMM/KTL)	FIMMDNA
20	Helsinki Functional Imaging Center	HFIC BF
23	High Throughput Center	HTC
26	National Virus Vector Laboratory	AIV Vector Core
33	National infrastructure network in Structural Biology	NSB
34	Advanced Electron Microscopy Unit of the Institute of Biotechnology (consisting of Electron Microscopy and Cryo-electron Microscopy Units)	IBAEM
35	Protein Crystallisation Infrastructure	ProCryst
37	European Molecular Biology Laboratory	EMBL
41	Genome-wide and high-throughput methods, BiocenterFinland infrastructure network	GWHT
42	National RI for Molecular, Cellular and Integrative Neuroscience Research	MCIN
46	Center for Systems Neuroimaging	NEUROIMAGING
48	Stations for Measuring forest Ecosystem - Atmosphere Relationships	SMEAR
50	Finnish Genome Center	FIMM-FGC
54	Turku BioImaging	BTI
72	Biological Stations of the Faculty of Biosciences of University of Helsinki	BioHelsinki

* Proposals for the list of existing RIs evaluated by LME Panel jointly with other Panels.

The Panel reviewed four proposals from national institutes, listed in Table 3. While the institutes do not meet the criteria for research infrastructures, the services they provide in calibration, radiation monitoring, statistical support and agricultural research are essential 'infrastructural' services for leading-edge research in many fields. The Panel recommends that they should be considered as part of the wider infrastructure necessary to support research in Finland.

Table 3. Proposals from national institutes that provide essential infrastructure services for the research community that need to be supported. R denotes a proposal for RI Roadmap.

No	Title	Acronym
R27	Statistics Finland´s research services (upgrade)	Statistics
174	STUK-Radiation and Nuclear Safety Authority	STUK
176	National Metrology Institute	NMI
178	Agrifood Research Experimental Centre	MTT Experimental

4. Lessons learned

In the view of some of the Panel, too much unnecessarily detailed information had been gathered from proposers and it had not been sufficiently made clear to proposers that the case was to be made to a Panel of experts collectively covering the areas but individually not necessarily familiar with the jargon of specific research areas. A much shorter, simpler proposal answering the questions: What does this infrastructure do? How does it operate? Who uses it and to what extent? How do you wish to change and improve it? may have given a better comparison. Some proposals were very long and densely written with much jargon and many acronyms; others were very short and did not give a full picture so that the infrastructure was undervalued. A word limit of say 800–1000 words and an instruction to write for a general audience and specifically answer the above four questions as clearly as possible would have helped the Panel, as well as focussed the minds of the proposers.

Report of the Physical Sciences, e-Science and Engineering (PSE) Assessment Panel Report

October 3
2008

EXECUTIVE SUMMARY AND RECOMMENDATIONS

This document is the Report of the PSE Panel recommending new or upgraded Finnish Research Infrastructures (RIs), to be included in the first Roadmap of national level research Infrastructures or to be listed as existing research infrastructures in Finland. The infrastructures under consideration cover very different types, lifetimes and costs.

1. The PSE Panel faced a challenging task. We received many proposals from research institutions in Finland, which we considered to be of very high scientific value and which showed the high standard of scientific research in this country. Our primary task was to evaluate them under the criteria of research infrastructures and assess whether they fulfilled these criteria. Not being on our list of existing or proposed research infrastructures is therefore in no way an assessment of the scientific value of the proposal in itself. Such an assessment would have led to a significantly longer list.
2. In various fields of science large research infrastructures play an important role. Due to rapid technological development, the size and complexity of these infrastructures and the cost to build and operate them have increased steeply. In an increasing number of cases it is only possible to finance, build and operate them effectively on a national or international scale and not as a facility of an institute or a university alone. Such infrastructures should be open for all scientists based on the scientific merit of their research proposals, as judged by independent review.

   The organization running an infrastructure is expected to give support to its external users and should be willing to accept such service tasks for external users in addition to its in-house research activity. We observed that this has not been achieved in many of the proposals reviewed but there is a tendency to develop in this direction.
3. Research infrastructures do not have value in their own right, but they are a means to support major long term scientific visions or strategies. Therefore a scientific community should discuss its future perspective and from this derive the need to construct national research infrastructure or to participate in international ones. Therefore proposals should have a basis in the scientific community of potential users and not be in the interest of an institute alone. Due to the high investments and long lifetime of large scale facilities, decisions should be based on a broad discussion within the science community and between them and the funding agencies.

   In some research areas, where several proposals were submitted, we had difficulties in gaining a clear view of the outlook of the associated Finnish science communities, although we became convinced that there is a need to support related infrastructure activities. Therefore we set a mark on the Roadmap for these areas. We recommend that there should be a comprehensive view of the perspectives of the respective fields first followed by proposals for Roadmap projects later, without re-opening the whole Roadmap activity.

   - Astronomy. Finland has become a member of ESO. We expected that this would have had a major im-

pact on the astronomy activities in Finland in order to make best use of the new opportunities. The proposals we received delivered good arguments for the continuation of existing facilities and the construction of a new radio telescope in Finland. The proposals did not allow us to derive priorities for the future development of Finnish astronomy. We therefore recommend that a shared vision of the perspectives of both optical and radio astronomy in Finland must be formulated by the astronomy community before taking decisions.

- Environment and atmospheric sciences. We received very valuable proposals in this area; we believe more momentum could be gained if these activities would be part of a single coordinated research plan. In this area, too, we therefore recommend to bring the proposers together and develop a joint view of the activities in the field.
- E-infrastructure. There is no doubt that there is a need for this kind of research infrastructure and that CSC is the main actor in Finland. However, we received several proposals which did not allow us to get a complete picture. We suggest that CSC together with the scientific users develop a coherent strategy for the future of e-infrastructure for Finland.
- Synchrotron radiation. Finland (as member of the Nordsync consortium) is a partner in the ESRF in Grenoble and should make the best use of this opportunity. In addition there are strong and established relations to MAX Lab in Sweden. Finnish scientists want to participate in the upgrade of both facilities. While we support both activities we recommend that it is necessary to develop an overall perspective for the optimal use of the resources in this area.

4. Today no country can have all research infrastructures on its own soil. Especially for a country like Finland with mostly small research communities it is necessary to participate in international institutions to secure for its researchers access to world leading facilities. The highly competitive peer review at such facilities helps to ensure high quality of research in general.

   Internationally competitive research infrastructures offer excellent possibilities for higher education and the training of PhDs. The competitive peer review system is an accepted measure of high quality research. Due to the mostly cooperative projects young people learn to work in – often international – teams and on technologically challenging projects. We strongly recommend supporting especially the participation of young people in the use of first class research infrastructures.
5. To make best use of the participation in international institutions it is important to have a strong home base to ensure ownership of the science activities in the infrastructure. This ownership implies devoting human resources, especially the allocation of PhD positions, and providing resources to cope with the technologically challenging tasks for data analysis and for the development of instrumentation and of new experimental methods. Such measures should assure good relations between the home institution and the infrastructure. Particular emphasis is required in ensuring young researchers have tenure in order to allow for the long time constants in working in large research infrastructures.
6. The PSE Panel received some proposals which we considered to be very important infrastructures for the technical competitiveness of the Finnish economy. We recommend establishing a list of technological infrastructures, which have slightly different goals and should be assessed with different criteria than research infrastructures.
7. Recommendations to the government of Finland
   - There is an excellent multi-faceted research base in Finland. The Panel welcomes the effort to make best use of this basis by a systematic process with external review of research infrastructure proposals.
   - In order for this process to have an impact there is a need for longer term stable funding for research infrastructures and a systematic process to establish strategies and priorities for research areas in collaboration with the research communities.
   - Decisions on major new investment should only be made after a comparative analysis of the opportunities available, and avoiding ad hoc decisions as far as possible.
   - Stable government funding for such long term investments would allow government, universities and research institutions to adapt their planning accordingly.
   - Budgets for operation should also be made available on a multi-annual basis with regular peer review.

1. RESULTS OF THE EVALUATIONS

The PSE-Panel was given the task of examining existing infrastructures, proposals for upgrading existing infrastructures and constructing new infrastructures for physical sciences, e-science and engineering in Finland. After judging whether the proposal complied with the definition of a research infrastructure, the main criterion for recommendation for the national Roadmap was a strong science and technical case, taking into account competitiveness on a European and in some cases on a global scale. In addition, the financial demands in comparison with the situation and size of the Finnish research community were considered. Several proposals were based on an existing tradition of collaborative projects and cooperation on a national or international level in the respective research community, which favoured their recognition as a national level RI. Only a few of the proposals were sufficiently focused to contribute to the advancement of multidisciplinary research, or to tackle the study of complex systems.

Evaluation of all proposals was made from a consistent point of view agreed within the PSE Panel. Many proposals were rejected because of having too narrow a scientific scope or being of only local importance, mostly at the university department level. Some proposals were considered more like networks than infrastructures and therefore did not deserve consideration as RI. Another serious problem for insufficiently mature proposals was that they did not show a coherent management structure.

The PSE Panel identified thirteen projects for the list of existing RI, of which nine are international or regional Nordic cooperative infrastructures. Seven projects should be introduced to the national level Roadmap of which 5 are mentioned in the ESFRI Roadmap. In addition the Panel expects further projects for the Roadmap from the areas mentioned in the general recommendations (paragraph 3 of the Executive Summary).

1.1. Existing Research Infrastructures

The PSE Panel examined the proposals for existing infrastructures and suggests those listed in Table 1 to be accepted as research infrastructures using the agreed definition.

Table 1. Proposals suggested to be introduced to the list of existing RI, and participation in international RIs (international participation with shading).

Number	Acronym	Title
78	MRO*)	Metsähovi Radio Observatory
81	CRYOHALL	Cryohall of the Low Temperature Laboratory
83	JYFL-ACCLAB	Accelerator Laboratory of the Department of Physics
88	MAX-lab*)	MAX Synchrotron Radiation Facility
106	Micronova	Micronova, Centre for Micro-and Nanotechnology
91	ESRF*)	European Synchrotron Radiation Facility
93	ESA	European Space Agency
94	ESO*)	European Southern Observatory
95	CERN	European Organization for Nuclear Research
96	NOT*)	Nordic Optical Telescope
97	EISCAT	European Incoherent Scatter Association
98	JET	EFDA JET - Joint European Torus
99	ITER	ITER

*) See recommendations by PSE Panel.

1.2. New Research Infrastructures

Five proposals were considered by the PSE Panel, and two considered in parallel with other Panels, which according to the judgement of the PSE Panel fulfil the criteria of maturity (Table 2).

Table 2. Mature proposals suggested to be introduced to Roadmap (participation in international RIs indicated with shading).

Number	Acronym	Title
R95	JHR MTR (ESFRI)	Jules Horowitz Materials Testing Reactor
R97	FAIR (ESFRI)	Facility for antiproton and ion research
R100	ESRF-Upgrade (ESFRI) *)	ESRF Upgrade
R118	CRYOHALL	Upgrade of cryohall
R121	Micronova	Micronova Centre for Micro- and Nanotechnology
R35	ICOS (ESFRI) *)	Integrated Carbon Observation System
R39	ELIXIR (CSC) (ESFRI)	European Life Science Infrastructure for Biological Information

*) See recommendations by PSE Panel.

Several interesting proposals and/or concepts, which were considered by the Panel to be important for the development of research, but which are not yet mature in some technical, institutional and/or costing aspects, are identified as "Emerging" ideas. These need further consideration and possible preparatory phase support to reach maturity. As an example, R128 EISCAT_3D European next generation Incoherent Scattering Radar Project was considered as an emerging idea.

1.3. Research Infrastructures, decision pending

The PSE Panel identified four areas where several proposals were presented with well defined and important scientific needs but which were not yet mature as described in the Executive summary (paragraph 3). In these areas there should be an opportunity to submit new proposals before the final decision of the national Roadmap will be made. They are therefore left 'pending'.

1) Astronomy; the Panel calls for a shared vision to be formed of the perspectives for both optical and radio astronomy in Finland.

- 94 ESO, European Southern Observatory (participation in international RI as a core activity)
- 78 MRO, Metsähovi Radio Observatory
- 84 TO, Tuorla Observatory
- 96 NOT, Nordic Optical Telescope
- R96 E-ELT (ESFRI), European Extremely Large Telescope
- R119 MRO-2, Building Finnish Radio Astronomy´s Future

2) Environment and atmospheric sciences; more momentum could be gained if these activities would be part of a single coordinated research plan.

- 172 Pallas-Sod, Pallas-Sodankylä Super Site
- R33 COPAL (ESFRI), COmmunity heavy-PAyload Long endurance Instrumented Aircraft for Tropospheric Research in Environmental and Geo-Sciences
- R34 EINAR, European Institute for Atmospheric Research
- R35 ICOS (ESFRI), Integrated Carbon Observation System (participation in international RI as a core activity) as a core RI
- R38 SMEAR, SMEAR Stations

3) E-infrastructure; The Panel suggests that CSC together with scientific users develop a coherent strategy for the future of e-infrastructure for Finland, based on properly identified research community needs.

- 170 CSC-Funet, Funet (Finnish University and Research Network)
- 171 CSC-Services, IT Services for Science at CSC
- R106 Funet2030, Funet Roadmap to the next decades
- R107 FGI, Finnish Grid Infrastructure for mid-range computing
- R109 eSCI, e-Infrastructure supporting e-Science

4) Synchrotron radiation; it is necessary to develop an overall perspective for the optimal use of the resources in this area.

- 88 MAX-lab, MAX Synchrotron Radiation Facility
- 91 ESRF, European Synchrotron Radiation Facility (participation in international RI as a core activity for Finland)
- R99 MAX IV
- R100 ESRF-Upgrade (ESFRI)

1.4. Technological Infrastructures

The proposals for the Lappeenranta Laser Processing Centre (105, LLPC) and Reactors Lifetime Management of Finland (124, RELIEFI) were identified as existing national level infrastructures, but the Panel considered that these facilities are sufficiently different in their nature and deserve a separate listing. They should be referred to as technological infrastructures (TI) which are very important for the technical competitiveness of the Finnish economy, but have slightly different goals and should be assessed with different criteria than research infrastructures.

2. LESSONS LEARNED

A strategy should be developed for RI cooperation among the diverse agencies that work in the broad field of sciences and technology. RI projects need a mechanism for bringing in new partners (and new branches) under a joint or common management system. For example, some of the new RI initiatives may benefit from collaboration with existing RI or one of the new proposals. A trend towards integration, instead of fragmentation of initiatives working around the same themes, should be encouraged within the scientific community.

Detailed guidelines are needed to render the process more transparent and structured within and among Panels. Finland as many other countries is still in a learning phase regarding the best practice in selecting the RI proposals with the highest potential for the national or for the ESFRI Roadmap, especially evaluation of multidisciplinary proposals.

More attention should be given to facilitate cooperation between industry and academia regarding RI policies. The PSE Panel introduced the concept of 'technology infrastructures' (TI) on the same line as research infrastructures (RI) which serve more basic research.

The concept of a research *infrastructure* needs to be defined in a way that differ clearly from networking activities between research organizations. Some of the networks may be seeking the RI label to foster high-quality cooperation, although in some cases domestic and international networks may be a more appropriate approach for the participants. Some of the networks may later develop to become a distributed RI.

The Panel work would benefit from more specific guidelines for their technical evaluation in the future. Detailed guidelines would render the process more transparent and well structured within and among different Panels.

- Guidelines should explicitly instruct how Finland defines concept and research policy of national level RI.
- The methodology and procedure concerning the evaluation of proposals which need parallel assessment from two Panels needs to be clarified.

The advice from the Panel is to find mechanisms to increase and improve interaction between science communities to propose joint proposals to the Roadmap.

Social Sciences and Humanities (SSH)
Assessment Panel Report

October 7
2008

1. General Remarks

1. The SSH Panel met in Helsinki between 3 and 5 September 2008. 14 proposals were referred to it as Existing Infrastructures (EI) and 9 as proposals for the RI Roadmap (RIR) for Finland.

   Regarding the list of proposed EIs, the SSH Panel noted that the CESSDA proposal (140) was withdrawn from the list. It was also noted that CESSDA (R4) remained on the RIR list.

   On the EI list, 7 further proposals were initially defined to fall within the remit of all three panels. Of these, FUNET (170) was discussed by the SSH Panel. CSC-Services (171) was also discussed in general terms and with particular reference to its importance as a service hub. The Panel considered that it did not have the expertise to evaluate the other cross-panel proposals.

   On the RIR list, 7 proposals were initially defined to fall within the scope of all three panels. Of these, only one (Statistics Finland, R27) was discussed by SSH. As in the case of the EI list, the Panel concluded that the other six fell outside its domain of competence.

2. All proposals were discussed according to predefined criteria. The Panel was also proposed the opportunity to conduct site visits. However, instead of site visits, it was decided to invite speakers for some of the proposals to meet the Panel for short interviews on 3 September. These speakers were invited on the assumption that such interviews could be of some benefit to the Process in which the Panel was engaged.

3. On 4 and 5 September, the Panel discussed each of the proposals which had been referred to it. Each discussion was introduced by a lead "A" reader and then followed up by a "B" reader. The other Panellists were invited to contribute towards concluding overall assessments.

4. In addition to making our assessments, the Panel suggested that in a number of cases, rather than deny a place on the Roadmap or an Upgrade to these proposals, that the Process of developing more stable and serviceable infrastructures in Finland would be enhanced if some of the proposals could be associated.

   Accordingly, while the Panel's assessments on the individual proposals are given, it was felt that notwithstanding what are in some cases considerable strengths and maturity, some proposals might better serve Finland if they were encouraged to collaborate in more tangible ways. This would also ensure that great national institutions and research centres would not be duplicating efforts.

   In making these observations, Panellists also felt that it was not desirable for them, on the basis of the limited information that was available to it, to make choices between the great cultural institutions of Finland given the fact that as individual institutions, they are the keepers of the National Heritage. However, the Panel also recognises that Finland's heritage must be made more accessible and that resources, tools, competences and skills have to be developed towards this end, as well as the training and networking that is also required.

The Panel concluded that co-operation between these institutions, as reflected in those who applied to the Process, is essential to the ability of Finland to develop dynamic and efficient research infrastructures.

The Panel hopes that its comments will assist the Steering Group in this regard. These comments are contained in the section 3 “Suggestions for the co-operation”.

5. The Panel also understands that it was asked to assess proposals that aimed to promote the research infrastructure of Finland.

6. It also noted that there were no applications relating to arts (galleries, music, theatre).

7. The Panel strongly hopes that after such a detailed and honourable process of consultation, Finland will have regular calls for proposals on Research Infrastructure, or at the very least, a “post-box” by which new and/or emerging ideas can be identified, as well as appropriate financial resources to develop them.

2. Results of the evaluations

The SSH panel recommended that 7 projects should be introduced to the national level Roadmap (Table 1). Of these 7 projects 3 are mentioned in the ESFRI Roadmap.

Table 1. Projects recommended by the SSH Panel for inclusion on the Roadmap RIs.

Number	Acronym	Title
R 1	MIDAS	Micro Data Access System (ReTki)
R 2	FIN-CLARIN (ESFRI)	Finnish Clarin
R 3	ESS (ESFRI)	European Social Survey
R 4	CESSDA (ESFRI)	CESSDA
R 5	Upgrade FSD	Upgrade data services Finnish Social Science Data Archive
R 6	Digitointikeskus	Digitisation Centre
R 18		System Architecture for Memory Institutions

The SSH Panel identified 9 projects for the list of the existing RI and gave support for 2 projects without evaluating them (Table 2).

Table 2. Projects recommended and supported by the SSH Panel for inclusion on the list of the existing RIs.

Number	Acronym	Title
133	FinELib	The National Electronic Library
134	NARC	National Archives Service of Finland
135	NBA	National Board of Antiquities
136	ACLC/CELC	Archives and collections of linguistic corpora/Collections of electronic linguistic corpora
137	FNL	The collections of the National Library of Finland
138	FSD	Finnish Social Science Data Archive
139	ReTki	Finnish Information Centre for Register Research
141	-	Statistics Finland's research services
145	STAKES	National Research and Development Centre for Welfare and Health
170*	CSC-Funet (CSC)	Funet (Finnish University and Research Network)
171*	CSC-Services(CSC)	IT Services for Science at CSC

*In joint evaluation with other panels: Discussed and supported but not evaluated in the SSH panel

3. Suggestions for Co-Operation

1. Further to the general observations made in Chapter 1 and the detailed observations made on individual proposals, the SSH Assessment Panel felt that the Steering Group might consider a process for collaboration between the various proposals.

   This was substantiated for the Panel by an observation by one proposal that the data was "ours" and should be developed "by us". We do not believe that such views can be considered to serve the best interests of Research Infrastucture in Finland.

   The Panel also noted that in some cases, more than one proposal was in some way or other, associated with the same Host Institution.

2. In advocating more pragmatic and practical modes of collaboration, the Panel welcomes the positive moves that have already been made towards this end. The Panel wishes to encourage these moves and is making the suggestions that follow in this spirit.

3. The Panel also wishes to stress that in making its observations, it is doing so on the basis of the information that was at its disposal. Furthermore, while the Panel dealt with RI s from two different lists, the list of Existing Infrastructures, and the Roadmap. Nonetheless, it was not felt that their focus and function were sufficiently different to discourage us from this approach.

   However, the Steering Group may wish to access more detailed information and evidence in order to arrive at more definitive conclusions. Our observations are made in good faith and are merely one input into this.

4. The Panel also stresses that its proposals are directed towards greater collaboration. As such, the suggestions that are made are indicative and may be altered upon further reflection and more detailed information, including the strategic assessments which in some cases, have been made of some of the institutions involved and to which the Panel did not have access.

5. In general terms, our suggestions for collaboration have been constructed around a "Hub" and "Spoke" model, where the "Spokes" consist of individualised centres, each with its own, though sometimes overlapping agenda with others. While we see the "Hub" (or, "Reference Point") as recognising the diversity of these "Spokes", it can also serve those Spokes as they develop their areas of focus, protocols for quality control, governance and distribution, and strategic visions to promote research infrastructure which can best serve the SSH in Finland and enhance Finland's knowledge-based economy.

   Such a model might also be relevant to some absentees from the Process (such as Finland's galleries of art, museums, theatre and possible activities on data sets).

6. Without intending any particular order of importance, the Panel has clustered the applications that have been referred to us as follows:

6.1.

The Panel noted that if MIDAS were to assume the role of a Hub for the three others, its role would have to be specified in a clearer way than what we could see from the submissions. It was realized that while the existing cultures of some of the Spokes were mature in different ways, they would be strengthened by being considered together. It was felt that this will would bring greater strengths to all their activities, that the combination of data would best serve the interests of SSH research in Finland, and that this would well serve the development of Finnish research infrastructure as well as bring added value.

Further it was felt that if such a strategic role were assigned to MIDAS, the potential for SSH research in Finland would be very significant as would the potential usage of the RI by SSH researchers.

Proposed Spokes	**Proposed Hub**
Statistics Finland (141) STAKES (145) ReTki (139)	MIDAS (R1)

6.2.

During its discussions, the Assessment Panel was aware that each of these institutions is a prestigious repository of the Cultural Heritage of Finland. They also represent diversity. Moreover, even as individual institutions, they are often the sum of seemingly separate units which partly explains why in some cases, the Panel received multiple applications from the same general host. The Panel felt that this did not serve the Process well.

With respect to the above-mentioned proposals, the Panel recognised that a "Hub-and-Spoke" model may be more difficult to develop here (if at all), if only because some of these institutions, at a "sub-set" level, have already developed strategies of their own in the area of research infrastructure. Moreover, the Panel recognises that in any event, there may be no natural "hub" for the humanities.

Nonetheless, given the rationale that each "Spoke" can still develop on its own terms, regardless of how mature and/or dynamic its activities related to research infrastructures are at the present time, the Panel suggests that it is always useful to develop practical relationships between cognate institutions.

For these purposes, the Panel recognised that the System Architecture for Memory Institutions (R18)

Proposed Spokes	**Proposed Hub(s)**
National Archives (134) Board of Antiquities (135) Institutions (R18) National Library (137)	System Architecture for Memory

might provide a suitable template as a service "Hub" even if, in such circumstances, its template, as presented to the Panel, would have to take into account how it might optimally serve the constituent Spokes.

7. The Panel also recognised the potential of the Digitisation Centre (R6) and the National Electronic Library (133) and that they have already developed a distinctive maturity.

8. The Panel observed that a "Hub-and-Spoke" model might not be either practical or advantageous in the following cases, not least because of the nature and advanced maturity of the relevant activities. However, we suggest that the following proposals might benefit from better increased collaboration between cognate areas.

8.1.

FinCLARIN (R2)

Electronic & Linguistic Corpora (136)

The Assessment Panel noted the advanced maturity of the CLARIN Proposal within the ESFRI process and its funding profile under FP7. It noted the stiff and competitive process that has brought CLARIN to this stage of the ESFRI process and that FinCLARIN can only benefit as the national contact point for SSH researchers in Finland. CLARIN already provides a European reference point which will be of great advantage to SSH researchers in Finland, not least by benchmarking research in Finland by international standards.

Nonetheless, we add that those who are involved with the Electronic and Linguistic Corpora (136) should also engage with FinCLARIN and develop strategies of collaboration with Finland's Cultural Institutions, most notably with the National Library of Finland.

8.2.

CESSDA (R4)

FSD (138)

ESS (R3)

The Assessment Panel noted the **advanced** maturity of the CESSDA Proposal within the ESFRI process and its funding profile under FP7. It noted the stiff and competitive process which has brought CESSDA to this stage of the ESFRI process and that FSD (138) can only benefit as the national contact point for SSH researchers in Finland. CESSDA already provides a European reference point which will be of great advantage to SSH researchers in Finland, not least by benchmarking research in Finland by international standards.

Nonetheless, while we recognise that the ESS (3) is a research-driven activity, it might benefit from strategies of co-operation with CESSDA/FSD.

9. The Assessment Panel also strongly encourages the Steering Group to make greater room for researchers in the governance of its cultural and research institutions, especially where research infrastructures are being developed with respect to the processing and accessing of data, and the management of surveys and other infra networks.

   In this connection, the Panel also noted that only few proposals had been submitted to the Panel from researchers themselves.

   The Panel thus concluded that given that there were some important absentees from this Process that the present call is a beginning rather than an end.

10. The Panel also noted that there are different actors involved in promoting research infras in Finland: Ministries, Cultural Institutions (and in each of these cases, sub-sets of each), as well as Research Institutions. The Steering Group might wish to find ways of ensuring that these are not developed in mutually exclusive ways.

11. The Panel recognises that as in evaluation processes of this kind, there may be overlaps in the proposals submitted. However, in offering the foregoing suggestions, the Panel stresses that they are made in good faith with the intention of making SSH research infras in Finland robust and of the best possible service to Finland.

Appendix 4

Descriptions of national research infrastructures and membership in international infrastructures

Information on these descriptions is based on the original descriptions sent to the Steering Group by the co-ordinators of the proposals.

Content

Social Sciences and Humanities

National Board of Antiquities (NBA)

RI website: www.nba.fi

The National Board of Antiquities preserves Finland's material cultural heritage, collecting, studying and distributing knowledge of it. It offers a research infrastructure comprising: 1) Museum collections and scientific, archival and library collections (as well as their digital versions) concerning the museum sector and cultural environment. Information services connected with this material; 2) Data assets concerning the Finnish cultural environment (research and sites and monuments registers, documentation data) as well as methods and technical applications connected to their production and maintenance. Information services connected with this material; and 3) Equipment connected with the preservation and conservation of material cultural heritage (ancient monuments and remains, buildings and objects).

The RI is nationally significant; it is the main data asset of the Finnish heritage sector. It has relevance for research in archaeology in Finland as the collections cover the archaeological material of the country as a whole.

National Archives Service of Finland (NARC)

RI website: www.narc.fi

The National Archives Service's tasks are to secure that documents belonging to the national heritage are preserved and to promote research based on them. The National Archives serves scientific and amateur research, public authorities and other bodies having an interest in the records kept in the archives.

The National Archives Service has a normative position in making decisions on records to be preserved permanently for research use. The importance of digital research data, metadata models, data mining, data curation, international standards and information management are key issues in a global research process. The National Archives Service is the only organization in Finland having decision-making power concerning publicly funded research data produced by universities and research institutes. It also has a responsibility to develop systems for permanent preservation and access to records and data.

Collections of the National Library of Finland (NLF)

RI website: http://www.kansalliskirjasto.fi

The RI has the responsibility to collect, describe and preserve Finnish published cultural heritage items according the Legal Deposit Act. This responsibility concerns published books, journals, magazines, ephemera (e.g. posters, flyers and leaflets), sound recordings, electronic publications and Finnish material in open networks. These collections are the source material of historical and cultural studies. In addition, the RI has a significant historical science collection and several special collections which are unique in Finland and in some cases also in the global context.

The RI has a unique collection in Finland especially concerning Finnish publications from before the

year 1919, the largest public sound archive in Finland, the most notable 19th-century Russian collection outside Russia, and the oldest scientific foreign collection in Finland. Especially the Slavonic Library, medieval manuscripts and some special collections including manuscript collections are noteworthy.

The RI makes it possible to have source material for Finnish historical and cultural research today and in the future. Research in the humanities has impact on the economy, often indirectly. Concentrating on high-level Russian research, the Slavonic Library has impact on knowledge of Russian in Finland, a critical factor for the success of Finland. Russian studies in Finland are internationally recognized. The socio-economic impacts of this RI lie mainly in understanding of our own and foreign cultures as a crucial skill in a globalized environment.

National Electronic Library (FinELib)

RI website:
http://www.kansalliskirjasto.fi/kirjastoala/finelib/
http://www.nationallibrary.fi/libraries/finelib

FinELib, the National Electronic Library, is a consortium of Finnish universities, polytechnics, research institutes and public libraries. FinELib acquires Finnish and foreign electronic resources to support teaching, study and research and to promote the availability and use of high-quality information in the community. The FinELib service unit negotiates user-right agreements concerning electronic resources on a central basis for all the member organizations. The National Library of Finland is responsible for FinELib activities in accordance with the guidelines laid down by the FinELib steering group.

The licensing of electronic scientific content centrally to Finnish universities and some 40 research institutes enables volume discounts and the possibility to influence licensing terms. Working as a consortium furthers national cooperation among libraries in addition to enabling high-level expertise and international cooperation with other licensing consortia. International cooperation creates innovations and makes it possible to have more impact on scientific publishing.

Based on the FinELib user survey designed and analysed as part of an international research project in 2007, the use of electronic resources has an impact particularly on the work of researchers. The use of e-resources has made it easier for researchers to find and obtain material and to keep in touch with their own fields. In many cases, it has also expanded the volume of resources available and has saved working time. Licensed e-resources can also be used as part of online teaching packages.

Finnish Social Science Data Archive (FSD)

RI website: http://www.fsd.uta.fi/

The FSD is a national resource centre for social science research and teaching. Services include quantitative and qualitative data archiving in electronic form and dissemination for secondary use in research and education, and related information service. The services are developed in close international cooperation with other national data archives and comparative survey projects. The virtual services are available at the web address http://www.fsd.uta.fi/. They include data catalogues, a research methods web resource for quantitative and qualitative methods, web resources for research ethics and informing research participants, and a web resource for Finnish political party manifestos. The data is freely available for specified research and teaching purposes. It is not yet directly downloadable on the Internet. The data is sent to the recipient after receipt of a signed agreement on conditions for using the material use. The datasets are anonymous; research participants cannot be identified. The users agree not to try to identify research participants and to keep the data safe and unreachable by third parties.

The FSD services further data openness and verifiability of research, and add to a growing body of knowledge by providing access to existing research data. Research funding is more efficiently used when the data is reused after primary research. Data archiving increases the use of Finnish data in internationally comparative research and improves the competitive possibilities of Finnish researchers. Graduate and post-graduate students or researchers who are not yet involved in cooperative projects will have the possibility to conduct

comparative research with large surveys to which they would not normally have access because of the high cost of data collection.

Finnish Information Centre for Register Research (ReTki)

RI website: www.rekisteritutkimus.fi

The aim of ReTki is to promote the use of national registers for research purposes, particularly in the social and health sciences. The Centre's basic functions are to offer information on registers and the use of registers in research, to organize training on register-based research, to give practical advice on using register data in research and to maintain a network of contact persons of participating register authorities and research institutes. A web portal is designed to help a researcher find information on what kind of register data is available, what organizations are the register keepers and how to apply for the data. Examples of research projects, where register data have been used, are given on the web pages. ReTki is currently putting together a virtual study package to be used as a part of the teaching of research methodology at universities. ReTki is also trying to find new and more efficient ways to use register data.

Using data that has already been gathered (in administrative registers) instead of carrying out questionnaire surveys to obtain data is often much more cost-efficient. This was shown by Statistics Finland which compiled a totally register-based census in 1990, making Finland the second country in the world to do so. The researcher's improved knowledge of register-based research and modes for obtaining data improves, is of clear significance for the amount of research that can be undertaken within the limits of research budgets.

Archives and Collections of Linguistic Corpora (ACLC) / Collections of Electronic Linguistic Corpora (CELC)

RI website: www.kotus.fi/collections

Kotus – The Research Institute for the Languages of Finland – has an extensive and wide-ranging collection of research material containing dozens of millions words in Finnish and its cognate languages. The collection serves research on e.g. modern language, early literary language, literary language of the 19th century, dialects, onomastics, cognate languages, etymology, as well as Swedish, Finnish Romany and Finnish Sign Language. The data are in the form of file-card entries, electronic corpora, audio and video recordings etc. The collections (more than 20 million file cards) have been assembled over more than a century. Besides the material kept in paper form, there are also audio recordings totalling 23,000 hours (12,500 hours in digital form) and an increasing volume of electronic data. The on-line data service includes e.g. Finnish texts dating as far back as the 1500s.

Collection-based research is one way of fostering knowledge of the languages of Finland and their status in our culture and society, thereby building the foundations for linguistic equality in Finland.

European Social Survey (ESS)

RI website: www.europeansocialsurvey.org

The European Social Survey (ESS) is a biennial survey designed to chart values, attitudes and behaviour among European populations in the context of changing institutional settings. The survey employs the most rigorous methods from sampling and planning the questionnaire to field-work techniques and archiving. In addition to substantive research, the ESS aims to improve the rigour of quantitative social measurement for comparative studies throughout and beyond Europe, and to develop standard social indicators to stand alongside economic indicators as measures of the quality of life in different countries and regions. The survey covers approximately thirty countries. The data is freely and quickly available to all researchers, being used by almost twenty thousand researchers around the world.

Being a part of the ESS includes Finland in the international social science research community; it increases participation in international research co-operation. With international comparative analyses Finnish researchers will have better opportunities to publish their results in recognized journals; Finland becomes a more interesting target of research if placed

in a wider comparative context. Over 500 academics and students in Finland use the ESS data.

Environmental Sciences

Finnish Long-Term Socio-Ecological Research network (FinLTSER)

RI website: www.environment.fi/syke/lter

The aims of FinLTSER are:

- To provide a national infrastructure for long-term site-based ecosystem and biodiversity research in Finland, including climate change impacts.
- To provide a Finnish contribution to:
  - The observatories component (terrestrial, freshwater and marine observatories) of the proposed EU/ESFRI LIFE-WATCH initiative (www.lifewatch.eu).
  - The recently established European LTER-research network (www.lter-europe.ceh.ac.uk).
  - The global ILTER network (http://www.ilternet.edu/).

FinLTSER consists presently of 9 highly instrumented sites/research platforms, representing the main ecosystems of Finland (marine, terrestrial, lake, sub-arctic, urban). The core of the FinLTSER infrastructure is formed of:

- Research stations of the universities of Helsinki, Jyväskylä, Oulu and Turku.
- Research sites, instrumentation and long-term monitoring programmes of main governmental research institutes (SYKE, Finnish Meteorological Institute, Finnish Forest Research Institute, Finnish Game and Fisheries Research Institute, MTT Agrifood Research Finland).
- Information management structures and databases of the participating universities and research institutes.

The network started its activities in 2007 based on the decision of the high-level Coordination Group for Environmental Research in Finland. A major upgrade of the network is proposed to meet the highest international standards.

FinLTSER combines the expertise and resources of main universities and research institutes conducting research on long-term socio-ecological processes and problems in Finland, thus making optimal use of available resources. The development and testing of new instrumentation and sensor technology for ecological/environmental research provides marketing opportunities for technology companies.

Finnish Museum of Natural History (FMNH)

RI website: www.fmnh.helsinki.fi

The Finnish Museum of Natural History is a research institution functioning under the aegis of the University of Helsinki. It is also one of the three central nationwide museums in Finland, being responsible for national collections in its field. The collections, which include botanical, zoological, geological and paleontological specimens from all over the world, serve research in the fields of Biology and Geology as well as educational purposes.

The FMNH supplements and maintains its collections, lends the specimens; organizes exhibitions in natural history; takes care of public information, and publishes papers in its field of speciality. It coordinates the research, documentation, databasing and monitoring of the environment among Finnish biological museums, as well as the activities of national botanic gardens.

Stations for Measuring Forest Ecosystem-Atmosphere relationships (SMEAR)

RI website: http://www.atm.helsinki.fi/SMEAR/

Atmospheric aerosol particles and trace gases affect the quality of our life in many different ways. In polluted urban environments, they influence for example human health and deteriorate visibility. In regional and global scales, aerosol particles and trace gases have a potential to change climate patterns and hydrological cycle. To understand the changing climate long term, continu-

ous and comprehensive field measurements are needed. We operate 3 SMEAR field stations and all data and analysed results as well as the infrastructures themselves are generally available. All the field stations have comprehensive scientific program to investigate aerosol and trace gas concentrations, biosphere-atmosphere interactions, aerosol formation and growth and biogenic background processes leading to aerosol formation. Also comparisons between the urban and natural environments can be done by comparing urban station results with background ones. The three SMEAR stations are: SMEAR I, Värriö, 1991-; SMEAR II, Hyytiälä, 1994-, Urban SMEAR III, Kumpula, Helsinki, 2004-. So far the investments to stations are around €20 million. SMEAR II in particular has turned out to be a world-leading station in its field due to its comprehensive research programmes and to its unique time series of fresh aerosol formation.

Added value for Finland consists of the following:

- More harmonized European and global visions, a leading role in studying and directing the field
- Excellent opportunity to raise questions important to Finland related to both research and international environmental politics (for instance the significance of forests as sinks of carbon and sources of aerosols). Offers a direct way of influencing the international climate policies.
- Novel technological efforts where environmental problems would be solved to commercialization of ideas and innovations
- Intensive international research projects for studying important ecosystems and the influence that they have on the climate and, in turn, the influence atmospheric pollutants and climate change have on ecosystems.

Pallas-Sodankylä Super Site (Pallas-Sod)

RI website:

www.fmigaw.fmi.fi, www.fmiarc.fmi.fi, www.fmi.fi

This RI consists of the FMI Arctic Research Centre at Sodankylä and stations at Pallas. The region is representative of a boreal and sub-arctic Eurasian environment in a transition zone from marine to continental climate. The site provides *in situ* monitoring and high spatial resolution land-cover data sets that are not available for other regions north of the Arctic Circle. Continuous well-calibrated synoptic weather observation started in 1908, and aerological monitoring over 60 years ago. Since 1994 the Pallas-Sodankylä site has been one of the 22 global stations of the WMO Global Atmosphere Watch (GAW) programme; since 2008 it has been also a primary station in the WMO GCOS Reference Upper Air Network. GAW is globally the most important international network to monitor greenhouse gas and aerosol concentrations, ozone, ultraviolet radiation, reactive gases and precipitation chemistry. The site provides integrated data from soil, vegetation and the atmosphere (and their interactions) accompanied with radiation, albedo and reflectance observations over the spectrum of electromagnetic radiation. This enables the calibration and validation activities of environment and climate observing satellites.

Measurements are applied e.g. in

- Operational weather services,
- Climate change research
- Ecosystem research
- Satellite observation validation/calibration and methodology development.
- Geophysical research

The Pallas-Sodankylä infrastructure provides unique data as a primary station for several international networks. Similar observation systems and freely available data are not available for other regions of the continental northern Eurasia, which makes the site important globally. The use of the data is currently rapidly increasing, and the new applications are evolving. These include the calibration and validation of satellite instruments as one of the super sites available in the world. The observation systems at Pallas and Sodankylä provide integrated, continuous data sets that enable these activities. The activities are connected to various environmental and atmospheric research applications as well as the operational activities of weather services and related international organizations (WMO, Eumetsat, ESA).

Added value for Finland consists of the following:

- An infrastructure that is able to make Finnish research globally relevant top-level activity concerning issues that are the most relevant for global change and climate change at high latitudes
- Providing information essential for investigating climate change and its consequences for Finland
- Fostering the competitiveness of Finnish research and industry in the field of utilizing satellite data
- Raising issues important to Finland from the point of view of national and international environmental politics.
- Offering a test-bed for the development of novel technology e.g. in the field of hydro-meteorological information systems.

Biomedical and Life Sciences

National Biobanks of Finland (FIMMDNA)

RI website: www.nationalbiobanks.fi

Over the past decade, the Department of Molecular Medicine of the National Public Health Institute of Finland has developed a highly specialized biobank for centralized DNA extraction, quality control, storage and sample logistics. Because of this experience, Finland has a good chance to gain a leading role in pan-European and even global biobanking consortia such as BBMRI. The current facility has a permanent staff of six laboratory technicians, two co-coordinators for DNA extraction and aliquoting logistics, and a manager. The National Biobank of Finland presently houses DNA samples from more than 200,000 individuals. The Biobank is equipped with a state-of-the-art bar-coding system for sample tracking, automated DNA extraction equipment, liquid-handling robots, storage facilities and tailor-made data management tools for optimum efficiency and quality control. An advanced database, SamWise, has been developed on an in-house basis. The KTL DNA Biobank is a research infrastructure for Finnish genomic studies.

Helsinki Functional Imaging Center (HFIC)

RI website: http://www.hfic.helsinki.fi/

HFIC has a national role as a coordinator in the largest imaging consortium in Finland: it harbours 12 imaging core units in the biological and material sciences and contains a national electron microscopy unit. The HFIC activities are being shaped and continuously further developed by two national Centres of Excellence, and it serves in total five national Centres of Excellence. This is a dynamic and rapidly developing infrastructure that has established firm international collaborations and provides support for top-level Finnish research.

National Virus Vector Laboratory (AIV Vector Core)

RI website: www.uku.fi/bck/

AIV Vector Core produces full GMP-grade viral vectors for clinical trials and adenoviruses, lentiviruses, adeno-associated viruses and baculoviruses in smaller quantities for research use in cell culture and experimental animals, including toxicological testing. Both small-scale and large-scale production methods and downstream purification are available, including quality control and release assays for experimental and clinical use. Quality controls and release tests for phase I/II/III clinical material need to be agreed with each production lot. Researchers in Finland and Europe will have access to the highest quality viral vector production with reasonable costs and timetables. Access to these vectors will give researchers a competitive edge worldwide.

Finnish Infrastructure Network for Structural Biology (NSB)

RI website: http://www.biocenter.oulu.fi/bf/index3_structuralbiology.html

The Finnish infrastructure network in Structural Biology (NSB) supports and provides infrastructure for research in structural biology throughout Finland, with the primary centres in the biocentres in Helsin-

ki, Oulu and Turku. NSB provides infrastructure in three major disciplines: X-ray crystallography, nuclear magnetic resonance (nmr) spectrometry, and electron microscopy (em), and associated required facilities (virus production, protein characterization and crystallization etc.)

These techniques – x-ray, nmr and em – allow researchers to find out where each and every atom is in the molecules that make up living cells: to determine both their structure and how they work. This can be done for individual enzymes, for the large molecular machines in the cell that synthesize proteins or DNA or convert energy, and for viruses. Furthermore, we can learn about the dynamics of these structures – how they move in the resting state and how they change in response to "external changes" – for instance the binding of a drug molecule, another protein or a hormone. The work sits at the interface between biocomputing and imaging. Our facilities, essential to modern biological research, underpin molecular medicine, biotechnology and green technology.

This research infrastructure is essential for Finland to be competitive in molecular medicine and modern biological science. Structural biology is needed to gain a molecular understanding in fields such as enzyme design, drug metabolism and disease. Modern drugs, including the breakthrough cancer drug Gleevec™, develop from structural biology-driven basic research.

Genome-Wide and High-Throughput Methods, Biocenter Finland Infrastructure Network (GWHT)

RI website: http://www.biocenter.oulu.fi/bf/index3_genomewide.html

New technologies enabled by knowledge of genomes and the ability to silence genes one-by-one are a key to progress in life sciences. These genome-wide technologies require an infrastructure consisting of both integrated instrumentation for high-throughput analysis of genetic variants, mRNA expression, and cell signalling as well as tools to performing gene silencing and gene activation genome-wide in living cells. The Biocenter Finland GWHT RI integrates the instrumentation, genome-scale reagent sets, and expertise into services provided nationally. This provides a wide base of researchers with cost-efficient access to cutting-edge technologies facilitating new discoveries and innovations. This existing open access RI is active and well organized and supports a high-profile research area in Finland, but needs to expand in the rapidly developing areas of parallel DNA sequencing and genome-scale biology with integration with European level infrastructures (ESFRI BBMRI) in this area.

The RI efficiently combines the national expertise in the area of GWHT and provides the cutting-edge technology to researchers both in academia and industry in a cost efficient fashion. Through training and exchange programs and collaborations the RI greatly facilitates internationalization. The research results exploiting the GWHT are likely to result in a number of scientific innovations in several areas of life sciences. Such innovations can be further developed and utilized by industry.

Finnish Genome Center (FIMM-FGC)

RI website: www.fimm.fi

FIMM will continue the operations of the national Finnish Genome Centre, founded over 10 years ago, and will expand its capabilities to new fields under the concept of the FIMM Genome and Technology Center (FGTC). FIMM will strengthen the existing role of FGTC as a national facility for genotyping, sequencing and data analysis. In 2008, FGC produced 1,715,500,000 genotypes and carried collaborative projects with 25 group leaders across the country and with international and EU collaborations. In 2008, DNA sequencing services had over 200 users, while the IT services at FIMM had approximately 900 registered users in Helsinki, in Finland and around the world.

FIMM will expand its technology and service operations to other related fields linked to its role in three European infrastructure (ESFRI) efforts, EATRIS (translational research), BBMRI (biobanking and biomolecular resources) and ELIXIR (bioinformatics). Besides the existing capabilities mentioned above, FIMM will focus on the following technologies and

service efforts: 1) High-throughput "next-generation" sequencing, 2) Medical Bioinformatics, 3) Ultra-high-throughput screening technologies for functional genomics and drug discovery, 4) Metabolomics profiling, 5) Biobanking and diagnostic biomarker development. Taken together, these infrastructures facilitate personalized medicine.

The mission of FIMM is to advance genetic and epidemiological research in Finland, generate new scientific discoveries and technological-service capabilities, as well as facilitate the translation of the results from basic science towards clinical utility. This will lead to improved means of diagnostics and treatment and prevention of health problems.

Turku BioImaging (TBI)

RI website: http://www.bioimaging.fi

The RI of Turku BioImaging (www.bioimaging.fi) is based on the shared and highly interdisciplinary facilities of the University of Turku and the Åbo Akademi University. These include the following: (1) the preclinical imaging facilities of the Turku PET Centre and (2) the highly advanced cellular imaging technologies that are available at the Cell Imaging Core of the Turku Centre for Biotechnology. Significant scientific, regional, commercial and socio-economic benefits are to be gained from a networked and highly interdisciplinary approach to bioimaging, encompassing all supporting areas of imaging, with a continuous innovation chain, ranging from molecular to cellular and whole animal imaging, and from single cell analysis of sub-cellular events to high-throughput screening.

Turku BioImaging was initiated as a broad-based, interdisciplinary imaging consortium, which aims at bringing together bioimaging expertise in Turku and elsewhere in Finland. Turku BioImaging represents state-of-the-art imaging technologies in the bioscience community in Turku and is highly interdisciplinary, encompassing all areas of imaging, from molecular to cellular, from single molecule analysis to whole animal imaging, and from single cell analysis of sub-cellular events to high-throughput screening. Turku Bioimaging maintains close contact with leaders in the field of imaging, researchers located in key international imaging facilities at EMBL, Singapore, the Karolinska Institute and the United States. Turku coordinates BioCenter Finland Biological Imaging. In addition the CIC coordinates the Nordforsk-funded Nordic Network on Imaging in Biology and Medicine, comprising over 100 researchers at 10 research sites in the Nordic countries, Ireland and Russia. We aim to improve the European dimension by becoming part the EuroBioimaging infrastructure. We are planning to launch an international MA programme in Biomedical Imaging in 2010.

Center for Systems Neuroimaging (NEUROIMAGING)

RI website: http://ltl.tkk.fi/wiki/BRU, www.ami.hut.fi, http://www.biomag.hus.fi/

NEUROIMAGING is a network of three major national facilities in systems-level neuroimaging: MEG Centre and Advanced Magnetic Imaging (AMI) Centre at TKK, Espoo, Otaniemi, and BioMag Research Laboratory at HUSLAB in Meilahti Hospital. It serves both internal and external users by providing them with instrumentation, analysis tools and human know-how in non-invasive human brain imaging and its applications in studies of healthy and diseased brains. Magnetoencephalography (MEG) provides millisecond accuracy in terms of time and functional magnetic resonance imaging (fMRI) millimetre-spatial precision in pinpointing active brain areas and their coupling and time sequences. The applications include basic neuroscience to understand how the human brain works and clinical applications to identify and follow brain disorders such as epilepsy, stroke, chronic pain, and dyslexia. NEUROIMAGING also serves as a training centre for young scientists and acts as a node in collaboration between Finnish and foreign scientists. NEUROIMAGING facilities are used by scientists of 5 national centres of excellence. This is the only RI in Finland where both fMRI and MEG recordings can be carried out, both of healthy volunteers and different patient groups.

The European Molecular Biology Laboratory (EMBL)

RI website: http://www.embl.org

EMBL is supported by 20 member states and one associate member. It consists of five facilities: the main Laboratory in Heidelberg and Outstations in Hamburg, Grenoble, Hinxton and Monterotondo. Over 1,400 people from 60 nations currently work at EMBL. In addition to performing research and researcher training EMBL serves as a major European Infrastructure in bioinformatics (EBI, European Bioinformatics Institute in Hinxton, UK), in structural biology (Grenoble and Hamburg Outstations) and in transgenic mouse technologies (Monterotondo Outstation in Italy). The main laboratory in Heidelberg provides access to top-of-the-line imaging equipment and high-throughput facilities for scientists in member states. EMBL trains Finnish doctoral students. EMBL provides the bioinformatics infrastructure needed by a very large user community, and it also provides access to extremely expensive research equipment, e.g. x-ray beamlines in synchrotron radiation facilities, and to top-of-the-line research equipment.

Materials Science and Analytics

Centre for Micro- and Nanotechnology (Micronova)

RI website: http://www.micronova.fi

Micronova is a joint research facility of the Technical Research Centre of Finland (VTT) and Helsinki University of Technology (TKK), which offers micro- and nanofabrication facilities for the development of silicon and III-V semiconductor-based devices for microsystems, microelectronics, nanodevices and photonics. The cleanrooms cover a total area of 2,600 square metres, and are used by research teams from VTT, TKK, other universities and several companies. The cleanrooms are also used for teaching and researcher training. The infrastructure offers following processing capabilities:

- Nanofabrication including electron beam and nanoimprinting lithography and focused electron/ion beam processing
- Fabrication lines for microelectromechanical (MEMS) devices, microsystems and integrated circuits
  •Integration of MEMS devices and electronic circuits
  •Advanced deposition techniques, including atomic layer deposition of oxides and nitrides and epitaxy of compound semiconductors and metals.
- Packaging and testing of functioning devices
- Capability for prototyping and small-scale production.

The Millimetre-Wave Laboratory of Finland, MilliLab, is a joint VTT-TKK research institute based at Micronova, specializing in the research and development of millimetre-wave and THz devices, components and systems. MilliLab is also a European Space Agency external laboratory on mm-wave technology.

Micronova is a unique facility in Finland for micro and nanofabrication, with the capability of integrating a wide range of functioning devices, and combining top level basic research with industrial applications. Thus Micronova is attractive for both industrial as well as academic researchers. The technology platforms available at Micronova enable developments in many different applications and fields of research, including sensors, detectors, nanoelectronics, solid state light emitters, RFID technology, thin film devices, microsystems, telecommunication devices, millimetre wave devices, fabrication technologies and materials research.

The European Synchrotron Radiation Facility (ESRF)

RI website: www.esrf.eu

The European Synchrotron Radiation Facility (ESRF) is an international institute and single-site RI funded by 19 countries. It operates Europe's most powerful synchrotron light source and hosts 6,000 scientific user visits per year for 900 different experiments. On a yearly basis 11 to 20 Finnish researchers use ESRF on-site. The ESRF is internationally recognized as the leading European synchrotron light source producing tunable and high brilliance x-ray radiation. The Finnish user community of synchrotron radiation has

a global approach to available resources (ESRF and MAX Lab).

ESRF is the leading 3rd generation hard x-ray synchrotron source in the world. In Europe its capability to access a hard x-ray regime is an important asset extending the experimental techniques that are available at national light sources. It represents the forefront of basic and applied sciences utilizing radiation-matter interaction and is continuously expanding to new multidisciplinary fields.

Each beamline at ESRF is evaluated every 5 years. The ESRF scientific programme was evaluated for the upgrade programme in 2006–2007. ESRF gives scientists in Finland unique access to a top research laboratory with up-to-date instrumentation as well as the possibility to collaborate with leading scientists in the field. ESRF is of uppermost strategic value to Finland since there is no national synchrotron source. Materials science, biosciences, nanotechnology and environmental research are among major research fields in Finland. All modern experimental research within these fields requires access to synchrotron-radiation based characterization techniques which are available at ESRF. Multidisciplinary activities are expected to increase. Growing numbers of biologists are using more ESRF facilities than ten years ago.

Basic research is essential in the long-term perspective to any applied research. Furthermore, improving experimental techniques with faster throughput are expected to increase industry-related research with more direct economic relevance.

The ESRF supports student and post-doctoral user visits and hires young students and researchers from all member countries while they can be enrolled in their home institutes. The ESRF organizes frequent training for students and senior researchers in the utilization of synchrotron radiation in all scientific disciplines.

The MAX-lab synchrotron and free electron laser facility (MAX-lab)

RI website: http://www.maxlab.lu.se

MAX-lab is a synchrotron radiation facility that produces electromagnetic radiation for research in many scientific disciplines. The facility has three storage rings, MAX I (0.55 GEV), MAX II (1.5 GeV) and MAX III (0.7 GeV). Among the techniques used are electron spectroscopy, time-resolved fluoresvence, ion mass spectroscopy, x-ray fluorescence, x-ray absorption spectroscopy, circular dichroism, infra-red spectroscopy, x-ray diffraction and x-ray lithography.

MAX-lab serves the needs of numerous research groups in Finland within various disciplines. Especially the VUV and soft x-ray beamlines at MAX-lab complement the lack of these wavelengths at facilities such as ESRF, which has approximately the same sized user community as MAX-lab in Finland. Especially the gas phase beamlines at MAX II and MAX III, partly funded and commissioned by Finnish users are world-leading beamlines, providing pioneering results published in leading journals. For a small country like Finland, Nordic collaboration together with MAX-lab gives a chance to be a part of the rapid development in the field of SR sciences and serves local strategic needs, for example in applied research.

Space Research and Astronomy

European Space Agency (ESA)

RI website: www.esa.int

The purpose ESA purpose is to provide for, and to promote, for exclusively peaceful purposes, cooperation among European States in space research and technology and their space applications, with a view to being used for scientific purposes and for operational space applications systems.

The European Space Agency (ESA) and its 17 Member States work together for a wide range of goals in space. ESA has sites in several European countries. The European Space Research and Technology Centre (ESTEC) is the largest site and the technical heart of ESA located in the Netherlands. ESRIN, known as the ESA Centre for Earth Observation, is the ESA establishment responsible for managing the operation and exploitation of ESA's Earth Observation satellites. In cooperation with other space agencies, it also manages the acquisition, distribution and exploitation of data

from non-ESA satellites. The world's largest database of environmental data for both Europe and Africa is managed from ESRIN. ESAC is the site for the Science Operations Centres (SOC's) for the ESA Science missions, both astronomy-related and planetary.

The key areas for Finnish participation in ESA programmes are space science, remote sensing, telecommunications and technology development.

All Member States contribute to the funding of certain ESA activities, such as science programmes. The funding shares are calculated according to the GDP of each Member State. In addition, each individual Member State decides which additional programme it will take part in, and with what share. ESA offers technology cooperation to companies and research units. Over 2,000 specialists work in ESTEC on dozens of space projects.

European Southern Observatory (ESO)

RI website: www.eso.org

Finland's membership is important not only for the astronomy community in Finland but also in a wider sense for the space research community. Finnish astronomers, technicians, and students of astronomy have worked in ESO positions in Chile and Garching, thus developing their knowledge and skills and forming important international networks. Through ESO Finnish industry can be part of international cooperation for ground-breaking development of technology in its area. Active participation in ESO can offer radical innovations and push industry towards new solutions that can be applied outside astronomy. ESO offers new technological challenges but also a platform where cooperative R&D projects can be done. Possibilities of this kind provide a unique environment and network where industry and research can cooperate. It also offers an environment that enforces learning and competence sharing in innovative and demanding settings. As a partner ESO is a visible and significant reference point that has a great value as such for research and industry.

Nordic Optical Telescope (NOT)

RI website: http://www.not.iac.es

The Nordic Optical Telescope (NOT) is an optical telescope located at La Palma in the Canary Islands. It has been operated and maintained by the five Nordic countries since 1989. The NOT is the main astronomical observation facility (especially in the northern hemisphere) for Finnish astronomers. It has substantially increased the scientific activity and productivity of Finnish astronomers. It is also used for training young students in modern astronomical observing techniques. Several students have spent (and are spending) time at the NOT as student support astronomers. The NOT is also very good for educational purposes; several summer schools have been organized there, with active participation by Finnish students.

The European dimension and the added value of the NOT are amply demonstrated by its heavily oversubscribed participation in the EC-funded OPTICON Transnational Access programme. NOT is still a very important facility for Finnish astronomers, since it is the only Northern telescope to which we have clear access. Also it is well suited for teaching students and young astronomers in modern observing techniques for them to make successful use of the larger ESO telescopes in the Southern Hemisphere.

European Incoherent Scatter Association (EISCAT)

RI website: http://www.eiscat.se

The EISCAT system consists of a network of incoherent scatter radars and an ionospheric heating facility. The radars measure the temperature, density and velocity of electrons and ions in the ionosphere (the ionized part of the upper atmosphere) at altitudes 70 –2,500 km. The heater is applied to modify upper atmospheric conditions in a controlled manner. The current system has UHF- and VHF-radars (both transmitters and receivers) in Tromsö and two UHF-radars in Longyearbyen (Svalbard). The mainland UHF-system has receivers also in Kiruna and Sodankylä. This tri-static UHF system is unique in its capability to

measure all three components of ion velocity. EISCAT observations have multiple applications in space and atmospheric science, e.g., in the research of auroral physics and meteors, in modelling the ionospheric chemistry and in monitoring the space debris. The continuous work to improve the radars' performance has given the EISCAT community a forefront position in the area of ionospheric radar measurements. On the technology side Finnish contributions are important especially in the development of advanced modulation and data analysis algorithms. On the research side, magnetosphere-ionosphere coupling processes and solar driven changes in middle atmospheric chemistry are examples of Finnish areas of focus.

EISCAT provides unique measurements of upper atmospheric conditions at auroral latitudes and near the edge of the polar vortex. Consequently, Finland's membership has had positive impact on our aeronomy and solar-terrestrial research and education. Over the period 1986–2007, Finnish EISCAT work produced 250 peer-reviewed articles. EISCAT has an important role in the work of all the main Finnish institutes conducting geospace research (The Sodankylä Geophysical Observatory of the University of Oulu and the Finnish Meteorological Institute). These institutes have made significant hardware and software investments in order to facilitate EISCAT data harvesting. EISCAT-related innovations have led to four commercial enterprises in Finland.

Energy

Joint European Torus (EFDA-JET)

RI website: http://www.jet.efda.org

The European Fusion Development Agreement (EFDA) was established to provide a framework for magnetic confinement-controlled thermonuclear fusion research and development within the European Union and in Switzerland. JET is currently the world-leading experimental facility on the path towards controlled nuclear fusion. It produces internationally recognized scientific output of high quality and Finnish participation provides access to infrastructures for fundamental science and technology that would not otherwise be available. The facility will be working over the next decade which can be regarded as reasonable given the shift of emphasis towards ITER.

The *European Fusion Development Agreement* (EFDA) is an agreement between European fusion research institutions and the European Commission to strengthen their coordination and collaboration, and to participate in collective activities. Its activities include coordination of physics and technology in EU laboratories, the exploitation of the world's largest fusion experiment, the Joint European Torus (JET) in the UK, training and career development in fusion, and EU contributions to international collaborations. All the Euratom Fusion Associations are involved, as well as corresponding US, Russian, Japanese associations as based on a bilateral agreement with Euratom. Finnish partnership began in 1995.

JET, the Joint European Torus, is situated at the Culham Science Centre, Oxfordshire, UK. It is collectively used by EURATOM Associations from more than 20 European countries. The JET device is currently the world's largest Tokamak. The JET facilities include plasma heating systems capable of delivering up to 30 MW of power, an Active Gas Handling System and a Beryllium Handling Facility providing JET with a unique Tritium and Beryllium capability, respectively. The European fusion facility review was completed in the autumn of 2008.

International Thermonuclear Experimental Reactor (ITER)

RI website: http://www.iter.org

ITER is a global fusion energy research facility. The international Tokamak research/engineering project designed to prove the scientific and technological feasibility of a full-scale fusion power reactor. The heart of ITER is a superconducting Tokamak facility with striking design similarities to JET, but twice the linear dimensions. It will have a plasma volume of around 840m^3. It is designed to produce approximately 500 MW of fusion power sustained for more than 400 seconds. ITER will be the first fusion experiment with an output power higher than the input power.

When it begins operation ITER will be a world-leading experimental facility on the path towards controlled nuclear fusion. It will produce scientific output of high quality and Finnish participation will provide access to infrastructures for basic research and technology that would not otherwise be available.

The ITER Divertor Test Platform DTP2 at VTT in Tampere is an important national (and European) RI which serves remote handling systems development for ITER with spin-offs to many other applications. ITER remote handling systems will be tested by DTP2. Industry is heavily involved in the construction phase of ITER.

Physics and Technology

Cryohall of the Low Temperature Laboratory (Cryohall)

RI website: http://ltl.fkk.fi/wiki/LT

The Cryohall of the Low Temperature Laboratory (Cryohall) is one of some ten large ultra-low temperature research infrastructures in the world. It offers expertise, facilities and equipment for internal and external users to undertake experiments at temperatures from 4 K down to the lowest one attainable to date. Cryohall is expected to contribute to scientific progress and technical development in ultra-low temperature physics, quantum electronics and cryoengineering, to serve as an educational centre for young physicists, and to act as a node for scientific collaboration between Finland and other countries. One of its missions today is to open the microkelvin temperature regime for experiments in nanoscience. The RI consists of several ultra-low temperature refrigerators and modern supporting facilities. Most of the refrigerators are home-made and unique, one of them holding the present low temperature world record. The supporting facilities include machine and electronics shops, a semi-clean room for making nanosamples, and a delivery system for cryoliquids. The users of the RI are also offered access to the modern microelectronics processing equipment of nearby Micronova, the largest cleanroom complex in Scandinavia.

The Cryohall of Low Temperature Laboratory is a small research infrastructure which is mainly supporting basic research experiments. Its added value for Finland comes from its high international reputation and from its well-trained PhD's.

Accelerator Laboratory of the Department of Physics, University of Jyväskylä (JYFL-ACCLAB)

RI website: http://www.jyu.fi/accelerator

JYFL-ACCLAB is one of the leading medium-energy accelerator facilities in Europe. Its status is recognized in the Long Range Plan of NuPECC (ESF expert committee). It provides largest variety of stable-ion beams of around 6,500 hours a year. It is an official test site of European Space Agency and one of the access infrastructures in the EU-FP6-I3 –EURONS project. It has been a Marie Curie Training site. It has some 250 foreign users annually and foreign equipment investments of approximately 10 M€ It has a national status of a centre in accelerator-based physics and applications and related education in Finland

In Finland it provides expertise in a large variety of applications of ion beams and ionizing radiation and modern radiation detection technology. As a university laboratory its role in educating experts for these fields is important.

European Organization for Nuclear Research (CERN)

RI website: www.cern.ch

CERN is an intergovernmental organization for fundamental physics; currently it has 20 member states. The European Organization for Nuclear Research (CERN) is located near Geneva, at the borderline between France and Switzerland. CERN was founded in 1954 and presently has 20 member states. Besides the member states, also the US, Japan and Russia take part in CERN projects. Some 7,000 users, from more than 80 different countries and 500 universities, use the CERN laboratories. Researchers in other fields,

for example computer science, electronics and materials science, also work at CERN.

Finland has participated in CERN projects since 1966 and became a full member since 1991. The membership makes it easier for Finnish particle physicians to take part in the experiments conducted at CERN. Besides particle physicians, the laboratory employs Finnish researchers from other fields as well. CERN offers summer schools and courses for young scientists in the field, but the laboratory also provides training opportunities for a number of university and polytechnics students in natural sciences and engineering. In addition to training and research opportunities, companies may offer their services and products to the laboratory and carry out research and R&D cooperation with it.

CERN impact on certain technology domains, such as GRID and Microelectronics, has been of great importance for the research community in form of creating new technologies, gaining in competence, international co-operation and networking nationally & internationally. CERN has provided an important platform for commercializing research based innovations - The importance of the collaborative R&D cooperation in the future will grow as clustering takes places and more technology focused research structures take place (CSTI).

About 15 Finnish high school class visits every year increase the CERN visibility greatly - Proactive matching of CERN as very demanding customer and Finnish industry as having continuous search for challenging projects has resulted to over 100 commercial organizations to deliver to CERN during last 10 years. Through cooperation with CERN, many other commercial organizations have used the reference for expanding the business and luring in competent professionals - Various companies have used CERN projects as a training body for young professionals for example as MSc projects. This has resulted in technology and competence transfer. Several companies have reported creating new competence or technologies due to the CERN cooperation and therefore being more competitive. CERN projects have resulted to tighter national co-operation between industry and universities. Yearly about 21-50 Finnish researchers and 11-20 PhD students work on-site at CERN.

Information Technology and e-Infrastructures

The Finnish University and Research Network (CSC-Funet)

RI website: www.funet.fi

Funet is an advanced and reliable high speed data communications network and service platform serving the whole Finnish research and education community.

Funet connects 84 research organizations (including Finnish universities and polytechnics and most of the sector research institutes) and 380,000 users together in Finland. It also offers access to international research networks all over the world (including the Nordic NORDUnet and European GÉANT backbone networks and Internet2 in USA) as well as access to the general Internet. In addition to network connectivity, Funet also offers a wide portfolio of services to support research and education concerning the network both on an organizational and individual researcher level. Funet services are operated by CSC, the Finnish IT Center for Science, governed by the Ministry of Education.

Altogether, Funet is the essential platform to support all research in Finland and to provide access to all networked research data, resources and scientific instruments in the modern connected academic world.

Services of the IT Center for Science (CSC-Services)

RI website: http://www.csc.fi

CSC provides services for the Finnish research environment in high-performance computing, data management, Funet networking, offerings of scientific software and databases, and expert consultation. CSC is one of the largest supercomputing centres of Northern Europe, and a member of large European research e-infrastructure collaborations. Being a partner in several ESFRI projects, CSC plays a critical role in EU-level horizontal e-infrastructure connecting disciplines and organizations. Over the next few years the requirements for IT services in the research community will

grow considerably, because of the rise of computational science and the increasing importance of e-infrastructure in research. For Finland to play a significant role in research on the global scale, CSC must be upgraded into a European-level competence centre. The national e-infrastructure development coordinated by CSC has to be aligned with international e-infrastructure development. Sustained e-infrastructure funding is needed within the whole Finnish research system, using the coordinated development of computing and network capacity combined with capability to manage international research data. At the national level, CSC acts as a coordinator and integrator in cases where the provision of e-infrastructure services requires a neutral, reliable and experienced partner.

Researchers obtain better results faster due to the e-infrastructure offered by CSC. CSC supports research in areas such as nanoscience, biosciences, engineering, fusion research, management of nuclear waste, and climate change. Furthermore, computational science is expanding into new fields with huge cross-disciplinary impact. CSC is involved in industrial collaboration (for example with Nokia) in areas such as the acoustics modelling of mobile phones and nanoscience applications. Together with international partners, CSC improves competence in computational science, the development of open source scientific applications, and expertise in high-performance computing, data management and networking.

Appendix 5

Descriptions of roadmap projects

Information on these descriptions is based on the original descriptions sent to the Steering Group by the co-ordinators of the proposals.

Content

Social Sciences and Humanities

System Architecture for Memory Institutions

The aim of the system architecture project is to build a powerful and competitive information and communication infrastructure for universities, polytechnics, sectoral research institutions and memory organizations in Finland. The project will boost teaching and research by integrating them with other research infrastructures. The development of the system architecture will be divided into three inter-related sub-projects: 1) the Public Interface, 2) the National Union Catalogue, and 3) the Long Term Preservation System (PAS).

In the new system architecture, the public interface and the background systems will be kept separate. The public interface is a user interface to the services provided by the background systems, intended for the end-user. These background systems include library, museum and archive systems; long-term preservation systems and institutional repositories etc.

The Public Interface will replace current library, museum and archive user interfaces. It will be a quick and easy one-stop service for discovery and delivery to the top quality digital information resources and services.

Long term digital preservation – on the scale of dozens of years – is an acute challenge to all institutions dealing with digital cultural heritage, scientific data, archived records, etc. It requires not only adequate technological facilities, but also an administrational and financial framework that aims at mitigating the risks involved in preservation.

The challenges and solutions of preservation are actually quite similar among the memory institutions or organizations. Therefore, they have created a concept of a joint preservation system. The system will provide a technical infrastructure and related curation services to the organizations that take care of born-digital and digitized cultural and scientific materials. It will also be a hub of research and information that will educate and support creators and managers in how to take preservation matters into consideration.

A start will be made on the implementation of the National Joint Catalogue by modernizing the existing LINDA union catalogue software already in 2008 and increasing the number of participating libraries in the future. A genuine National Union Catalogue will make joint use of the library collections and customer services significantly easier and more cost-effective.

The development of system architecture for higher education institutions, research institutions and memory organizations in Finland is an essential part of the Finnish Research Infrastructure, because it enables easy and quick access to information resources regardless of time and place. It will exploit other national infrastructures, such as user authentication, digital payment systems and national data repositories.

The new infrastructure will enable more efficient workflows in memory organizations and better end-user services. The project will employ new technical architecture in which the public interface is separated from the background systems. The new architecture will make it easier to obtain information at a significantly faster rate than before and will enable services to be tailored according to user needs.

The following principles will be applied in implementing the aims: the promotion of compatibility between information systems and the acquisition of joint information systems in accordance with general governmental IT guidelines; the promotion of use and usability of services; the development of cooperation, division of labour, and skills; the development of joint services and operating methods among the memory organizations.

Finnish Language Resource Consortium (FIN-CLARIN), ESFRI

RI website: http://www.ling.helsinki.fi/finclarin/

FIN-CLARIN is the national Finnish language resource infrastructure the members of which are the University of Helsinki, the University of Joensuu, the University of Jyväskylä, the University of Oulu, the University of Tampere, CSC - IT Center for Science Ltd, and the Research Centre for Languages in Finland. FIN-CLARIN is the national part of the European CLARIN research infrastructure. FIN-CLARIN will store and create CLARIN-compliant language resources at CSC which will also operate the services. FIN-CLARIN will make existing and forthcom-

ing national language resources accessible and usable for Finnish and European users, and respectively, the European resources accessible and usable for national scholars. FIN-CLARIN will also collect and create a Basic Language Resource Kit (BLARK) for national languages and written, spoken, multimedia, lexical materials and corresponding tools. The availability of BLARK resources is understood to be vital for the usability of languages in a modern everyday environment of ubiquitous technology.

Finnish scholars will join the European CLARIN research infrastructure through FIN-CLARIN. CLARIN will renew the patterns of research in the humanities by providing seamless access to language-related materials and tools. CLARIN will enable users to find materials, obtain the necessary permits for use, and secure the interoperability of materials and services. In brief, the cultural heritage of Europe and its languages will be brought to the desktops of researchers.

European Social Survey (ESS), ESFRI

RI website: www.europeansocialsurvey.org

The European Social Survey (ESS) is a biennial survey designed to chart values, attitudes and behaviour among European populations in a context of changing institutional settings. The survey employs the most rigorous methods from sampling and planning the questionnaire to field-work techniques and archiving. In addition to substantive research, the ESS aims to improve the rigour of quantitative social measurement for comparative studies throughout and beyond Europe, and to develop standard social indicators to stand alongside economic indicators as measures of the quality of life in different countries and regions. The survey covers approximately thirty countries. The data will be freely and quickly available to all researchers and will be used by almost twenty thousand researchers around the world.

Being a part of the ESS combines Finland with the international social science research community; it increases participation in international research cooperation. Through international comparative analyses Finnish researchers will have better opportunities to publish their results in leading journals; Finland will become a more interesting target of research if it is placed in a wider comparative context. The use of ESS data concerns more than 500 academics and students in Finland.

Council of European Social Science Data Archives (CESSDA), ESFRI

RI website: http://www.cessda.org/project/ (2008–2009)

The CESSDA network provides efficient data services to support European Social Research by facilitating network access to more than 25,000 data collections for thousands of users world-wide. CESSDA includes twenty European social science data archives and it has existed for over thirty years. Since the 1970s member organizations have significantly improved access to social science data for researchers, policy-makers and students through the negotiation of data access agreements with data producers and the management of cross-national data transfers.

The CESSDA data portal has also provided access to important social science data materials and to national collections including: census collections; household, health and labour market data; election and political studies data; social and demographic indicators; attitudinal data; and digitized historical materials. CESSDA also serves as the gateway to key data investments such as the European Social Survey, the Eurobarometers, the International Social Survey Programme and the European Values Surveys. To facilitate use, CESSDA has in recent years developed resource discovery and data management and access tools, including the Nesstar data browsing and tabulation tool and the multilingual resource discovery tool as part of the CESSDA Data Portal.

Added value for Finland entails the following:

The centralized administrative coordinating body of the CESSDA-ERI will undertake many tasks and duties which will provide remarkable added value to social science data services in Finland:

- Providing a unified portal/gateway to resource discovery;
- Providing common access/authentication protocols;

- Providing common portal/gateways to data access and delivery;
- Development and maintenance of persistent identifiers;
- Training/Professionalization;
- Production of guides to 'Good Practice';
- Standards development (both procedural and data management);
- Development and maintenance of quality data collections (central and virtual) through the identification of gaps/needs and brokering data access agreements;
- Development and maintenance of data harmonization tools;
- Development and maintenance of discovery and delivery tools;
- Development and maintenance of operational/ingest tools;
- Promotion of data sharing/outreach;
- Widening/expansion of the data infrastructure;

Environmental Sciences

Environmental Data System (EnviData)

RI website: www.ymparisto.fi, www.ymparisto.fi/oiva

The aim of this proposed Research Infrastructure is to facilitate the use of the large amount of environmental data kept by Finnish Environment Institute SYKE, including as much as possible the data that SYKE has in its databases but which is not owned by it. The proposed RI will upgrade the current infrastructure. It will consist of environmental data repositories, Internet user interfaces, professional analysis services and support.

The environmental datasets and information systems at SYKE include a large amount of nationwide environmental data in three sub-systems:

1) The Environmental Information System consists of several subsystems including information (time series, *in-situ* data) on water quantity and quality, environmental protection, biological diversity, land use, environmental loads etc.
2) The Environmental GIS System has more than 100 databases on themes such as protected sites, groundwater areas, land use, vegetation etc. The system includes tools for analysing, updating, printing etc.
3) Remote Sensing (RS) data is used for monitoring the environment. Results from the RS systems include information on land cover, land cover change, snow characteristics, water quality, algae blooms, water surface temperature etc.

These information systems are partly available to the public through the web-based Oiva service (www.ymparisto.fi/oiva).

Finland can also contribute and give its experiences to other countries and to initiatives under preparation in this area, because the open access and use of environmental information through network services has been tested in 'real life'. The benefit for Finland of this can be that the regulations and recommendations given e.g. by the EU are suitable for Finland.

e-Science and technology infrastructure for biodiversity data and observatories (LIFE WATCH), ESFRI

RI website: www.lifewatch.eu

The LIFE WATCH initiative has been developed by eight major EU scientific networks and it builds on preceding developments such as the Global Biodiversity Information Facility (GBIF) and various EU-projects. It brings together:

- infrastructure networks and instrumentation (observatories) for data generation and data processing (field sites and biological collections)
- facilities for data integration and interoperability
- virtual laboratories to encourage the use of a range of analytical and modelling tools
- a Service Centre providing services for European and national policies, and research opportunities for young scientists.

LIFE WATCH will boost many innovative developments. The wealth of large data sets from different levels opens up exciting research opportunities. The

infrastructure will promote value-added networking both with respect to data and tools, and will enable the more focused attention of the scientific communities on common problems, such as climate/global change. LIFE WATCH will also help to understand and manage our environment so that spatial requirements for human activities are balanced with the need to protect the natural environment. In Finland the FinLTSER network (www.environment.fi/syke/lter) would form the core of the national observatory component.

Finland has excellent science in this field and should have a national component in this major European exercise. The planned national LIFE WATCH component combines the expertise, resources and databases of main universities and research institutes in Finland, thus making optimal use of available resources.

Finnish Long-Term Socio-Ecological Research network (FinLTSER)

RI website: www.environment.fi/syke/lter

The aims of FinLTSER are:

- To provide a national infrastructure for long-term site-based ecosystem and biodiversity research in Finland, including climate change impacts.
- To provide the Finnish contribution to:
  - Observatories component (terrestrial, freshwater and marine observatories) of the proposed EU/ESFRI LIFE-WATCH initiative (www.lifewatch.eu).
  - The recently established European LTER-research network (www.lter-europe.ceh.ac.uk).
  - The Global LTER-network (ILTER, http://www.ilternet.edu/).

FinLTSER consists presently of 9 highly instrumented sites/research platforms, representing the main ecosystems (marine, terrestrial, lake, sub-arctic, urban) in Finland. The core of the FinLTSER infrastructure consists of:

- Research stations of the universities of Helsinki, Jyväskylä, Oulu and Turku.
- Research sites, instrumentation and long-term monitoring programmes of main governmental research institutes (SYKE, Finnish Meteorological Institute, Finnish Forest Research Institute, Finnish Game and the Fisheries Research Institute, MTT Agrifood Research Finland).
- Information management structures and databases of the participating universities and research institutes.

The network began its activities in 2007 based on the decision of the high-level 'Coordination Group for Environmental Research' in Finland. A major upgrade of the network is proposed to meet the highest international standards.

FinLTSER combines the expertise and resources of main universities and research institutes conducting research on long-term socio-ecological processes and problems in Finland, thus making optimal use of available resources. The development and testing of new instrumentation and sensor technology for ecological/environmental research provides marketing opportunities for technology companies.

Environmental and Atmospheric Sciences: Integrated Carbon Observation System (ICOS), ESFRI, SMEAR Stations (SMEAR) and Pallas-Sodankylä

RI website: http://www.atm.helsinki.fi/SMEAR/; http://www.icos-infrastructure.eu/;

Finland has reached a leading position in many fields of atmospheric sciences. Such challenges include for instance climate change and its consequences, air quality and the development of environmental and climate technology. The RI operates five different field stations, and all data and analysed results as well as infrastructures themselves are generally available. All the field stations have a comprehensive scientific programme to investigate aerosol and trace gas concentrations, biosphere-atmosphere interactions, aerosol formation and growth and biogenic background processes leading to aerosol formation. SMEAR and the Pallas-Sodankylä field stations are the existing research infrastructures. ICOS is the ESFRI Roadmap project devoted to the long-term monitoring of greenhouse gas concentrations and fluxes, and airborne atmospheric measurements, respectively.

Added value for Finland:

- More harmonized European and global visions, a leading role in studying and directing the field
- An excellent opportunity to raise questions important to Finland related to both research and international environmental policies (for instance the significance of forests as sinks of carbon and sources of aerosols). It offers a direct way of influencing international climate policies.
- Novel technological efforts where environmental problems would be solved through commercialization of ideas and innovations
- Intensive international research projects for studying important ecosystems and their influence on the climate and, in turn, the impact of atmospheric pollutants and climate change on ecosystems.

Biomedical and Life Sciences

The European Infrastructure for phenotyping and archiving of model mammalian genomes (INFRAFRONTIER), ESFRI

RI website: www.infrafrontier.eu

Genetically modified mice have become the most important organisms for analysis of mammalian gene functions and genetic diseases. A key task for Biomedical Sciences is the functional analysis of thousands of mouse models for human diseases that will be available over the next years. INFRAFRONTIER will guarantee the accessibility of mouse models and will be essential to facilitate their exploitation. 1) For obtaining as much information as possible from the generated mouse models, access to systemic phenotyping in Mouse Clinics to every scientist, as well as informatics tools to handle, analyse and curate the captured phenotype data across a distributed network will be provided. 2) Archiving of mouse models will be coordinated and run by the European Mouse Mutant Archive "EMMA". EMMA currently contains an archive of 1150 mouse mutant lines. Mice or frozen embryos have been shipped to customers in 35 countries worldwide. However, nodes in each country are essential to ensure sufficient capacity and links to the wider user community. 3) During the preparatory phase, internal training courses and site visits will lead to the establishment of common standards for phenotyping, animal welfare, archiving and dissemination among all partners.

A large portion of the over 2000 scientists and PhD students within Finnish bioinstitutes use mouse models in their research. Participation in INFRAFRONTIER provides access to standardized facilities for mouse analyses, and selected Finnish laboratories will have the possibility to provide services as part of the pan European structure. A Finnish node for archiving mutant mice will be established in Oulu, and Finnish participation will facilitate the harmonization of procedures and data on work with mutant mice according to European standards. This will lead to more efficient use of current facilities, avoidance of duplication of infrastructure, and the stronger impact of Finnish scientists on European Biomedical Research.

European Advanced Translational Research Infrastructure (EATRIS), ESFRI

RI website: www.eatris.eu

EATRIS is a new pan-European Infrastructure for translational research, consisting of a network of components needed for the development of new diagnostic or therapeutic innovations and products from basic biomedical research. FIMM will be the Finnish EATRIS node, planning its own translational infrastructures as part of the European network and coordinating the Finnish EATRIS activities with other national experts and technology providers.

Efficient translation of research discoveries into industrial applications is an essential element for maintaining Europe's competitiveness. Currently the main bottleneck is the lack and the fragmented nature of translational research infrastructures and know-how, leading to delays and preventing the development of new innovative medicines and diagnostics. The quality-controlled pan-European EATRIS network will provide users with access to several translational infrastructures. As examples, these could include animal facilities for proof of concept studies, small molecule screening facilities to identify new drug molecules,

diagnostic development capabilities, high-resolution imaging facilities for preclinical and clinical validation, disease-specific patient and population cohorts, centralized facilities for bioprocess development and manufacturing, and facilities to undertake clinical phase I studies.

EATRIS users will be biomedical researchers and clinical scientists at universities, research institutions, hospitals or SME's who need to move their research projects from basic science discoveries to the preclinical and clinical stages.

Access to state-of-the-art technologies and translational research facilities is crucial for improving the practical impact and industrial competitiveness of biomedical research. Investments to build all the components needed for clinical translation are high for any single country. The impact of EATRIS is therefore expected to be significant in Finland, having high-quality scientific work, but often under-performing in the translation of key findings towards applications in the health-care sector. EATRIS has the potential to significantly boost the impact of research on the economy and industry in Finland, as well facilitating the access of patients to new treatments.

European Life Science Infrastructure for Biological Information (ELIXIR), ESFRI

RI website: http://www.elixir-europe.org

Sequencing the human genome alone cost 3,000 million. Compared with the costs of generating data, the cost of storing this information in openly accessible databases is probably less than 1%.

Research funding parties across Europe must attend to the future of our databases. Otherwise it is as if we did not gather the data in the first place.

The goal of ELIXIR is to safeguard the future of data. This does not just mean information collected and organized into databases to date; we need to plan for the massive scale-up of data production by next-generation sequencing technology and by the numerous 'big biology' projects.

The sheer amounts of data generated by modern biology require Europe to rethink how it archives and serves information to the biologists who need it. Until recently, biology has lagged behind the physical sciences in terms of the amount of data generated. This is set to change. Furthermore, biologists have to contend with the complexity of living systems. ELIXIR will therefore need to harness the power of modern supercomputing and grid technologies to create a robust home for biology in the pan-European data-centric e-infrastructure.

The costs of storing and organizing biological information are tiny in comparison to the funds spent on generating them. ELIXIR is the most cost-effective way for EU member states to provide biologists – pure and applied – with these tools.

Biobanking and Biomolecular Resources Research Infrastructure (BBMRI), ESFRI

RI website: www.bbmri.eu

The Biobanking and Biomolecular Resources Research Infrastructure (BBMRI) project was officially launched in February 2008 after a preparatory period of over three years. A large number of both private and publicly funded biobanks exist globally. The most well known international projects are the Icelandic, Estonian and UK projects, the latter two also being involved in BBMRI. The National Public Health Institute hosts the largest public sector collections in Finland of human samples with a deep national population exposure. Finnish researchers have a central role in BBMRI. Professor Leena Peltonen is the chair of the steering committee of BBMRI and Prof. Eero Vuorio, Chancellor of Turku University, has been appointed the executive manager of the project.

The newly launched two-year establishment period focuses on technical, legal, administrative and financial issues as well as operational harmonization on the European scale. The aim is to establish a Pan-European biobanking procedure for scientific purposes for the generation of new information on impact of genes, environment and life-style factors on health and disease susceptibility. Organized storage and analysis provision to European researchers is important in order to take full advantage of the sample collections as a European resource of biomedical information and derived applications. Approximately

80 large population-based biobanks as well as a large number of clinical sample collections have already joined or expressed interest in joining the project. A specific goal in BBMRI is to harmonize biobanking procedures for ease and promotion of collaborative research.

The Finnish biobanks have provided valuable genetic information on a majority of inherited diseases enriched to Finland (Finnish Disease Heritage). This work forms the basis for the development of novel therapeutics. In addition to samples the biobanks contain an extensive library of information related to citizens' health, life-style and nutritional behaviour. This data is crucial for the discovery of risk factors for common diseases. These can be used to detect susceptibility, and to develop prevention and treatment of common diseases. The development of effective diagnostics for common diseases such as type II diabetes requires large population-based sample collections, the maintenance of which demands high quality resources as well as specialized know-how. As a key partner in BBMR, Finland will have an important role in the development of international standards. Active participation will also increase the possibility to benefit from international research in a way that best fits the Finnish population.

National Virus Vector Laboratory (AIV Vector Core)

RI website: www.uku.fi/bck/

The AIV Vector Core produces full GMP-grade viral vectors for clinical trials and adenoviruses, lentiviruses, adeno-associated viruses and baculoviruses in smaller quantities for research use in cell culture and experimental animals, including toxicological testing. Both small- and large-scale production methods and downstream purification are available, including quality control and release assays for experimental and clinical use. Quality controls and release tests for phase I/II/III clinical material need to be agreed with each production lot. Researchers in Finland and Europe will have access to the highest quality viral vector production with reasonable cost and timetables. The availability of the most modern high quality viral vectors will significantly improve the competitive edge of Finnish biomedical research worldwide.

The National Virus Vector Laboratory guarantees the access to Finnish researchers to the highest quality modern viral vectors for preclinical biomedical research and clinical gene drug development. Access to these vectors will give Finnish researchers significant competitive benefits worldwide.

Energy

Jules Horowitz Materials Testing Reactor (JHR-MTR), ESFRI

RI website: www.cadarache.cea.fr/fr/enterprises/projets/index-php

European test reactors have played a crucial role in developing and solving technical issues on nuclear technology for over 40 years. The tests reactors in use at this moment do not, however, cover the needs for the forthcoming decades mainly due to ageing. Therefore the French nuclear research organization CEA (Commissariat à l'Énergie Atomique) has started to plan a new test reactor, the Jules Horowitz Material Testing Reactor (JHR MTR), to be located in Cadarache in South France. The design and manufacturing of the reactor has been planned to be performed through European cooperation for which a consortium has been established in March 2007. The power of the test reactor will be 100 MWt and its technical preparedness for different tests in several different environments will be versatile and flexible. The first aim is to serve the present second-generation reactors and at the same time to develop test facilities and preparedness to serve the third- and fourth-generation (so-called GEN-IV) reactors. The reactor has been designed so that the available neutron flux doubles the radiation dose in comparison to the present test reactors. Moreover, the design takes better account of the requirements for instrumentation and monitoring. In this way, maximum output is obtained from the reactor tests, which facilitates the modelling and simulation work in different reactor environments and conditions. The second aim

in the future is to serve the fast reactors, which may be either gas or sodium-cooled or some other type of reactor developed via GEN-IV concepts. The operation requirements of the test reactor also have to include the needs of different research programmes as well as of industrial test series. Finland participates in the construction of the JHR test reactor via VTT's in-kind deliveries that have been established in the negotiations between VTT and CEA. Participation in the JHR project guarantees access to the applications and technologies developed for the reactor. Full membership in the international consortium also gives us a membership in the management board of the project. In this way the Finnish participants can affect the features of the reactor already in the construction phase and enable better planning of the tests to be performed after the start-up of the reactor. The agreement signed between VTT and CEA states that the value of the Finnish in-kind contribution is €10 million in 2007–2014. The Finnish in-kind contribution includes four systems to be delivered: 1) the hot cell NDE, 2) the underwater photon emission and transmission tomography system, 3) material handling systems (conveyors) and 4) water chemistry modules for the corrosion loop used in material studies. The work has been planned to be performed by the consortium directed by VTT and consisting of mainly Finnish companies that have the relevant expertise to develop the needed systems. In Finland no such in-kind deliveries have been done for a long time, if ever before, in the field of nuclear energy. Therefore, this project will produce new and relevant knowledge in Finland taking into account the increasing importance of nuclear energy in our country. However, the impact of the development work is not only limited to the nuclear industry. The technologies will serve Finnish industry on a much wider scale, as the participants will achieve important references for their future business. The Finnish Ministry of Employment and the Economy has expressed its support for participation in this project (see Appendix in the application).

Materials Science and Analytics

European Synchrotron Radiation Facility (ESRF Upgrade), ESFRI

RI website: www.esrf.eu

The European Synchrotron Radiation Facility (ESRF) is an international institute, a single-site RI funded by 19 countries. It operates Europe's most powerful synchrotron light source and hosts 6,000 scientific user visits per year for 900 different experiments. Yearly about 11–20 Finnish researchers use ESRF on-site. The ESRF is internationally recognized as the leading European synchrotron light source producing tunable and high brilliance x-ray radiation. The Finnish user community of synchrotron radiation has a global approach to available resources (ESRF and MAX-Lab).

ESRF is the leading 3rd generation hard x-ray synchrotron source in the world. In Europe its capability to access a hard x-ray regime is an important asset extending experimental techniques available at the national light sources. It represents the forefront of basic and applied sciences utilizing radiation-matter interaction and continuously expanding to new multidisciplinary fields.

Every beamline at ESRF is evaluated every 5 years. The ESRF scientific programme was evaluated for the upgrade programme in 2006–2007.

Materials science, biosciences, nanotechnology and environmental research are among major research fields in Finland. All modern experimental research within these fields requires access to synchrotron radiation-based characterization techniques, which are available at ESRF. Multidisciplinary activities are expected to increase. Increasing numbers of biologists are using more ESRF facilities than ten years ago.

Basic research is essential in long-term perspective to any applied research. Furthermore, the improving experimental techniques with faster throughput are expected to increase the industry-related research with more direct economic relevance. For Finnish PhD students the ESRF offers an international training facility.

The ESRF has already demonstrated a huge impact on basic research. Furthermore, it is estimated that presently 20–25 % of the peer-reviewed experi-

ments at the ESRF have direct impact on applied research and industrial needs. This number is expected to increase further. The engineering challenges to be met in constructing the new accelerator and beamline components will also drive innovation resulting in new technologies. The ESRF is contributing significantly to the education of young researchers in their use of large-scale research infrastructures. The special value lies in the fact that ESRF users come from many scientific areas and the students are exposed to an extremely multidisciplinary research environment. The ESRF supports student and post-doctoral user visits and is hiring young students and researchers from all member countries while they can be enrolled in their home institutes. The ESRF organizes frequent training for students and senior researchers on the utilization of synchrotron radiation in all scientific disciplines.

The European Synchrotron Radiation Facility (ESRF) is a storage ring based X-ray source, which provides the research user community in Europe and beyond with world-class experimental stations, exploiting the unique properties of synchrotron radiation for research in a large variety of fields. In order to maintain its leading role and to respond to emerging scientific challenges, the ESRF is envisaging an ambitious Upgrade Programme, comprising (i) the extension of the experimental hall to enable the construction of new and upgraded beamlines with largely improved performance and new scientific opportunities, as well as improved infrastructures for the preparation of experiments, (ii) a programme of improvements of the accelerator complex, and (iii) the development of productive science and technology-driven partnerships. The upgraded ESRF facility, together with the neighbouring international research institutes the Institut Laue-Langevin (ILL) and the European Molecular Biology Laboratory (EMBL), will constitute a centre with highly optimized research and support infrastructures.

The planned upgrade will enable significant progress in S&T fields such as nanoscience and nanotechnology, structural and functional biology, health, environment, energy and transport, information technology, and materials engineering. The science case and the related technological challenges are laid out in an exhaustive document, the so-called Purple Book, which has been already widely disseminated, and is available on the ESRF website (http://www.esrf.fr/AboutUs/Upgrade/purple-book/).

Micronova Centre for Micro- and Nanotechnology (Micronova)

RI website: http://www.micronova.fi

Micronova is a joint research centre of the Technical Research Centre of Finland (VTT) and the Helsinki University of Technology (HUT), offering micro- and nanofabrication facilities for the development of devices for microsystems, microelectronics, nanoelectronics and photonics. Micronova's facilities are used by research teams from VTT, HUT, other universities and several companies for research, development, teaching and researcher training. Micronova offers processing capabilities for device prototyping and small-scale production.

The main forces behind the research infrastructure upgrade are:

- Improving our capability to support the MEMS industry and researchers.
- Development of technology for nanoelectronics, nanoelectromechanical systems (NEMS), and integration of different technology platforms and devices.
- Finding new application areas with a new facility for research and development in the field of Bio-Nano-Electronics.
- Increasing the number of industrial partners.

These goals will be achieved by:

- Upgrading our processing lines to increase wafer size from 150 to 200 mm
- Development of new nanofabrication capabilities
- Building a new centre in close proximity to Micronova, to combine innovative companies, new bio-nano research teams and researchers from the new Aalto University as well as VTT.
- Forming a new process expert group to support our users and customers.

Added value for Finland is provided by:

- Significantly more effective use of the infrastructure due to a larger number of users
- The ability of new users to quickly achieve results due to available process support and expertise
- New applications from bio-nano research
- Greatly enhanced researcher training due to the combination of multiple research fields
- The increased attractiveness of Micronova as a base for international collaboration.

Physics and Technology

Facility for Antiproton and Ion research (FAIR), ESFRI

RI website: www.gsi.de/fair/index_e.html

The FAIR accelerator laboratory will enable nuclear research with antiproton and ion beams with very high luminosity along with associated applied science and technology development. FAIR will have several synchrotrons and storage rings as well as associated detectors.

Participation in FAIR will ensure participation in forefront of international nuclear research for Finnish scientists as well as research training in nuclear physics and technology. FAIR participation provides opportunities for the Finnish high-technology industry.

Upgrade of Cryohall (CRYOHALL)

RI website: http://ltl.tkk.fi/wiki/LT

The Cryohall of the Low Temperature Laboratory (LTL) is one of some ten large ultra-low temperature research infrastructures (RI) around the world. It offers expertise, facilities and equipment for internal and external users to undertake experiments at temperatures from 4 K down to the lowest attainable to date. The Cryohall is expected to contribute to scientific progress and technical development in ultra-low temperature physics, quantum electronics and cryoengineering, to serve as a first-rate educational centre for young physicists, and to act as a node for scientific collaboration between Finland and other countries. One of its missions today is to open a microkelvin temperature regime for experiments in nanoscience. The RI consists of several ultra-low temperature refrigerators and modern supporting facilities. Most of the refrigerators are home-made and unique, one of them holding the present low temperature world record. The supporting facilities include machine and electronics shops, a semi-clean room for making nanosamples, and a delivery system for cryoliquids. The users of the RI are also offered access to the modern microelectronics processing equipment of nearby Micronova, the largest cleanroom complex in Scandinavia.

Information Technology and e-Infrastructures

CSC, Funet roadmap to the next decades (Funet), Finnish Grid Infrastructure for mid-range computing (FGI)

RI website: http://www.csc.fi

CSC is one of the largest supercomputing centres in Northern Europe, and a member of large European research e-infrastructure collaborations. Being a partner in several ESFRI projects, CSC plays a critical role in EU-level horizontal e-infrastructure connecting disciplines and organizations. Over the next few years the requirements for IT services among the research community will grow considerably because of the rise of computational science and the increasing importance of e-infrastructure in research. To manage this transition, significant additional funding is required to develop e-infrastructure. For Finland to play a significant role in research on the global scale, CSC must be upgraded to a European-level competence centre. The national e-infrastructure development work coordinated by CSC has to be aligned with international e-infrastructure development. Sustained e-infrastructure is needed within the whole Finnish research system, using coordinated development of computing and network capacity combined with the capability

to manage international research data. At the national level, CSC acts as a coordinator and integrator in cases where providing e-infrastructure services requires a neutral, reliable and experienced partner.

Access to e-infrastructure is vitally important for Finland. Researchers obtain better results faster due to the e-infrastructure offered by CSC. CSC supports research in areas such as nanoscience, biosciences, engineering, fusion research, management of nuclear waste, and climate change. Furthermore, computational science is expanding into new fields with huge cross-disciplinary impact. CSC is involved in industrial collaboration (for example with Nokia) in areas such as the acoustics modelling of mobile phones and nanoscience applications. Together with international partners, CSC improves competence in computational science, the development of open-source scientific applications, and expertise in high-performance computing, data management and networking.

Partnership for Advanced Computing in Europe (PRACE), ESFRI

RI website: http://www.csc.fi/english/collaboration/projects/e-infra, http://www.prace-project.eu

Access to international e-infrastructures is of vital importance for Finnish research. The eSCI e-infrastructure integrates EU e-infrastructure aimed at facilitating virtual laboratories across Europe with the Finnish infrastructure for e-science. As one of the leading centres of IT services for research in Europe, CSC provides through eSCI a gateway for Finnish researchers to international e-infrastructures – from supercomputers and large-scale data management and storage to unique scientific instruments.

The provisioning of leading supercomputing capacity and support is of strategic importance for Finland, and CSC has a key role in the ESFRI roadmap project Partnership for Advanced Computing in Europe (PRACE), hosting a prototype of the next generation of supercomputers. The whole ecosystem of computing resources needs to be integrated. CSC manages this by taking an active role in European e-infrastructure projects such as DEISA/eDEISA/DEISA2, EGEE/EGEE-II/EGEE-III, EGI_DS, ELIXIR, EMBRACE, PRACE, and the Nordic NDGF. The complexity of e-infrastructures is increasing, and CSC will provide a high-level competence centre in Finland by integrating national and international e-infrastructure for research and by enabling Finnish researchers to advance their participation in nationally strategic fields of the European Research Area.

The eSCI initiative (PRACE ESFRI) ensures that Finnish scientists will have efficient access to major European research infrastructures and are given the opportunity to impact the development of these infrastructures. This can only be achieved by active participation in the preparation and construction of a pan-European e-Infrastructure for research. The European project-based e-infrastructures are now in transition to sustainable organizational models, and a similar development — from EU-projects to sustainability — is expected for a pan-European data-centric e-infrastructure.

Appendix 6

Descriptions of roadmap development projects

Information on these descriptions is based on the original descriptions sent to the Steering Group by the co-ordinators of the proposals.

Contents

Social Sciences and Humanities

Micro Data Remote Access System (MIDRAS)

Administrative and statistical registers form huge databases for scientific research in Finland within the fields of medicine and social sciences. At the moment the use of register data for research purposes is, however, complicated, time consuming, costly, and sometimes there are confidentiality risks involved. The Finnish Information Centre for Register Research (ReTki) suggests that researchers should be able to obtain register data for research purposes through a remote access system. Through the Micro Data Remote Access System (MIDRAS) the researchers would have access to databases and could perform their analyses via the Internet. The researcher would not be able to transfer the data to his/her computer, but all data processing would be done in the special servers of the system. ReTki suggests a system of federated databases, where the researchers could be connected simultaneously to several register keepers' register data via grid technology. Only authorized researchers would be able to gain on-line access.

Making the use of administrative and statistical register data easier, faster and cheaper would no doubt increase the number of research projects employing registers. MIDRAS would greatly increase the accessibility to register data for the entire research community. When the access to the register data would be easier and faster the waste of time and other resources in research would decrease. MIDRAS would also facilitate public sector research serving decision-making in society. The impact, effectiveness and productivity of health and social services and policies could be assessed more easily and in a timelier manner with the use of MIDRAS.

Upgrade of the Data Services of the Finnish Social Science Data Archive (FSD)

RI website: http://www.fsd.uta.fi/

The FSD is a national resource centre for social science research and teaching. Services include quantitative and qualitative data archiving in electronic form and dissemination for secondary use in research and education, and related information services. The services are developed in close international cooperation with other national data archives and comparative survey projects. The virtual services can be accessed freely at the URL: http://www.fsd.uta.fi/. They include data catalogues, a research methods web resource for quantitative and qualitative methods, web resources for research ethics and informing research participants, and web resources for political party manifestos. The data is freely available for specified research and teaching purposes, but is not yet directly downloadable on the Internet. The data is sent to the recipient after receipt of a signed agreement on material use conditions. The datasets are anonymous; research participants cannot be identified. The users agree on not to try to identify research participants and on keeping the data out of the reach of others. After the upgrade, access to the services will remain open in the same manner as now. The main difference will be user registration, authentication and data delivery through a web-based user interface, and the increased number of different types of data available.

The aim is to further data openness and verifiability of research, and to add to a growing body of knowledge by providing access to existing research data. Research funding is more efficiently used when the data is reused after primary research. Data archiving increases the use of Finnish data in internationally comparative research and improves the competitive opportunities of Finnish researchers. Graduate and post-graduate students or researchers who are not yet involved in cooperative projects will have the possibility to conduct comparative research with large surveys, to which they would not normally have access because of the high cost of data collection.

Environmental Sciences

COmmunity heavy-PAyload Long endurance Instrumented Aircraft for Tropospheric Research in Environmental and Geo-Sciences (COPAL)

RI website: www.eufar.net

COPAL has the objective of providing the European scientific community with a unique research aircraft platform capable of reaching and operating in any remote area of the world and offering a heavy payload for integration of a wide panoply of instruments for research in environmental and geo-sciences. It will offer an unprecedented opportunity to countries that are not yet operating research aircraft to develop expertise in airborne measurements and to participate to international multidisciplinary experiments. User requirements will be refined and translated into specifications for aircraft performance and modifications for research. The acquisition, modification, and maintenance costs will be precisely quoted. Procedures will be defined for the selection of the aircraft and data management operators. A network of academic centres of excellence and SME's will be constituted for the development and airborne certification of innovative instruments for the community aircraft. New governance schemes will be elaborated for evaluation of access proposals and allocation of time slots, which will accommodate the Pan-European use of the aircraft with national authority in terms of scientific programming. These activities will be coordinated with EUFAR, with the operator of community research aircraft in the USA, and with the other Preparatory Phase studies, especially those with points of similarity with COPAL, such as research vessels. They will supply with technical and logistics solutions for the research institutions which will develop a new organizational model for the distributed COPAL European infrastructure. The Consortium includes 10 national research and funding institutions, an SME and, a pan-European law firm. Among the national institutions, six are research councils, three are meteorological services supporting research, and one is a national aerospace research institution. Seven participants are members of the EUFAR network of European aircraft operators for research in geo-sciences.

The COPAL aircraft will enhance the technical and scientific training of MSc and PhD students, and provide opportunities for Finnish private companies to supply instruments to the airframe, and to develop and test their instruments, algorithms, etc.

Geoinformatics Research Infrastructure Network (GRIN)

RI website: www.geoinformatics.fi

The Geoinformatics Research Infrastructure Network serves a variety of basic and applied research where methods of geoinformatics (remote sensing, GIS, geo-computing, spatio-temporal modelling, navigation and location-based services) are needed. GRIN is constituted by distributed laboratory and computing resources in the participating academic environments, supported by (1) coordinated infrastructure development, (2) jointly purchased spatial data with their direct access through download and interface technologies, (3) a permanent research data repository with metadata and delivery services supporting open access to scientific data, (4) shared software and analysis application resources (local and distributed) and (5) centralized high performance computing. The latter facilities are provided by CSC, the Finnish IT Center for Science. GRIN is a key resource of the Finnish University Network of Geoinformatics (FIUGINET), which involves five universities at the establishment phase (2008) and will likely grow to comprise up to 10 Finnish universities and to be included in international spatial science infrastructure networks. GRIN liberates scientists and developers from frequent and time-consuming data policy and access restrictions. The practical operation of the networked infrastructure is coordinated by a steering group and the FIUGINET-GRIN secretary collaborates with other spatial data and service developers at the national and international levels.

GRIN helps to overcome the problem of small isolated research entities in geoinformatics research, which was recognized by the Academy of Finland's

geo-sciences evaluation report. It releases the capacities of researchers from technical duties to effective, internationally competitive and innovative scientific work. It helps the science community to circumvent the possibly restrictive policies of Finnish implementation of EU's INSPIRE directive. It supports the progress of many different scientific disciplines simultaneously and boosts interdisciplinary collaboration. GRIN enhances product development, natural resource management and planning. It reinforces the Finnish ICT industry and competence-based societal growth.

Biomedical and Life Sciences

Finnish Stem Cell Bank (FinnStem)

RI website: www.regea.fi

This Finnish Stem Cell Bank will host clinical-grade human embryonic stem cell (hESC) lines, and later also other types of stem cells (adult, iPSC etc), derived xeno-free to avoid immunological problems or disease transmission. The bank will create new lines, and supply them for research purposes to other organizations, and to be used in clinical stem cell treatments. The estimated size of the bank is 100 adult stem cell lines, 500 hESC and iPSC lines, which is sufficient to enable a match to most Finnish citizens and many patients abroad as well. The bank will utilize Regea's class A cleanrooms, built especially for tissue-engineering purposes. The laboratory personnel will be from Regea. In its fifth year of operation, the bank should be able to provide several cGMP (Current Good Manufacturing Practice)-class xeno-free lines for clinical treatments for a fee. The personnel will include technicians, a quality control unit and a production unit, according to cGMP standards. The creation of lines requires expert knowledge, which we have. The infrastructure has required investments of over 20 million (facilities, personnel, know-how etc). In international evaluation, Regea's research was evaluated in the top 5% globally (Academy of Finland CoE evaluation 2006). The physical infrastructure (laboratories, clean rooms etc) already exist, but to start actual banking, major new investments (€5–20 million) are required.

This infrastructure will enable the production of clinical-grade stem cells, which are intended specifically for clinical use. Due to the special Finnish gene population, a Finnish bank is required to find a perfect match for each individual in Finland requiring treatment for a severe illness or trauma, such as spinal cord injuries, diabetes, heart diseases etc.

The infrastructure will also facilitate the development of new technologies, such as the automated monitoring of stem cell colony growth and automated manipulation devices in order to become cost-effective. Naturally, new students will be trained in these new technologies. The cell lines will also enable a new era of novel treatments, simultaneously with research developing new differentiation methods to produce differentiated cells, such as specific neuronal cells and cardiomyocytes.

Finnish Integrated Network for Structural Biology (FinnStruct)

RI website: http://www.biocenter.oulu.fi/bf/index3_structuralbiology.html

The Finnish infrastructure network in Structural Biology (FinnStruct) supports and provides infrastructure for research in structural biology throughout Finland, with the primary centres in the Biocentres in Helsinki, Oulu and Turku. FinnStruct reports to the new national program, Biocenter Finland, though it was formed earlier. We provide infrastructure in three major disciplines: X-ray crystallography, nuclear magnetic resonance (nmr) spectrometry, and electron microscopy (em), and associated required facilities (virus production, protein characterisation and crystallisation etc.)

These techniques – x-ray, nmr and em – allow researchers to find out where each and every atom is in the molecules that make up living cells: to determine both their structure and how they work. This can be done for individual enzymes, for the large molecular machines in the cell that synthesize proteins or DNA or convert energy, and for viruses. Furthermore, we can learn about the dynamics of these structures – how

they move in the resting state and how they change in response to "external changes" – for instance the binding of a drug molecule, another protein or a hormone. The work sits at the interface between biocomputing and imaging, and our facilities, underpin molecular medicine, biotechnology and green technology.

This research infrastructure is essential for Finland to be competitive in molecular medicine and modern biological science. Structural biology is needed to get a molecular understanding in fields like enzyme design, drug metabolism and disease. Modern drugs, including the breakthrough cancer drug Gleevec™, develop from structural biology-driven basic research.

Integrated Structural Biology Infrastructure Proposal (INSTRUCT), ESFRI

RI website: http://instruct.rns4u.com

Structural biology and biophysics has been strong in Europe. To keep the international lead in a field where considerable infrastructure investments (in billions of Euros) are needed, a European-level united effort is a necessity. The idea behind INSTRUCT is to utilize the national investments in this research field in a way that the entire European research community have access to all INSTRUCT-associated research infrastructures. This will be achieved by reserving 20–25% of the instrument capacity for external users. As the investments are distributed around Europe the reciprocal use will balance the investments done at the national level. The INSTRUCT activity has also a strong training component so that the experts at infrastructure facilities will provide different level support for the user community – from the inexperienced users to top professionals. The plan is that the INSTRUCT coordination unit(s) is kept light leading to low national participation expense. This endeavour is particularly important to smaller nations that are not in the position to generate large research infrastructures such as synchrotrons and top electron microscopy and NMR facilities. INSTRUCT is organized around eight core centres plus one associate centre per core providing more specific infrastructures. This proposal includes the participation expenses and a proposal to fund one associate centre. If accepted by INSTRUCT and funded nationally this would be the Finnish contribution to the INSTRUCT facilities allowing our user community to access all other INSTRUCT infrastructures.

To include structures to biological work is a must and will be even more so in the future. How small nations provide the access to top instrumentation? The answer is to open up the European national infrastructures to the entire user community in a manner that benefits everyone with reasonable joining expense. The training component is also crucial due to the reasonably short history of structural biology and biophysics.

Biomedical Imaging Cluster (TBI&NEUROIMAGING&BIU)

RI website: www.pet.fi, http://www.bioimaging.fi, http://ltl.tkk.fi/wiki/BRU, http://www.ami.tkk.fi, http://www.biomag.hus.fi/biomag_suomi.html, http://www.uku.fi/aivi/services/biu/index.shtml

The Biomedical Imaging Cluster aims to meet the future needs of biological and medical imaging by:

- Upgrading cellular and molecular imaging facilities to facilitate all imaging modalities from structural and chemical imaging to functional imaging at the single molecule and cellular level
- Establishing a Biomedical Imaging Cluster to create a national network of imaging services
- Offering access to its research infrastructure and imaging services in a coordinated matter to both internal and external users
- Conducting and promoting high-level research and development work in new imaging techniques
- Providing a support platform for new research groups in emerging areas of bioimaging
- Providing a support platform in Finland for MSc and PhD training in bioimaging to meet the needs of society
- Offering high-quality services in bioimaging and its applications to other universities, Strategic Centres for Science, Technology and Innovation (CSTI's), biocentres, and private companies

Biomedical imaging is rapidly growing field globally. In Finland, there is a lot of excellence in bioimaging but the expertise is distributed into several centres.

In addition, there is somewhat limited access to up-to-date imaging devices and, furthermore, the earlier purchased devices are becoming outmoded. The aim of the Biomedical Imaging Cluster is to create an imaging network that could bring the players together, increase the availability of imaging resources without unnecessary internal competition. Based on expertise and earlier experiences, the Cluster has excellent possibilities to compete internationally for imaging services for industry. To be successful, it is important to attend not only to expertise but also to hardware resources. In addition, the Cluster will provide competitive advances for Finnish industry and the pharma sector as the value of imaging is rapidly growing in biomedicine.

Materials Science and Analytics

MAX IV Synchrotron and Free Electron Laser Facility (MAX IV)

RI website: http://www.maxlab.lu.se/acc-phys/projects/max4/

MAX IV is an innovative new synchrotron radiation (SR) facility that has been proposed to be built in Lund, Sweden. The MAX IV project was initiated at MAX-Lab, the Swedish SR facility specializing in the production of soft x-rays. MAX IV will be a combined synchrotron and a free electron laser (FEL) facility. MAX IV synchrotron will be optimal for producing high energy x-rays suitable for structural studies of materials and biological systems. FEL is a new technology providing highly intense short pulses of x-rays and offering unique opportunities for example for time-resolved studies on molecular level phenomena on nanopatterned surfaces. Studies at MAX IV will be carried out in truly interdisciplinary collaboration between physics, chemistry, and the life sciences.

Synchrotron radiation based techniques are crucially important for cutting-edge research in e.g. physics, nanotechnology and biology. Several large European countries have recently built new national synchrotron facilities in addition to supporting the European Synchrotron facility ESRF. For Finland, MAX IV will be a similar complementary research facility targeting local strategic needs e.g. in applied research. Max IV is expected to strongly support industrial research and, in addition to unique facilities for soft x-ray spectroscopy, it will offer easier and more frequent access to hard x-ray beam lines and FEL than large joint international facilities. In Finland, synchrotron radiation has been used actively for more than 20 years and several research groups are closely networked in the international community of SR users. This offers the means to train young researchers who are capable of utilizing SR-related techniques after transitioning out of academia into industrial R&D work, and to conduct high-impact interdisciplinary research.

Space Research and Astronomy

Metsähovi Radio Observatory (MRO-2: "Building Finnish Radio Astronomy's Future")

RI website: http://www.metsahovi.fi/

We are proposing to expand the Metsähovi Radio Observatory functions by erecting a new 25-metre radio telescope, MRO-2, with surface accuracy high enough to enable millimetre-wavelength observations to secure especially the European need for high-frequency Very Long Baseline Inteferometry (VLBI). The new MRO-2 telescope will be mainly dedicated to VLBI observations: astronomical and geodetic VLBI, and also for various kinds of *ad hoc* VLBI/eVLBI experiments. The current 14-metre MRO-1 telescope will remain a mostly single-dish instrument, but through an upgrade it will better serve the Finnish astronomical community.

The overall scenario includes securing the current high-quality radio astronomical competence that Finnish astronomers already possess, offering the Finnish astronomy community the opportunity to use state-of-the-art radio astronomical instruments in Finland, participating in demanding VLBI observing campaigns and eVLBI experiments with a new highly sensitive and accurate telescope, and acting as the training centre for Finnish astronomy, geodesy and technology students. The continuous development of new technologies in Metsähovi is primarily targeted at

scientific research, but the technologies and skills can also be used for more general purposes and to benefit Finland's high-technology industries.

European Extremely Large Telescope (E-ELT), ESFRI

RI website: www.eso.org/sci/facilities/eelt/

A major component in the world-wide strategy of astronomy during the next decade is to deploy huge ground-based optical-IR telescopes with exquisite image quality, dubbed ELT for Extremely Large Telescopes. Two projects are being pursued in North America and the largest one by ESO in Europe, provisionally dubbed European ELT or E-ELT in short. As mandated by the ESO Council, the development of a Baseline Reference Design for an E-ELT started in December 2005 with extensive involvement from the ESO Community. A number of hard technical challenges are to be faced. The ongoing € 57 million Detailed Design Phase for the whole facility started in December 2006 and covers the 3-year period until 2010. It also paves the way for starting construction in 2011, provided adequate funding is secured. E-ELT is aiming at more than a factor of ten in improvements in collected light and a factor of five in image sharpness over ESO's present VLT telescopes. The combination of unprecedented acuity and light-gathering power of the future ELT's will not only provide unique images of objects at all scales, from solar and extra-solar planets to the first points of light in our Universe; it will also allow detailed spectral analysis, thus revealing their nature, motions and characteristics. Careful trade-offs will need to be made to find the optimal design, site, and instrumentation.

Participation in E-ELT will be a necessary prerequisite for the Finnish astronomy community to keep and strengthen its position in the front line of astronomy. Finnish institutes will actively seek opportunities to collaborate in the construction of E-ELT and its instruments which are constructed as joint projects between ESO and institutes and high-tech companies of member countries. Through E-ELT, Finnish research and industry can be part of international cooperation for ground-breaking technology development in its area. Active participation in the E-ELT project can give new preforms that could offer radical innovations and push industry towards new solutions. The value for industry will come when the solutions find other business areas outside astronomy. ESO's opportunities can add value to national technological research and give feedback to development strategies in certain technology domains. The E-ELT project also offers an environment that enforces learning and competence sharing in innovative and demanding settings.

European Next Generation Incoherent Scatter Radar (EISCAT_3D), ESFRI

RI website: https://e7.eiscat.se/groups/EISCAT_3D_info

The EISCAT_3D system will contain three radar stations. Planned station locations are near Tromsø in Northern Norway, Porjus in Northern Sweden and Kaamanen in Northern Finland. All stations will work as a receiver and at least one of them will transmit. The target is the upper atmosphere between altitudes of 50 and over 1000 km. This part of the atmosphere contains free electrons because of solar radiation and particle precipitation from the magnetosphere, which makes the atmosphere visible to radar. The amount of free electrons, the temperature of the target region, the wind in the target area and the electric field can be measures from the received signal. The antennas of the radar are arrays of thousands of individual antennas, which can be electronically controlled to form one or more narrow antenna beams. The beam directions can be changed extremely rapidly. In this way the target can be measured simultaneously or almost simultaneously in many volumes and in short timescales 3-dimensional picture can be formed of the atmospheric parameters within the radar system horizon. The results are used in scientific research on detailed processes in the upper atmosphere.

EISCAT_3D provides new scientific possibilities in a field of research in which the Finnish community already has already long experience based on existing EISCAT radars. EISCAT-3D is a gate to the next generation international scientific cooperation in research working towards an understanding of the processes of the atmosphere on our planet. The Finnish radar

community has also developed methods in incoherent scatter radar measurements to a great degree and that has been recognized internationally. EISCAT_3D allows further possibilities also in this kind of research.

Physics and Technology

Biomaterial Infrastructure (BIOMATINFRA)

RI website: www.kcl.fi

BIOMATINFRA includes all infrastructure located at KCL, the basic scientific laboratory equipment at the Helsinki University of Technology, mainly in the Forest Products Department, and part of the infrastructures at VTT, all used for studying wood and other bio-based materials and their applications. The combined RI covers the data collections and main equipment used in the forest cluster industry to process wood into products: wood products, fibres, wood-based chemicals and composites, and from fibres to paper/board products: webs with different surface treatments giving different functionalities. The upgrades will be in the area of separation and chemical processing of wood-based materials to chemicals or nanomaterials, novel technologies for bio-based composite products, new lean technologies of web forming and thin surface treatments and special printing methods combined with nanoparticles and bio-based materials. Some novel scientific analysis equipment is needed to create scientific understanding of different phenomena and the advanced techniques are used to measure composite structures, thin physical structures, new biomaterial compositions and various functional properties of the products. The research data collections will be further developed for life-cycle analysis and sustainability evaluations and on the other hand to model the phenomena or processes based on the experimental data generated in the research projects.

The profitability of the forest cluster is very important for the Finnish economy. The Finnish forest cluster outlined its national research agenda with the goal of doubling the value of its products and services by 2030. This cannot be achieved without extensive investments in infrastructure. BIOMATINFRA will support these targets well with research and development work after several implemented upgrades. The main focus is on sustainable biomaterials and applications. The first seven research projects out of a total of nine are supported by the nationally important and unique BIOMATINFRA infrastructure. In addition, basic scientific research is supported by training new researchers (KCL college).

Appendix 7
List of parties invited to participate in the mapping work

RESEARCH INSTITUTIONS
The Finnish Meteorological Institute
The Finnish Institute of Marine Research
The Finnish Geodetic Institute
The Finnish Food Safety Authority
MTT Agrifood Research Finland
The Finnish Forest Research Institute
The Finnish Game and Fisheries Research Institute
The National Research Institute of Legal Policy
Research Institute for the Languages of Finland
The National Public Health Institute
The National Research and Development Centre for Welfare and Health
The Radiation and Nuclear Safety Authority
The Finnish Institute of Occupational Health
The Geological Survey of Finland
The National Consumer Research Centre
Centre for Metrology and Accreditation
The Government Institute for Economic Research
The Finnish Environment Institute
The Technical Research Centre of Finland
National Archives of Finland
The National Board of Antiquities
The Finnish Institute of International Affairs
CSC – IT Center for Science Ltd
The Finnish Defence Forces Technical Research Centre
Statistics Finland

UNIVERSITIES AND INSTITUTIONS OF HIGHER LEARNING
The Helsinki School of Economics and Business Administration
The University of Helsinki
- The National Library
The University of Joensuu
The University of Jyväskylä
The University of Kuopio
The Finnish Academy of Fine Arts
The University of Lapland
The Lappeenranta University of Technology
The University of Oulu
The Sibelius Academy
The Swedish School of Economics and Business Administration
The University of Art and Design Helsinki
The Tampere University of Technology
The University of Tampere
The Theatre Academy
The Helsinki University of Technology
The Turku School of Economics
The University of Turku
The University of Vaasa
Åbo Akademi University
The National Defence University

COOPERATION NETWORKS
Biocenter Finland
The Jyväskylä Nanoscience Centre

UNIVERSITIES OF APPLIED SCIENCE
ARENE

FINNISH CONTACT BODIES IN ESFRI INITIATIVES

BASIC AUTHORITIES, INSTITUTIONS, OTHER ARCHIVES
Population Register Centre
The Consumer Agency and Consumer Ombudsman
National Agency for Medicines
Finnish Road Administration
The National Survey of Finland
The National Board of Patents and Registration
The Finnish National Board of Education
Finnish Customs
National Pensions Institute, Research Division
Finnish Broadcasting Company Archives
The Finnish Film Archives
The Archives of the Parliament of Finland
Red Cross Blood Service
The Finnish Cancer Registry
The Bank of Finland
The Folkhälsan organization
The Family Federation: Population Research Institute
The Research Institute of the Finnish Economy ETLA
Labour Institute for Economic Research
The Pellervo Economic Research Institute PTT
The Wihuri Research Institute
The Church Research Institute
Yksityiset keskusarkistot ry – Association of Private Central Archives
The South Karelia Allergy and Environment Institute
The Finnish Association of Intellectual and Developmental Disabilities (FAIDD)
KIHU – Research Institute for Olympic Sports
The Niilo Mäki Institute
The Rheumatism Foundation Hospital
The Finnish Literature Society
The Institute of Migration
Federation of Finnish Learned Societies
The Technobothnia Research Centre
The Gerontological Institute
The Finnish Centre for Pensions
The Folk Music Institute

Appendix 8
Submitted proposals for existing research infrastructures

Name of the Proposal	Organization that has submitted the proposal
Finnish Long-Term Socio-Ecological Research network	Finnish Environment Institute
Mekrijärvi Research Station	Mekrijärvi Research Station
Bothnian Bay Research Station	University of Oulu
Oulanka Research Station	University of Oulu
Finnish Museum of Natural History	Finnish Museum of Natural History
The Geological Museum of the Oulu University	University of Oulu
Botanical Gardens and Museum, University of Oulu	University of Oulu
Oulu University Zoological Museum	University of Oulu
METINFO statistical database	Finnish Forest Institute
Hydraulic laboratory and water research facilities	University of Oulu
Experimental Animal Centre	University of Helsinki
Biomedicum Genomics	Biomedicum Helsinki
National Biobanks of Finland (DNA-logistics Core Unit, FIMM/KTL)	National Public Health Institute and Institute for Molecular Medicine Finland FIMM
R7V Aranda	Finnish Institute for Marine Research
Research vessel Muikku	University of Joensuu
Research vessel Geomari	The Geological Survey of Finland
Cohort surveys	National Public Health Institute
Geoninformatics research infrastructure	-
Biocenter Finland: medical technology network- Translational tissue technologies	University of Tampere
Helsinki Functional Imaging Center	University of Helsinki
The Biocenter Finland National Imaging Infrastructure Network	National Imaging Infrastructure Network
Biomedicum Imaging Unit	Biomedicum Helsinki
High Throughput Center	Biomedicum Helsinki
Biological Imaging Centre (Promoted by Biocenter Finland Biological Imaging Infrastructure)	A.I. Virtanen Institute/University of Kuopio
Oulu Model Organism Center	University of Oulu
National Virus Vector Laboratory, A.I. Virtanen Institute	A.I. Virtanen Institute/University of Kuopio
Oulu Center for Bioprocess Development	University of Oulu
DNA Sequencing and Genomics laboratory	University of Helsinki
Biomedicum Virus Core Facility	Biomedicum Helsinki
Biocenter Finland: Quantitative Biology Infrastructure	Biocenter Finland
Protein Chemistry Research Group and Core Facility	Biotechnology Institute/University of Helsinki
The National Biological NMR Center	Biotechnology Institute/University of Helsinki
Finnish infrastructure network in Structural Biology	University of Helsinki
Advanced Electron Microscopy Unit of the Institute of Biotechnology (consisting of Electron Microscopy and Cryo-electron Microscopy Units)	Biotechnology Institute/University of Helsinki
Protein Crystallisation Infrastructure	Biotechnology Institute/University of Helsinki
Model organisms network, Biocenter Finland	Biocenter Finland, Biocenter Oulu
European Molecular Biology Laboratory	information on the membership was submitted by the Academy of Finland

Global Biodiversity Information Facility	information on the membership was submitted by the Academy of Finland
International Neuroinformatics Coordination Facility	information on the membership was submitted by the Academy of Finland
Environmental datasets and information systems	Finnish Environment Institute
Genome-wide and high-throughput methods, Biocenter Finland infrastructure network	Biocenter Finland
National RI for Molecular, Cellular and Integrative Neuroscience Research	Neuroscience Center
Light Microscopy Unit	Biotechnology Institute/University of Helsinki
Movable Environmental Monitoring Laboratory	TAMK University of Applied Sciences
National Forest Inventory	Finnish Forest Research Institute
Center for Systems Neuroimaging	Helsinki University of Technology
Network of research forests	Finnish Forest Research Institute
Stations for Measuring forest Ecosystem - Atmosphere Relationships	SMEAR stations
The Culture collection of the Department of Applied Chemistry and Microbiology, Faculty of Agriculture and Forestry, University of Helsinki	University of Helsinki
Finnish Genome Center	Institute for Molecular Medicine Finland FIMM
VTT Biomanufacturing pilot plant	VTT TECHNICAL RESEARCH CENTRE OF FINLAND
TREEBREEDEX: a working model network of tree improvement for competitive, multifunctional and sustainable European forestry	Finnish Forest Research Institute
Evolution of trees as drivers of terrestrial biodiversity	Finnish Forest Research Institute
Turku BioImaging	University of Turku and Åbo Akademi University
VTT TECHNICAL RESEARCH CENTRE OF FINLAND Culture Collection	VTT TECHNICAL RESEARCH CENTRE OF FINLAND
The European Infrastructure for Phenotyping and Archiving of Model Mammalian Genomes	Biocenter Oulu and Biocenter Finland
Systems biology initiative	University of Helsinki
Finnish Food Safety Authority Evira	Evira
Finnish Forest Condition Monitoring Programme	Finnish Forest Research Institute
University of Helsinkin Viikin tiedepuiston kasvihuoneet ja koekenttä	University of Helsinki
Protein Chemistry/Proteomics Unit Biomedicum Helsinki	Biomedicum Helsinki
Biomedicum Biochip Center	Biomedicum Helsinki
Yeast Two-hybrid Core Facility	Biomedicum Helsinki
Transgenic Unit, Exp. Animal Center, Univ Helsinki	University of Helsinki
Metabolomics Unit	University of Helsinki
Kuopio Ischaemic Heart Disease Risk Factor Study Database	University of Kuopio
Finnish Game and Fisheries Research Institute	Finnish Game and Fisheries Research Institute
A Systems Biology Innovative Chain	University of Turku
Ympäristötekniikan opetus ja tutkimusyksikkö	Savonia University of Applied Sciences
Valtakunnallinen päiväperhosseuranta	South Karelia Allergy and Environment Institute
Virlab	Finnish Forest Research Institute
Biological Stations of the Faculty of Biosciences of University of Helsinki	University of Helsinki
Center of expertise on structure-based biocatalysis research	University of Oulu
The Finnish Peptide Society	Biocentrum Helsinki
BioMater Centre, BioMater - keskus	BioMater
Deinking pilot	University of Oulu
Metsähovi Fundamental Station	Finnish Geodetic Institute

Metsähovi Radio Observatory	Helsinki University of Technology
European Centre for Theoretical Studies in Nuclear Physics and Related Areas	information on the membership was submitted by: Helsinki Institute of Physics
Bioenergy NoE research infra	information on the membership was submitted by: VTT TECHNICAL RESEARCH CENTRE OF FINLAND
Cryohall of the Low Temperature Laboratory	Helsinki University of Technology
Ship laboratory	Helsinki University of Technology
Accelerator Laboratory of the Department of Physics, University of Jyväskylä	University of Jyväskylä
Tuorla Observatory	University of Turku
Fire safety, testing laboratory	VTT TECHNICAL RESEARCH CENTRE OF FINLAND
Finnish Research Reactor (FiR1)	VTT TECHNICAL RESEARCH CENTRE OF FINLAND
Helsinki Institute of Physics	Helsinki Insitute of Physics
MAX Synchrotron Radiation Facility	University of Oulu
IODP (Integrated Ocean Drilling Program)/ECORD (European Consortium for Ocean Research Drilling)	information on the membership was submitted by the Academy of Finland
ICDP, International Continental Scientific Drilling Program	information on the membership was submitted by the Academy of Finland
European Synchrothron Radiation Facility	information on the membership was submitted by the Academy of Finland
NORDSIM laboratory	information on the membership was submitted by: The Geological Survey of Finland
European Space Agency	information on the membership was submitted by: Tekes
European Southern Observatory	information on the membership was submitted by the Academy of Finland
European Organization for Nuclear Research	information on the membership was submitted by the Academy of Finland
Nordic Optical Telescope	information on the membership was submitted by the Academy of Finland
European Incoherent Scatter Association	information on the membership was submitted by the Academy of Finland
EFDA-JET - Joint European Torus	information on the membership was submitted by: Tekes
ITER	information on the membership was submitted by: Tekes
Wind Tunnels at TKK	Helsinki University of Technology
GTK/Mineral Processing	The Geological Survey of Finland
GTK/Research Laboratory	The Geological Survey of Finland
Full-scale simulator for nuclear power plant	Fortum Ltd
CentekLabs	University of Kuopio
Lappeenranta Laser Processing Centre	Lappeenranta University of Technology
Micronova - Centre for Micro- and Nanotechnology	VTT TECHNICAL RESEARCH CENTRE OF FINLAND ja Helsinki University of Technology
Iter Divertor Test Platform 2	VTT TECHNICAL RESEARCH CENTRE OF FINLAND
CoE in Process Chemistry/CoE for Functional Materials	Åbo Akademi University
Explosive safety and analysis	Finnish Defence Forces

Laboratory of nanochemistry	University of Joensuu
Intelligent Factory	Jyväskylä University of Applied Sciences
Operator Level Data Network Research Environment	Jyväskylä University of Applied Sciences
Information technology R&D Unit	Savonia University of Applied Sciences
Fastems Training Center	Tampere University of Applied Sciences
Digipolis Research	Kemi-Tornio University of Applied Sciences
Foundry Institute	TAMK University of Applied Sciences
Biological and Chemical protection	Finnish Defence Forces
Geological Survey Finland	The Geological Survey of Finland
National Geodata warehouse	The Geological Survey of Finland
National Drill Core Depot	The Geological Survey of Finland
Otaniemi forest and biomaterial infrastructure	Helsinki University of Technology
Pilot plant for roll research	Tampere University of Technology
Printed Electronics and Smart Systems	University of Oulu
Reactors Lifetime Management of Finland	VTT TECHNICAL RESEARCH CENTRE OF FINLAND
VTT TECHNICAL RESEARCH CENTRE OF FINLAND Technical Research Centre of Finland	VTT TECHNICAL RESEARCH CENTRE OF FINLAND
VTT TECHNICAL RESEARCH CENTRE OF FINLAND Research hall 1	VTT TECHNICAL RESEARCH CENTRE OF FINLAND
Jyväskylä University Computational Science Infrastructure	University of Jyväskylä
Technobothnia Research Centre	Technobothnia Research Centre
Fibre based production chain	VTT TECHNICAL RESEARCH CENTRE OF FINLAND
Facility for determining exhaust emissions and energy use of heavy duty vehicles and engines	VTT TECHNICAL RESEARCH CENTRE OF FINLAND
Maanpuolustuskorkeakoulu	National Defence University
Digital Simulation Platforms	VTT TECHNICAL RESEARCH CENTRE OF FINLAND
Kansalliset kirjastojärjestelmäpalvelut	National Library
The National Electronic Library	National Library
National Archives Service of Finland	National Archives of Finland
National Board of Antiquities	The National Board of Antiquities
Archives and collections of linguistic corpora/Collections of electronic linguistic corpora	Research Institute for the Languages of Finland
The collections of the National Library of Finland	National Library
Yhteiskuntatieteellinen tietoarkisto/ Finnish Social Science Data Archive	Finnish Social Science Data Archive /University of Tampere
Finnish Information Centre for Register Research	Finnish Information Centre for Register Research ReTki
CESSDA	information on the membership was submitted by: Finnish Social Science Data Archive
Statistics Finland's research services	Statistics Finland
Media Centre Lume	The University of Art and Design Helsinki
Educational Research in Finland - Research database KOTU	Finnish National Board of Education
Centre for Digitizing Archival Cultural Heritage at the Finnish Literature So	Finnish Literature Society
National Research and Development Centre for Welfare and Health	National Research and Development Centre for Welfare and Health
University of Helsinkin kirjastot	University of Helsinki

Arctic Centre	University of Lapland/Arctic Centre
Collection of historical resources	University of Oulu
Bank of Finland Reseach Unit	Bank of Finland
Centre for gerontological research	Age Institute
ETLA, The Research Institute of the Finnish Economy, Helsinki	Research Institute of the Finnish Economy
Hanken Library Catalogue	Swedish School of Economics and Business Administration
The Cultural Heritage Research Infrastructure	University of Jyväskylä
Tiealan erikoiskirjasto	Finnish road Administration
Institute of Migration	Institute of Migration
Library of the Finnish Institute of International Affairs	Finnish Institute of International Affairs
Comparative Study of Electoral Systems	information on the membership was submitted by: University of Tampere
World Values Survey (&European Values Survey)	information on the membership was submitted by: Finnish Social Science Data Archive
International Social Survey Programme	information on the membership was submitted by: Finnish Social Science Data Archive
Inter-University Consortium for Political and Social Research	information on the membership was submitted by: Finnish Social Science Data Archive
Design Research Laboratory	University of Lapland
Oulun nauhoitearkisto	University of Oulu
Department of Psychology	University of Helsinki
Agrifood Research Finland - EconomyDoctor FADN Standard Results	MTT Agrifood Research Finland
Kehitysvamma-alan tieteellinen kirjasto	The Finnish Assoc. of Intellectual and Developmental Disabilities (FAIDD)
Helsinki School of Economics Library	Helsinki School of Economics and Business Administration
Kansanmusiikki-Instituutin arkisto	The Folk Music Institute
The Interdisciplinary e-Research Project Platform for Scholarly Edition Projects and Culture Research	Finnish Literature Society
Oulu university library	University of Oulu
Funet (Finnish University and Research Network)	CSC - IT Center for Science Ltd
IT Services for Science at CSC	CSC - IT Center for Science Ltd
Pallas-Sodankylä Super Site	Finnish Meteorological Institute
Biomaterial research infrastructure	KCL - Oy Keskuslaboratorio - Centrallaboratorium Ab
STUK-Radiation and Nuclear Safety Authority	Radiation and Nuclear Safety Authority
NanoCenter Finland	NanoScience Center, Jyväskylä
National Metrology Insitute	Centre for Metrology and Accreditation
Population Information System	Population Register Centre
Agrifood Research Experimental Centre	MTT Agrifood Research Finland
Well Life Center	Well Life Center, Laurea University of Applied Sciences
Bioenergy Development Centre	Jyväskylä University of Applied Sciences

Appendix 9
Submitted proposals for the roadmap

Name of the Proposal	Organization that has submitted the proposal
Micro Data Access System	Finnish Information Centre for Register Research ReTki
Finnish CLARIN	University of Helsinki
European Social Survey	University of Turku
CESSDA	Finnish Social Science Data Archive/University of Tampere
Upgrade of the Data Services of the Finnish Social Science Data Archive	Finnish Social Science Data Archive /University of Tampere
Digitisation of the Finnish cultural heritage and development of the National Digitisation Centre	National Library/ National Digitization Centre
National Database for Economic Research	Bank of Finland
RI-programme for the development of the extensive digitized e-research environment for scholarly editions and culture research	Finnish Literature Society
-	Society of Swedish Literature in Finland
Arctic Centre	University of Lapland/Arctic Centre
Kansainvälisesti kilpailukykyisen tutkimuksen tarvitsemat keskeiset elektroniset tieteelliset aineistot	University of Helsinki/Helsingin ylipiston kirjastot
Future Production Flow	The University of Art and Design Helsinki
The Making of the Modern World	Finnish Society for Eighteenth-Century Studies
The Cultural Heritage Research Infrastructure	University of Jyväskylä
Data Archive for Business Knowledge	Turku School of Economics
Design Research Library	University of Lapland
System Architecture for Memory Institutions	National Library
Center for Knowledge and Innovation Research	Helsinki School of Economics and Business Administration
Institute of Migration	Institute of Migration
Oulun nauhoitearkisto	University of Oulu
Finnish Church Architecture Research Infrastructure	University of Helsinki
Helsingin yliopiston julkaisuarkistopalvelut	University of Helsinki/Helsingin ylipiston kirjastot
Information Service for Tourism Studies	University of Joensuu
Statistics Finland's Research Services	Statistics Finland
Kuopio Welfare Research Centre	University of Kuopio
Architectural Cloudberry	University of Oulu
Community heavy-Payload Long endurance Instrumented Aircraft for Tropospheric Research in Environmental and Geo-Sciences	Finnish Meteorological Institute
European Institute for Atmospheric Research	University of Helsinki

Integrated Carbon Observation System	University of Helsinki
Wind Power Test Station	University of Vaasa
Bio-Fuel Laboratory	University of Vaasa
SMEAR stations	University of Helsinki
European Life Science Infrastructure for Biological Information	CSC – IT Center for Science Ltd
Nokiareena Living Lab	Tampere University of Technology
Demonstration Project for a global biological resource centres network	VTT – Technical Research Centre of Finland
Free-Air Sites for Ozone Fumigation	University of Kuopio
Pallas-Sodankylä Super Site	Finnish Meteorological Institute
Finnish Long-Term Socio-Ecological Research Network	Finnish Environment Institute
e-science and technology infrastructure for biodiversity data and observatories	Finnish Environment Institute
Environmental datasets and information systems	Finnish Environment Institute
Global Forest Information Service	Finnish Forest Research Institute
Finnish Biodiversity Data Centre	Finnish Museum of Natural History
Sensor Web for Environmental Monitoring, Agriculture and Land Use	MTT Agrifood Research Finland
Experimental Animal Centre	University of Helsinki
The European Infrastructure for phenotyping and archiving of model mammalian genomes	Biocenter Finland, Biocenter Oulu, University of Oulu
European Advanced Translational Research Infrastructure	The Institute for Molecular Medicine Finland **FIMM**
A Finnish Integrated Network for Structural Biology	University of Helsinki
Integrated Structural Biology Infrastructure Proposal	University of Helsinki
National Biobanks of Finland	National Public Health Institute
Biocenter Finland-Model organisms network	Biocenter Finland, Biocenter Oulu
Restructuring and streamlining the Quantitive Biology Infrastructure into a) the Finnish Bioinformatics Institute (FBI) and b) a Proteomics and Metabolomics infrastructure (PMi)	Biocenter Finland
National Imaging Infrastructure Roadmap	Åbo Akademi University
Biomedical Imaging Center (Kuopio part of the Biomedical Imaging Cluster)	University of Kuopio
Helsinki Functional Imaging Center	-
Oulu Model Organism Center	University of Oulu
Cluster of Biomedical Imaging	Turku Bioimaging, Center for Systems Neuroimaging (Helsinki), Biomedical Imaging Unit (Kuopio)
Biomedicum Imaging Unit	Biomedicum Helsinki
High Throughput Center	University of Helsinki
National Virus Vector Laboratory	University of Kuopio
Upgrade of the Protein Crystallisation Infrastructure	University of Helsinki
Advanced Microscopy Unit of the Institute of Biotechnology	University of Helsinki
European Clinical Research Infrastructures Network and Biotherapy	Kuopio Innovation Ltd.
Geoinformatics Research Infrastructure Network	University of Turku (submitted the joint proposal)
Systems Biology Initiative	University of Helsinki

Protein Dynamics and Interaction Imaging Platform	Biotechnology Institute
National Center for Proteomics, Lipidomics and Metabolomics	University of Helsinki
Upgrade of Protein Chemistry Research Group and Core Facility, Institute of Biotechnology, University of Helsinki	University of Helsinki
Center for Microbe and Plant Genomics	University of Helsinki
The finnish Biological NMR Center	University of Helsinki
Center of expertise on structure-based biocatalysis research	University of Oulu
Finnish Stem Cell Bank	University of Tampere/Regea Institute for Regenerative Medicine
Research Tissue Bank Finland	Pirkanmaa Hospital District
Genome-wide high-throughput RI	Biocenter Finland
Systems Biology Turku	University of Turku, Åbo Akademi University, Intermunicipal Hospital District of Southwest Finland, VTT – TECHNICAL RESEARCH CENTRE OF FINLAND
National RI for Molecular, Cellular, and Integrative neuroscience research	University of Helsinki/Neuroscience Centre
National NMR Facility	University of Oulu
Biomedicum Genomics Upgrade	University of Helsinki
Bioprocess Development Center Oulu	University of Oulu
Kuopio PET Centre: Joint project between North Savo Hospital District and University of Kuopio	University of Kuopio and North Savo Hospital District
Chemical Biology	University of Helsinki
Research Centre for Disability Studies	The Finnish Assoc. of Intellectual and Development Disabilities (FAIDD)
Finnish Microbial Culture Collections to the Microbiological Resource Center	Finnish Environment Institute
Well Life Center Ltd	Laurea University of Applied Sciences
NanoCentre Finland	University of Jyväskylä
Jules Horowitz Materials Testing Reactor	CEA Commissariat à l'energie atomique (VTT – TECHNICAL RESEARCH CENTRE OF FINLAND submitted the answer)
European Extremely Large Telescope	Finnish national Committee for Astronomy on behalf of the Finnish Astronomers' Communities at the Helsinki, Oulu and Turku universities and at the Metsähovi Radio research Station of Helsinki University of Technology
Facility for Antiproton and ion research	Gesellschaft für Schwerionenforschung mbH (Helsinki Institute of Physics submitted the answer)
Centre for Underground Physics in Pyhäsalmi	University of Oulu
MAX IV	University of Helsinki
ESRF upgrade	University of Helsinki
Finnish Peta/Exaflops Computing	CSC - IT Center for Science Ltd
Otaniemi Forest Materials Research Infrastructure	Helsinki University of Technology
Upgrade of the Accelerator Laboratory of JYFL	University of Jyväskylä
Infrastructure of processing biomaterials	KCL - Oy Keskuslaboratorio-Centrallaboratorium Ab

Upgraded CSC Services for Science 2020	CSC - IT Center for Science Ltd
Funet roadmap to the next decades	CSC - IT Center for Science Ltd
Finnish Grid Infrastructure for mid-range computing	CSC - IT Center for Science Ltd
Finnish Peta/Exabyte Safe Storage for Research Data	CSC - IT Center for Science Ltd
e-Infastructure supporting e-Science	CSC - IT Center for Science Ltd
European Software Services Network for Large-Scale Research Facilities	CSC - IT Center for Science Ltd
Infrastrcuture for Preservation of Unrevealed Scientific Data	CSC - IT Center for Science Ltd
Finnish Geosciences Laboratory	The Geological Survey of Finland
GTK/Mineral Processing	The Geological Survey of Finland
The Airborne remote sensing platform of TKK	Helsinki University of Technology
Experimental Fluid Dynamics	Helsinki University of Technology
Upgrade of Cryohall	Helsinki University of Technology
Building Finnish Radio Astronomy's Future	Helsinki University of Technology
Metsähovi Fundamental Station	Finnish Geodetic Institute
Micronova Centre for Micro- and Nanotechnology	VTT – TECHNICAL RESEARCH CENTRE OF FINLAND
Joint Infrastructure of Photo-Electric Conversion from Technologt to Metropolitan Energy	Helsinki University of Technology
Materials and Process Center	Åbo Akademi
Materials research consortium of Eastern Finland	University of Joensuu
Printed and Smart Systems Centre	University of Oulu and VTT – TECHNICAL RESEARCH CENTRE OF FINLAND
Scientific Energy Research Ltd	The Lappeenranta University of Technology
Jyväskylä Computational Science Infrastructure	University of Jyväskylä

Appendix 10
Roadmap questionnaire

2008 Survey on National Research Infrastructures (RI) in Finland and Finnish Partnerships in International RI's

This survey is organized by the Steering Group for the Finnish Research Infrastructure Survey and Roadmap

SECTION 1: Information on respondent and responding institution

1) Mr/Ms name, family name

(Example Mr John Doe)

2) Name and location of the responding institution

(Example PET Centre, Turku)

3) Please indicate if you are responding on behalf of another institution than your own host institution?

(Please note that in order to avoid multiple entries, each institution should designate internally a person for each RI to fill in this questionnaire.)

○ YES ○ NO

4) Your position in the responding institution

(Example Administrative Research Infrastructure Manager)

5) Your personal email address

6) Your mailing address

7) Please tick if you do not have any national RI's.

If ticked, you do not have to fill in the whole survey, but please return the information filled in up to this question. (The criteria for national RI's are given in the instruction letter attached to this questionnaire.)

○ we do not host any national RI's

8) Please tick if you are answering as a stakeholder of an international RI (e.g. ESO, ESRF etc.). (Please go straight to part B.)

○ I am answering as a stakeholder of international RI

PART A: ONLY FOR NATIONAL RESEARCH INFRASTRUCTURES (RI)

SECTION 2: General description of the RI

9) Name of the RI

(Please submit one questionnaire form for each RI.)

10) Give an acronym for the RI.

11) Please tick the right type of RI.

(More than one choice can be possible. The definitions of "RI types" are given in the instruction letter attached to this questionnaire.)

- ☐ Single-sited
- ☐ Distributed
- ☐ Virtual

12) Website of the RI, if available

(Please give the exact address.)

13) Location of the RI in 2008

(In case of a distributed RI, please indicate as location the city of a central office.)

14) Location(s) of the RI participant(s) in 2008

(In case of a distributed RI, please indicate all locations of partners or nodes separately.)

15) Please tick the closest organization type of the RI, or of the RI host institution.

- ○ Governmental/Public
- ○ University/Higher Education
- ○ Private Company/Industry
- ○ National Scientific Organization/Institution
- ○ Other, please specify:

16) In case of a distributed RI, please also indicate all organization types of partners or nodes separately and give the number of the specific type of partner(s).

	number of this type of partner(s)
☐ Governmental/Public	
☐ University/Higher Education	
☐ Private Company/Industry	
☐ National Scientific Organization/Institution	
☐ Other, please specify:	

17) Please tick a main scientific and technological domain(s) served in the RI.

(Please select the nearest domain. More than one choice can be possible.)

	Please specify the field, if needed.
☐ Social Sciences & Humanities	
☐ Environmental Sciences, Ecology	
☐ Life Sciences and Medicine	
☐ Physical Sciences and Engineering	
☐ Energy	
☐ eSciences and IT technology	
☐ Other, please spesify	

18) Please give a brief description of the RI.

(The description should be no more than 700 characters. Please note the instruction letter attached to this questionnaire.)

19) Concerning the RI, please list all facilities, installations and attached instruments.

(These may include telescopes, vessels, wave channels, data archives, libraries, biobanks, samples, grid –type infrastructure, virtual laboratories, etc. Please list up to ten (10) items.)

20) Concerning the RI, please state the most meaningful new investment during the past 5 years.

(Please remember to note the year and the amount of funding used as well.)

21) Concerning the RI, please state the most recent upgrade investment during the past 5 years.

(An upgrade should have cost at least 10 % of the total costs of the facility. Please remember to note the year and the amount of funding used as well.)

22) Please select the year, when the operational phase of the RI actually started or is intended to start.

(Operational phase means an active operational phase of the RI after the construction phase.)

- ○ before 1997
- ○ 1997-2001
- ○ 2002-2006
- ○ 2007-2011
- ○ after 2011, please estimate, when

23) Are there any plans to close RI or parts of it in the near future? Please indicate also the estimated closing year.

- ○ Yes, there are plans to close the RI within the next 5 years
- ○ Yes, there are plans to close the RI within the next 6-10 years
- ○ Yes, there are plans to close parts of the RI within the next 5 years
- ○ Yes, there are plans to close parts of the RI within the next 6-10 years
- ○ There are no plans for closing

SECTION 3: Operation and types of activities: personnel and users

24) Please select the number of permanent scientific/engineering staff operating in this RI in 2007.

(The definition of “staff” is given in the instruction letter attached to this questionnaire.)

- ○ <10
- ○ 11-20
- ○ 21-50
- ○ 51-100
- ○ 101-200
- ○ 201-500
- ○ 501-1000
- ○ >1000

25) Please indicate the average total number of individual internal scientific users ON SITE per year.

(Please indicate in terms of 2007. The definition of “internal” is given in the instruction letter attached to this questionnaire.)

- ○ <10
- ○ 11-20
- ○ 21-50
- ○ 51-100
- ○ 101-200
- ○ 201-500
- ○ 501-1000
- ○ >1000

26) Please indicate the average total number of individual external users ON SITE per year.

(Please indicate in terms of 2007. The definition of “external” is given in the instruction letter attached to this questionnaire.)

- ○ <10
- ○ 11-20
- ○ 21-50
- ○ 51-100
- ○ 101-200
- ○ 201-500
- ○ 501-1000
- ○ >1000

27) Referring to the number of individual external users ON SITE, please estimate the total percentage of individual users coming from industry/organizations serving industry per year.

(Please indicate in terms of 2007.)

- ○ 0%
- ○ 1-10%
- ○ 11-25%
- ○ 26-50%
- ○ 51-75%
- ○ 76-100%

28) Referring to the number of individual external users, please estimate the total percentage of individual VIRTUAL users per year.

(Please indicate in terms of 2007. The definition of “virtual” is given in the instruction letter attached to this questionnaire.)

- ○ 0%
- ○ 1-10%
- ○ 11-25%
- ○ 26-50%
- ○ 51-75%
- ○ 76-100%

29) Referring to the number of individual external users ON SITE per year, please give an estimate of the number of trainees or students (not PhD students) per year.

(Please indicate in terms of 2007. The definition of “external” is given in the instruction letter attached to this questionnaire.)

- ○ <10
- ○ 11-20
- ○ 21-50
- ○ 51-100
- ○ 101-200
- ○ 201-500
- ○ 501-1000
- ○ >1000

30) Referring to the number of individual external users ON SITE per year, please give an estimate of the number of foreign experienced researchers per year.

(Please indicate in terms of 2007. The definition of “foreign” is given in the instruction letter attached to this questionnaire.)

- ○ <10
- ○ 11-20
- ○ 21-50
- ○ 51-100
- ○ 101-200
- ○ 201-500
- ○ 501-1000
- ○ >1000

31) Referring to the number of individual external users ON SITE per year, please give an estimate of the number of foreign young researchers/ PhD students per year.

(Please indicate in terms of 2007. The definition of ”foreign” is given in the instruction letter attached to this questionnaire.)

- ○ <10
- ○ 11-20
- ○ 21-50
- ○ 51-100
- ○ 101-200
- ○ 201-500
- ○ 501-1000
- ○ >1000

32) Referring to the number of individual external users ON SITE per year, please give an estimate of the number of foreign trainees/students (not PhD students) per year.

(Please indicate in terms of 2007. The definition of ” foreign” is given in the instruction letter attached to this questionnaire.)

- ○ <10
- ○ 11-20
- ○ 21-50
- ○ 51-100
- ○ 101-200
- ○ 201-500
- ○ 501-1000
- ○ >1000

33) Referring to the number of individual external users and to your previous answers in questions 30, 31 and 32, please estimate the total percentage of foreign individual users ON SITE per year.

(Please indicate in terms of 2007. The definition of "foreign" is given in the instruction letter attached to this questionnaire.)

- ○ 0%
- ○ 1-10%
- ○ 11-25%
- ○ 26-50%
- ○ 51-75%
- ○ 76-100%

34) Please list all activities and services provided by the RI to users

(Please indicate in terms of year 2007. More than one choice is possible.)

- ☐ Management of data
- ☐ Measurement
- ☐ Access to materials, data sets, data-related materials, archives or libraries
- ☐ Processed materials, pre-modelled data sets/data-related materials
- ☐ Training courses, guides, education, guidance, consultancy
- ☐ Networking possibilities, platforms, online societies, communication possibilities
- ☐ Websites, web services, software
- ☐ Sample techniques
- ☐ Chemicals
- ☐ Access to research equipment
- ☐ Access to biobanks or circulation of samples
- ☐ Access to grid –type infrastructures, virtual laboratories
- ☐ Access to in situ observatories
- ☐ Access to observing systems
- ☐ Access to laboratories or concrete research spaces
- ☐ Access to mechanical measuring & testing devices or systems, analytical instruments (incl. in- situ)
- ☐ Access to medical devices
- ☐ Access to preclinical or clinical facilities
- ☐ Access to HPC, PC-clusters, gateway servers
- ☐ Access to food processing or packaging equipment
- ☐ Robots, automated manufacturing lines, scanners
- ☐ Other, please specify

35) Please give a brief description of the access policy and procedures of this RI for external and internal users.

(The description should especially cover any arrangements for trans-national access, ethical issues, and confidentiality issues. Maximum 1,000 characters.)

36) Please specify the access policy for external and internal users.

- ☐ Free access for internal users
- ☐ Free access for external users
- ☐ Access requires payment by internal users
- ☐ Access requires payment by external users
- ☐ Payment for services

SECTION 4 : International co-operation and memberships in international organizations; operation and activities

37) Please list all main types of structured international cooperation activities organized through contract or cooperation agreement.

(More than one choice can be possible.)

- ☐ Joint research programmes
- ☐ PhD training
- ☐ Courses, networks, workshops
- ☐ S&T work, joint development, joint production
- ☐ Personnel exchange
- ☐ Joint equipments, systems or other materials
- ☐ Other, please specify:

38) Please list all cooperation agreements and partnerships existing at the organizational level for this RI with different organizations in Finland.

(Please note also the location [city] of partners in 2008. Maximum is 700 characters.)

39) Please list all international cooperation agreements and partnerships existing at the organizational level for this RI with different organizations in Europe and outside Europe.

(Please note also the location [city, country] of partners in 2008. Maximum is 700 characters.)

40) Please estimate the amount of funding used for international cooperation activities.

(Please indicate in terms of year 2007. The figures are given in millions of Euros.)

- ○ < 1M€
- ○ 1-5 M€
- ○ 6-10 M€
- ○ 11-20 M€
- ○ 21-50 M€
- ○ 51-100 M€
- ○ 101-200 M€
- ○ > 200 M€

41) Comments regarding the previous question, if desired (Maximum 500 characters):

42) Please select the main sources of funding for international cooperation activities of this RI during the past 3-5 years.

(PLEASE INDICATE THE RELEVANCE OF FUNDING ON EVERY CHOICE YOU CHOOSE: 5=VERY IMPORTANT, 4=IMPORTANT, 3=THERE IS SOME IMPORTANCE, 2=NOT VERY IMPORTANT, 1=INSIGNIFICANT. More than one choice can be possible.)

	1	2	3	4	5
☐ Own resources of the RI/host	○	○	○	○	○
☐ Governmental budget funding, please specify source:	○	○	○	○	○
☐ Tekes	○	○	○	○	○
☐ Academy of Finland	○	○	○	○	○
☐ Sitra	○	○	○	○	○
☐ EU funding, please specify source:	○	○	○	○	○
☐ Private companies	○	○	○	○	○
☐ Other private funding	○	○	○	○	○
☐ Other source of funding, please specify source:	○	○	○	○	○

43) Please estimate the amount of funding used for this RI's memberships in international organizations

(Please indicate in terms of 2007. The figures are given in millions of Euros.)

- ○ < 0.20 M€
- ○ 0.21-0.50 M€
- ○ 0.51-1.00 M€
- ○ 1.01 – 2.0 M€
- ○ 2.1-5.0 M€
- ○ 5.1-10 M€
- ○ >10 M€

44) Comments regarding the previous question, if desired (Maximum 500 characters):

45) Please estimate the number of Finnish users (external, virtual or staff) of the RI's activities or services related to international agreements / membership in international organizations.

(Please indicate in terms of 2007. The definitions of "external"," virtual" and "staff"are given in the instruction letter attached to this questionnaire.)

- <10
- 11-20
- 21-50
- 51-100
- 101-200
- 201-500
- 501-1000
- >1000

46) Please describe any further needs / possible opportunities for collaboration with similar or related RI's.

(Maximum is 500 characters)

SECTION 5: Finance and funding of RI

47) Please select the total replacement cost for the initial construction / setting up of this RI if possible.

(Figures are given in millions of Euros. The selected figure should include all investments, such as buildings, equipment, and current upgrades.)

- < 1 M€
- 1-10 M€
- 11-20 M€
- 21-50 M€
- 51-100 M€
- 101-200 M€
- 201- 500 M€
- > 500 M€

48) Please select the main sources of funding for the initial construction/setting up of this RI.

(PLEASE INDICATE THE RELEVANCE OF FUNDING ON EVERY CHOICE YOU CHOOSE: 5=VERY IMPORTANT, 4=IMPORTANT, 3=THERE IS SOME IMPORTANCE, 2=NOT VERY IMPORTANT, 1=INSIGNIFICANT. More than one choice can be possible.)

	1	2	3	4	5
☐ Own resources of the RI/host	○	○	○	○	○
☐ Governmental budget funding, please specify source:	○	○	○	○	○
☐ Tekes	○	○	○	○	○
☐ Academy of Finland	○	○	○	○	○
☐ Sitra	○	○	○	○	○
☐ EU funding, please specify source:	○	○	○	○	○
☐ Private companies	○	○	○	○	○
☐ Other private funding	○	○	○	○	○
☐ Other source of funding, please specify source:	○	○	○	○	○

49) Please select the average figure of operational costs of this RI per year.

(Figures are given in millions of Euros. The selected figure should include administrative, personnel and maintenance costs.)

- ○ <0.25 M€
- ○ 0.26-0.50 M€
- ○ 0.51-1.00 M€
- ○ 1.01 – 5.0 M€
- ○ 5.1-10 M€
- ○ > 10 M€

50) Comments regarding the previous question, if desired (Maximum 500 characters):

51) Please select the main sources of funding for the operational costs of this RI.

(PLEASE INDICATE THE RELEVANCE OF FUNDING ON EVERY CHOICE YOU CHOOSE: 5=VERY IMPORTANT, 4=IMPORTANT, 3=THERE IS SOME IMPORTANCE, 2=NOT VERY IMPORTANT, 1=INSIGNIFICANT. More than one choice can be possible.)

	1	2	3	4	5
☐ Own resources of the RI/host	○	○	○	○	○
☐ Governmental budget funding, please specify source:	○	○	○	○	○
☐ Tekes	○	○	○	○	○
☐ Academy of Finland	○	○	○	○	○
☐ Sitra	○	○	○	○	○
☐ EU funding, please specify source:	○	○	○	○	○
☐ Private companies	○	○	○	○	○
☐ Other private funding	○	○	○	○	○
☐ Other source of funding, please specify source:	○	○	○	○	○

SECTION 6: The scientific impact and national role of RI

52) Please list the most important publications or peer-reviewed conference proceedings, technical reports or patents highlighting the cutting-edge of research carried out in this RI.

(Please list up to ten (10) examples during the past five (5) years. Maximum is 700 characters.)

53) Please list the main national and international structured research projects managed through contracts or cooperation agreements that highlight recognition of this RI at the international level.

(Please list up to ten (10) examples during the past five (5) years. Maximum is 700 characters.)

54) Do you consider this RI to be of top-level relevance for the scientific community in Finland?

Does it have a clear European dimension and international added value? Please describe e.g. in terms of users, researchers, technologies, cooperation, publications, mission statement, etc.?(Maximum is 1,000 characters.)

55) Do you consider this RI to be of top-level relevance or having added value for Finland in view of national research strategies and economic strategies?

(Maximum is 1,000 characters.)

56) Estimated socio-economic impacts: development of new technologies, effects on training, involvement of industries, local impact, other?

(Maximum is 1,000 characters)

57) Assuming available funding, would you see a clear potential for a long-term extension/continuation of the operations of this RI at the international level?

○ YES ○ NO

58) Please give a reference if the RI has been evaluated during the past five years.

(Please remember to note also the time of the evaluation.)

59) Your organization may give here recommendations or support concerning other RI's than that you are hosting or than that you are as a partner.

Please give your argumentations for upgrading the existing national RI's, for constructing up new national RI's, or for Finnish participation in international RI's or their upgrades. (NOTE: To be able to give recommendations or support, your organization can not be a host or a partner in the RI you are supporting or giving recommendations of. Maximum is 100 characters.)

PART B: ONLY FOR STAKEHOLDERS OF INTERNATIONAL RESEARCH INFRASTRUCTURES (RI)

SECTION 2: General description of the RI

60) Name of the RI

(Please submit one questionnaire form for each RI.)

61) Give an acronym for the RI

62) Please tick the right type of RI.

(More than one choice can be possible. The definitions of "RI types" are given in the instruction letter attached to this questionnaire.)

- ☐ Single-sited
- ☐ Distributed
- ☐ Virtual

63) Website of the RI, if available

(Please give the exact address.)

64) Location of the RI in 2008

(In case of a distributed RI, please indicate as location the city of a central office.)

65) Please tick a main scientific and technological domain(s) served in the RI.

(Please select the nearest domain. More than one choice can be possible.)

	Please specify the field, if needed.
☐ Social Sciences & Humanities	
☐ Environmental Sciences, Ecology	
☐ Life Sciences and Medicine	
☐ Physical Sciences and Engineering	
☐ Energy	
☐ eSciences and IT technology	
☐ Other, please spesify	

66) Please give a brief description of the RI.

(The description should be no more than 700 characters. Please note the instruction letter attached to this questionnaire.)

67) Please select a year when the Finnish membership of RI officially started or is intended to start.

- ○ before 1997
- ○ 1997
- ○ 1998
- ○ 1999
- ○ 2000
- ○ 2001
- ○ 2002
- ○ 2003
- ○ 2004
- ○ 2005
- ○ 2006
- ○ 2007
- ○ 2008
- ○ after 2008, please estimate, when

68) Are there any plans to close RI or parts of it in the near future? Please indicate also the estimated closing year.

- ○ Yes, there are plans to close the RI within the next 5 years
- ○ Yes, there are plans to close the RI within the next 6-10 years
- ○ Yes, there are plans to close parts of the RI within the next 5 years
- ○ Yes, there are plans to close parts of the RI within the next 6-10 years
- ○ There are no plans for closing

SECTION 3: Operation and types of activities: Finnish personnel and users

69) Please choose the number of permanent FINNISH scientific/engineering staff operating in this RI in 2007.

(The definition of “staff” is given in the instruction letter attached to this questionnaire.)

- ○ <10
- ○ 11-20
- ○ 21-50
- ○ 51-100
- ○ 101-200
- ○ 201-500
- ○ 501-1000
- ○ >1000

70) Referring to the number of individual FINNISH external users ON SITE per year, please give an estimate of the number of trainees or students (not PhD students) per year.

(Please indicate in terms of 2007. The definition of “external” is given in the instruction letter attached to this questionnaire.)

- ○ <10
- ○ 11-20
- ○ 21-50
- ○ 51-100
- ○ 101-200
- ○ 201-500
- ○ 501-1000
- ○ >1000

71) Referring to the number of individual external users ON SITE per year, please give an estimate of the number of FINNISH experienced researchers per year.

(Please indicate in terms of 2007.)

- ○ <10
- ○ 11-20
- ○ 21-50
- ○ 51-100
- ○ 101-200
- ○ >200

72) Referring to the number of individual external users ON SITE per year, please give an estimation of the number of FINNISH young researchers/ PhD students per year.

(Please indicate in terms of 2007.)

- ○ <10
- ○ 11-20
- ○ 21-50
- ○ 51-100
- ○ 101-200
- ○ >200

73) Referring to the number of individual FINNISH external users, please estimate the total percentage of individual users coming from industry / organizations serving industry ON SITE per year.

(Please indicate in terms of 2007.)

- ○ 0%
- ○ 1-10%
- ○ 11-25%
- ○ 26-50%
- ○ 51-75%
- ○ 76-100%

74) Referring to the number of individual FINNISH external users, please estimate the total percentage of individual VIRTUAL users per year.

(Please indicate in terms of 2007. The definition of "virtual" is given in the instruction letter attached to this questionnaire.)

- ○ 0%
- ○ < 5 %
- ○ 6 -10%
- ○ 11-25%
- ○ 26-50%
- ○ 51-75%
- ○ 76-100%

75) Please give a brief description of the access policy and procedures for the members of this RI.

(The description should especially cover any arrangements for trans-national access, ethical issues, and confidentiality issues. Maximum is 400 characters.)

76) Please specify the access policy for users benefiting from Finnish membership in this RI.

- ○ Free access for Finnish users
- ○ Access requires payment from Finnish users, please specify the estimated amount:
- ○ Payment for services, please specify the estimated amount:

SECTION 4: Funding of the RI

77) Please estimate the total amount of Finnish share considering membership in this international RI.

(Please indicate in terms of 2007. The numbers are given in millions of Euros.)

- ○ < 0.5 M€
- ○ 0.6- 1 M€
- ○ 1.1-5.0 M€
- ○ 5.1-10 M€
- ○ 11-20 M€
- ○ 21-50 M€
- ○ > 50 M€

78) Comments regarding the previous question, if desired (Maximum 500 characters):

79) Please select the total replacement cost for initial construction/setting up of this RI for Finland, if possible.

(Numbers are given in millions of Euros. The selected number should include all investments, such as buildings, equipment, and current upgrades.)

- ○ < 1 M€
- ○ 1-10 M€
- ○ 11- 20 M€
- ○ 20-50 M€
- ○ 51-100 M€
- ○ >100 M€

80) Comments regarding the previous question, if desired (Maximum 500 characters):

81) Please select main sources of funding of Finnish share for initial construction/setting up of this RI.

(PLEASE INDICATE THE RELEVANCE OF FUNDING ON EVERY CHOICE YOU CHOOSE: 5=VERY IMPORTANT, 4=IMPORTANT, 3=THERE IS SOME IMPORTANCE, 2=NOT VERY IMPORTANT, 1=INSIGNIFICANT. More than one choice can be possible.)

	1	2	3	4	5
☐ Own resources of the RI/host	○	○	○	○	○
☐ Governmental budget funding, please specify source:	○	○	○	○	○
☐ Tekes	○	○	○	○	○
☐ Academy of Finland	○	○	○	○	○
☐ Sitra	○	○	○	○	○
☐ EU funding, please specify source:	○	○	○	○	○
☐ Private companies	○	○	○	○	○
☐ Other private funding	○	○	○	○	○
☐ Other source of funding, please specify source:	○	○	○	○	○

82) Please select the average figure of operational costs (Finnish share) of this RI per year.

(The numbers are given in millions of Euros. The number should include administrative, personnel and maintenance costs.)

- ○ < 0.5 M€
- ○ 0.6- 1 M€
- ○ 1.1-5.0 M€
- ○ 5.1-10 M€
- ○ 11-20 M€
- ○ 21-50 M€
- ○ > 50 M€

83) Comments regarding the previous question, if desired (Maximum 500 characters):

84) Please select the main sources of funding of the Finnish share for operational costs of this RI.

(PLEASE INDICATE THE RELEVANCE OF FUNDING ON EVERY CHOICE YOU CHOOSE: 5=VERY IMPORTANT, 4=IMPORTANT, 3=THERE IS SOME IMPORTANCE, 2=NOT VERY IMPORTANT, 1=INSIGNIFICANT. More than one choice can be possible.)

	1	2	3	4	5
☐ Own resources of the RI/host	○	○	○	○	○
☐ Governmental budget funding, please specify source:	○	○	○	○	○
☐ Tekes	○	○	○	○	○
☐ Academy of Finland	○	○	○	○	○
☐ Sitra	○	○	○	○	○
☐ EU funding, please specify source:	○	○	○	○	○
☐ Private companies	○	○	○	○	○
☐ Other private funding	○	○	○	○	○
☐ Other source of funding, please specify source:	○	○	○	○	○

85) Please estimate the total amount of Finnish share considering funding for international cooperation activities in this RI

(Please indicate in terms of 2007. Numbers are given in millions of Euros.)

- ○ < 0.5 M€
- ○ 0.6- 1 M€
- ○ 1.1-5.0 M€
- ○ 5.1-10 M€
- ○ 11-20 M€
- ○ 21-50 M€
- ○ > 50 M€

86) Comments regarding the previous question, if desired (Maximum 500 characters):

87) Please select the main sources of funding of the Finnish share for operational costs of this RI.

(PLEASE INDICATE THE RELEVANCE OF FUNDING ON EVERY CHOICE YOU CHOOSE: 5=VERY IMPORTANT, 4=IMPORTANT, 3=THERE IS SOME IMPORTANCE, 2=NOT VERY IMPORTANT, 1=INSIGNIFICANT. More than one choice can be possible.)

	1	2	3	4	5
Own resources of the RI/host	○	○	○	○	○
Governmental budget funding, please specify source:	○	○	○	○	○
Tekes	○	○	○	○	○
Academy of Finland	○	○	○	○	○
Sitra	○	○	○	○	○
EU funding, please specify source:	○	○	○	○	○
Private companies	○	○	○	○	○
Other private funding	○	○	○	○	○
Other source of funding, please specify source:	○	○	○	○	○

SECTION 5: The scientific impact and national role of the RI

88) Please list the most important publications or peer-reviewed conference proceedings, technical reports or patents, highlighting the cutting-edge of research carried out in this RI.

(Please list up to ten (10) examples with Finnish partners during the past five (5) years. Maximum is 700 characters.)

89) Do you consider this RI to be of top-level relevance for the scientific community in Finland? Does it have a clear European dimension and international added value?

Please describe e.g. in terms of users, researchers, technologies, cooperation, publications, mission statement, etc. (Maximum is 1,000 characters.)

90) Do you consider this RI to be of top-level relevance or having added value for Finland in view of national research strategies and economic strategies?

(Maximum is 1,000 characters.)

91) Estimated socio-economic impacts: development of new technologies, effects on training, involvement of industries, local impact, other?

(Maximum is 1,000 characters.)

92) Assuming available funding, would you see a clear potential for a long-term extension/continuation of the operations of this RI at the international level?

- YES
- NO

93) Please give us reference, if the RI has been evaluated during the past five years.

(Please remember to note also the time of the evaluation.)

94) Your organization may give here recommendations or support concerning other RI's than that you are hosting or than that you are as a partner.

Please give your argumentations for upgrading the existing national RI's, for constructing up new national RI's, or for Finnish participation in international RI's or their upgrades. (NOTE: To be able to give recommendations or support, your organization can not be a host or a partner in the RI you are supporting or giving recommendations of. Maximum is 100 characters.)

Lähetä

Appendix 11
Existing questionnaire

Research Infrastructure Proposal for the Finnish RI Roadmap

1) Please choose, whether you are answering for the *

○ PART A: new research infrastructure (RI) and upgrade of national relevance in Finland

○ PART B: Finnish participation in new international research infrastructures (RI); joining in existing international RI's; or Finnish participation in upgrades of international RI's

PART A: new research infrastructure (RI) and upgrade of national relevance in Finland

2) Information on the host organization of this Proposal for the Finnish RI Roadmap

Name of the host organization:

Address of the host organization:

Phone:

Email:

3) Information on the RI

Title of the Proposal:

Acronym:

Website of the RI, if available (Please give the exact address.):

4) Please tick the right RI type

(More than one choice can be possible. The definitions of "RI types" are given in the instruction letter attached to this questionnaire.):

☐ Single-sited

☐ Distributed

☐ Virtual

5) Synthesis description of a new national RI or upgrade of a national RI in use. Add links to relevant data / web pages

(Maximum 2 pages. The description should include only the most important facts about the usage of the RI; description of the organization model of the RI; and description of the organization personnel.)

6) Science case: Scientific area(s) and potential and/or explicit users

(please estimate the numbers of Finnish and foreign users); how the new national RI/upgrade of a national RI will fit into the existing and future landscape of research and of existing RI's, at the national, European and world level (Maximum 4 pages, links to relevant documents, references).

7) Technical case: Summary of results (technical specifications) of conceptual and/or technical design studies.

(Maximum 2 pages, list references/links).

8) E-infrastructure: What does the new national RI/upgrade of a national RI require as far as e-infrastructure is concerned? How is it integrated with existing e-infrastructure?

(Maximum 1 page, e.g. Géant, grid, digital repositories)

9) Other expected socio-economic impacts: Development of new technologies, effects on training, involvement of industries, local impact, other.

(Maximum 2 pages, references).

10) International exchange and cooperation: Planned agreements, collaboration and activities, and their expected added value to the Finnish research community

(Maximum half page).

11) Commitments / maturity: What organizations have demonstrated interest / commitment in supporting and/or funding the proposal?

(Maximum 1 page)

If applicable to this RI, costs for construction, operation and decommissioning, indications for project financing

(Maximum half page, with references/links). Please give budget info in M€, and if necessary, please separate Finnish share from the total cost.

12) Total preparatory cost

13) (of which already spent or committed)

14) Total construction cost

15) (specify contributions committed or indicated)

16) Operation cost /year

17) (specify contributions by possible funding parties)

18) Decommissioning cost

19) (possible funding parties)

If you answered the previous section, please give a timetable for construction, operation and decommissioning with duration and possible starting dates.

20) Preparatory phase Up to to

21) Construction phase From to

22) Operation From to

23) Decommissioning

If applicable to this RI, costs for upgrades (Maximum half page, with references/links). Please give budget info in M€, and if necessary, please separate Finnish share from the total cost.

24) Total preparatory cost

25) (of which already spent or committed)

26) Total upgrading cost

27) (specify contributions committed or indicated)

28) Operation cost /year

29) (specify contributions by possible funding parties)

30) Decommissioning cost

31) (possible funding parties)

If you answered the previous section, please give a timetable for upgrades (Maximum half page, with references/links).

32) Preparatory phase Upto to

33) Construction phase From to

34) Operation From to

35) Decommissioning

36) Please give a description of the services provided and of access policy to materials, training or services, and the participation of partners (Maximum 1 page)

37) Your organization may give here recommendations or support concerning other RI's than that you are hosting or than that you are as a partner.

Please give your argumentations for upgrading the existing national RI's, for constructing up new national RI's, or for Finnish participation in international RI's or their upgrades. (NOTE: To be able to give recommendations or support, your organization can not be a host or a partner in the RI you are supporting or giving recommendations of. Maximum is 100 characters.)

38) Reference:

Person who has submitted this proposal and will give more information

Name and title:

Address:

Phone:

Fax:

Email:

PART B: Finnish participation in new international research infrastructures (RI); joining in existing international RI's; or Finnish participation in upgrades of international RI's

39) Information on the host organization of this Proposal for the Finnish RI Roadmap

Name of the host organization:

Address of the host organization:

Phone:

Email:

40) Information on the RI

Title of the Proposal:

Acronym:

Website of the RI, if available (Please give the exact address.):

41) Synthesis description of the international RI or upgrade of an international RI in use. Add links to relevant data/web pages

(Maximum 2 pages. The description should include only the most important facts about the usage of the RI; description of the organization model of the RI; and description of the organization personnel.)

42) Science case: Scientific area(s) and potential and/or explicit users

(please estimate the numbers of Finnish and foreign users); how the international RI/upgrade of the international RI will fit into the existing and future landscape of research and of existing RI's, at the national, European and world level (Maximum 4 pages, links to relevant documents, references).

43) Technical case:

Summary of results (technical specifications) of conceptual and/or technical design studies (Maximum 2 pages, list references/links).

44) E-infrastructure:

What does the international RI/upgrade of the international RI require as far as e-infrastructure is concerned? How is it integrated with existing e-infrastructure? (Maximum 1 page, e.g. Géant, grid, digital repositories)

45) Other expected socio-economic impacts:

Development of new technologies, effects on training, involvement of industries, local impact, other (Maximum 2 pages, references).

46) International exchange and cooperation:

Planned agreements, consortiums with other countries, collaboration and activities, and their expected added value to the Finnish research community (Maximum half page).

47) Commitments / maturity:

What organizations have demonstrated interest / commitment in supporting and/or funding the proposal? (Maximum 1 page)

If applicable to this RI, costs for construction, operation and decommissioning, indications for project financing

(Maximum half page, with references/links). Please give budget info in M€, and if necessary, please separate Finnish share from the total cost.

48) Total preparatory cost

49) (of which already spent or committed)

50) Total construction cost

51) (specify contributions committed or indicated)

52) Operation cost /year

53) (specify contributions by possible funding parties)

54) Decommissioning cost

55) (possible funding parties)

56) Estimated membership fee per year €

If you answered the previous section, please give a timetable for construction, operation and decommissioning with duration and possible starting dates.

(Maximum half page, with references/links)

57) Preparatory phase Up to to

58) Construction phase From to

59) Operation From to

60) Decommissioning

If applicable to this RI, costs for upgrades

(Maximum half page, with references/links). Please give budget info in M€, and if necessary, please separate Finnish share from the total cost.

61) Total preparatory cost

62) (of which already spent or committed)

63) Total upgrading cost

64) (specify contributions committed or indicated)

65) Operation cost /year

66) (specify contributions by possible funding parties)

67) Decommissioning cost

68) (possible funding parties)

69) If you answered the previous section, please give a timetable for upgrades

(Maximum half page, with references/links).

70) Preparatory phase Upto to

71) Construction phase From to

72) Operation From to

73) Decommissioning

74) Please give a description of the services provided and of access policy to materials, training or services, and the participation of partners

(Maximum 1 page)

75) Your organization may give here recommendations or support concerning other RI's than that you are hosting or than that you are as a partner. Please give your argumentations for upgrading the existing national RI's, for constructing up new national RI's,

(NOTE: To be able to give recommendations or support, your organization can not be a host or a partner in the RI you are supporting or giving recommendations of. Maximum is 100 characters.)

76) Reference: Person who has submitted this proposal and will give more information

Person who has submitted this proposal and will give more information

Name and title:

Address:

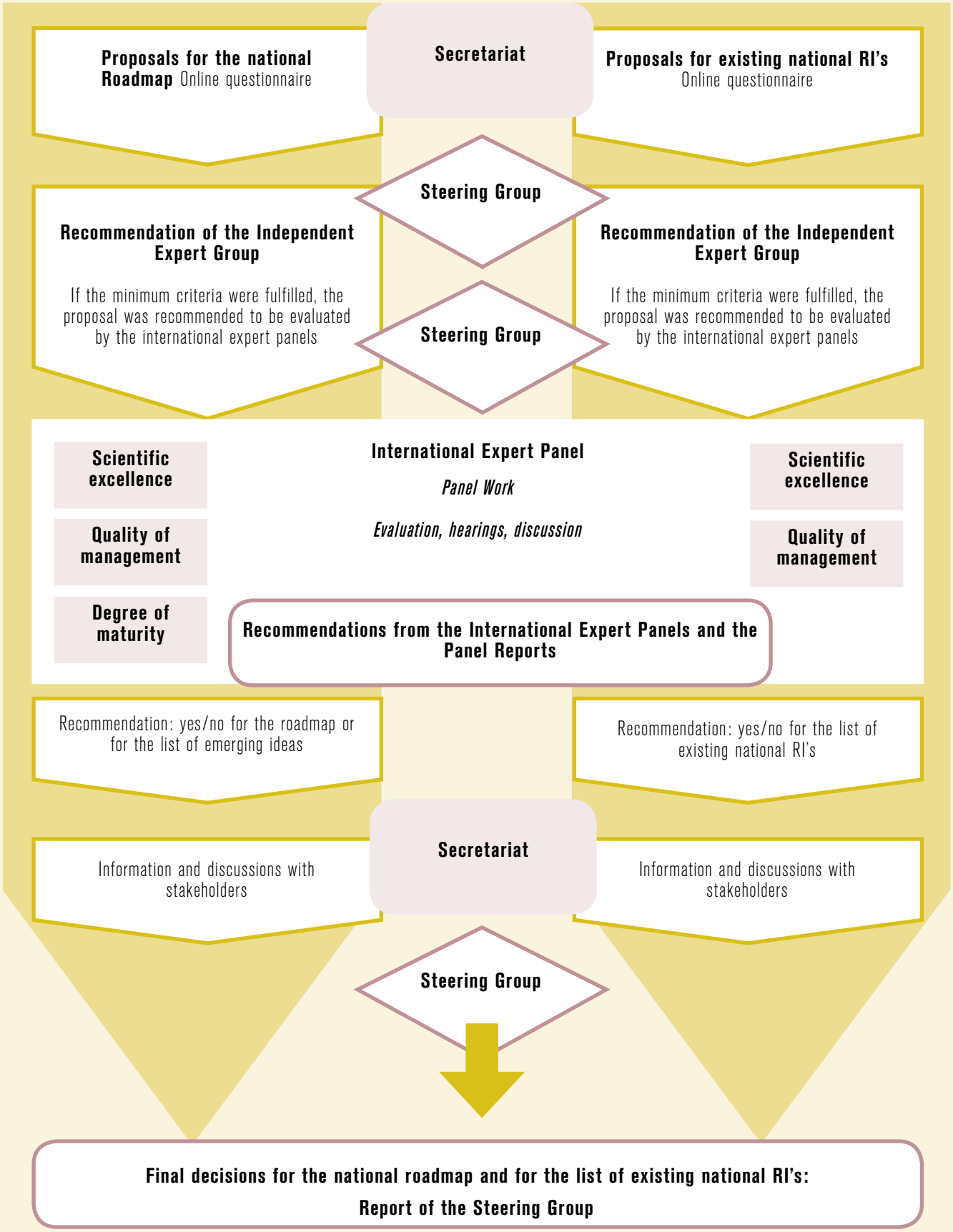
Phone:

Fax:

Email:

Lähetä

Appendix 12
Process



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