



EURAB Recommendations on Research Infrastructures (RI)

1. Decisions on future research infrastructures must be based on knowledge, needs and strategy.

- An inventory survey of *all* existing RIs of large and mid-size, including the RIs which are operated at a purely national level, should be compiled periodically by the Commission.
- Likewise, a periodic survey of the RI needs of the research community in Europe should be conducted, i.e. a bottom-up ‘pull’ action.
- A periodic survey of new scientific-technological opportunities for new RIs, including forthcoming project proposals should be conducted, i.e. a ‘push’ action.
- For evaluation and assessment of existing facilities and forthcoming proposals, a science-driven advisory scheme must be established, capable of and recognized to produce independent science-driven advice from a European perspective and with an encompassing scientific scope.

2. The decision-process for large research infrastructures must ensure that scientific recommendations are heard and that decisions, once taken, are implemented.

- To ensure co-ordinated decisions on research infrastructures, a ‘strategic body’ with appropriate authority is needed. ESFRI could evolve into this important instrument in the decision-process, provided that it is given the necessary authority and operational resources to fulfil its remit.
- Furthermore, to ensure that decisions are based on sound and comprehensive advice, ESFRI should be expanded to include not only representatives from all present and incoming member-states, but also involve relevant actors possessing the necessary scientific and operational expertise in Europe (e.g. from the EIROforum and the ESF), as well as representatives from European industry.
- To ensure a co-ordinated approach at the political level, ESFRI (or the ‘strategic body’) should report to the European (Competitiveness) Council.

3. Funding and organisation schemes for new infrastructures, i.e. for their development and operation, must be adequate to master the full time-scales involved.

- ESFRI should seek to develop advanced European models and instruments for the variable-geometry realisation of RI.
- The Commission should monitor how and how much funding is dispensed under FP-6 in support of research infrastructures, both relatively to FP-5 and to the future needs of European science.
- The Commission should initiate a study of the feasibility of financing models involving loan-based funding or public/private partnerships (EIB, etc.).
- The Commission and Member States should make Structural Funds available to support research infrastructure investments on a cost sharing basis.
- Certain infrastructures, which can be shared by most or all scientific disciplines and organisations (such as Géant and the Grid), should be funded by the Commission.
- When setting priorities, those fields where Europe is or might be in a world-wide leading position should be given high consideration while at the same time enabling the development of new and emerging fields of research.

1. Introduction

EURAB was requested by the Commission to review the situation related to the development of new Research Infrastructures in Europe including the European Strategy Forum on Research Infrastructures (ESFRI). EURAB's recommendations follow the publication of the ESFRI Annual Report 2003. While the ESFRI report deals with actions by ESFRI, the current report and its recommendations aim to take a broader look at the issues surrounding decisions on research infrastructures.

Research infrastructures are defined as 'facilities and resources that provide essential services to the research community in both academic and/or industrial domains. Research infrastructures may be 'single-sited' (single resource at a single location), 'distributed' (a network of distributed resources, including infrastructures based on Grid-type architectures), or 'virtual' (the service being provided electronically).

Examples include singular large-scale research installations, collections, special habitats, libraries, data-bases, integrated arrays of small research installations, high-capacity/high-speed communications networks (e.g. Géant), networks of computing facilities (e.g. Grids), as well as infrastructural centres of competence which provide a service for the wider research community based on an assembly of techniques and know-how.'¹

EURAB acknowledges the need for adopting the widest possible definition of the term to cover the specific needs of the social sciences and the humanities. In any case, the WG emphasises the crucial importance of access to up-to-date, world-class research infrastructures to enable and secure competitiveness of European research.

Decisions on European or national infrastructures have so far been taken at the national level, occasionally invoking variable geometry solutions, and been confined to individual scientific fields.

Not surprisingly, the present landscape of research infrastructures in Europe is characterised by huge diversity, not only due to the broad range of scientific disciplines and fields but also caused by various operating models and ad-hoc solutions.

Some fields of science, mainly in physics and related areas, have achieved a high degree of organisation at a European level and have managed to establish

¹ 'Support for Research Infrastructures in the FP6 Specific Programme on 'Structuring the European Research Area' WORK PROGRAMME (2002-2003), European Commission, the Directorate-General for Research - Unit RTD-B.4: 'Research Infrastructures' and the Directorate-General for Information Society - Unit INFSO-F.2: 'Research Networks'

European research infrastructures (such as CERN, ESA, ESO, ESRF and other organisations represented in the EIROforum), often working in parallel with national research facilities. In biology, the rapid progress of this field of science brings needs for high performance computing infrastructure in addition to the current genomic and proteomic facilities provided by EMBL, including very large facilities specifically dedicated to biomedical research (massive storage and analysis of clinical data, simulations, cell modelling, visualisations). Solutions for support at a European level have to be found urgently.

Other areas have developed national facilities only, some of which however are, or can be, opened to researchers of other nations e.g. by means of the instruments of the Framework Programme. It is becoming increasingly clear, however, that beyond providing for trans-national access, European co-ordination is indispensable to ensure an optimum use of those facilities, and even more so for decisions on future ones.

Thus, up to now, bottom-up initiatives in Europe for new research facilities of trans-national dimension are severely hampered and delayed by the lack of adequate models for collaborative variable-geometry approaches, for both the development phase of a new facility (which can be an enterprise of many years) and the operation phase during its full facility lifetime (which can extend over decades). Furthermore, no accepted mechanism for prioritizing decisions has been put in place.

Some disciplines, among others in the social sciences and the humanities, are left without adequate research infrastructures necessary to carry out comparative studies at a European level, and by implication, the experience to work with such facilities.

2. After Strasbourg – Current developments

The changes in the European research landscape, embodied in the concept of the ERA and underpinned by political declarations, such as the Barcelona statement by the European Council (March 2002) and, more recently, by the draft Constitutional Treaty, have invigorated the discussion about science policy decision-making at the European level, not least as regards research infrastructures.

The establishment of the European Strategy Forum for Research Infrastructures (ESFRI) marked a first step in this direction. However, since ESFRI has focussed on ‘the complex phase of informal policy discussions [preceding decisions on major infrastructures]² and, so far, chosen to deal with individual fields of research and individual projects, it has not developed into the ‘strategic body’ called for in the conclusions of the Strasbourg conference.

² ESFRI Annual Report 2003

The ESF has implemented a 'Priority Action Line on Research Infrastructures', charged to provide independent science-driven advice from a European perspective.

The establishment of the EIROforum, as a collaboration between those European intergovernmental research organisations operating large infrastructures³, also provide impetus to the strengthening of the European dimension in European Research.

The recognition that (new) scientific infrastructures can be supported through the Framework Programme, albeit at an extremely modest level, has opened a perspective for increased European funding, also involving funding instruments such as those provided by the EIB as well as those implied by Article 169 of the current Treaty (Articles III-146 and III-147 of the Draft Constitutional Treaty).

The deepening of the European integration has led to an increased understanding for developing the European perspective for the social sciences and the humanities, with establishment of appropriate research infrastructures that can address pan-European issues.

More recently, both the discussion about a possible European Research Council and the nascent attempts by the European Union to become more involved in scientific research⁴, and possibly basing it on a communal approach (as opposed to a national or intergovernmental solution), will affect the decision processes concerning new research infrastructures in Europe.

3. Conclusions

Decisions on future research infrastructures must be based on knowledge, needs and strategy.

In order to have a scientifically competitive infrastructure there are clear requirements. There should be general support and encouragement for scientists to engage in discussion and define the infrastructure requirements in a given subject area. This will require seed funding to explore the technologies required. General engineering funding may then be required to turn this into a costed realistic proposal before a decision to build is taken. At all three stages it is crucial that a rapid decision making process is in place. In the context of ERA it is clear that this decision making should be European, for projects above some

³ CERN, EFDA, EMBL, ESA, ESO, ESRF and ILL

⁴ In the context of seeking to develop a European Space Policy (in collaboration with ESA) and secure a constitutional base for it. Also with respect to fusion research, until now supported through the EURATOM Treaty.

scale (probably €100 Million), although in the context of capacity-building the scale may be smaller for some research areas and geographic regions.

This decision making process must be efficient and speedy. Here efficiency means firstly having a full knowledge of the scientific gains and risks as well as the opportunity costs of funding the particular project. Speedy means that the scientific community is aware of the process, understands the funding tensions and knows that a decision will occur and when.

In Europe, where funding decisions are normally being made in the context of small national budgets, there is no systematic procedure of the above kind⁵. European science will not be able to use the available funding in an efficient way until such a machinery is put in place.

3.1 Scientific Assessments of Needs

3.1.1 The Commission has published a list of infrastructures that have been supported under FP-5. However, for the moment, a comprehensive inventory of European research infrastructures does not exist. A complete list of existing research facilities available to European scientists should be compiled.

3.1.2 Further, there is a need for a similar, comprehensive description of the future needs for European science and the development of a coherent plan to meet those needs, as seen by the scientific community, similar to existing processes in the United States of America⁶.

The following decision base is thus regarded as necessary to plan and establish the RI park of the ERA in international competition:

- A (periodic) inventory survey of all existing RI of large and mid-size, including the RI which are operated at a purely national level.
- A (periodic) survey (invitation to bid) of the RI needs of the science research community in Europe, i.e. a bottom-up 'pull' action.
- A (periodic) survey of new scientific-technological opportunities for new RI, including forthcoming project proposals, i.e. a 'push' action.
- As regards evaluation and assessment of existing facilities and forthcoming proposals: a science-driven advisory scheme, capable of and recognized to produce independent science-driven advice from a European perspective and with an all-science scope.

⁵ In some scientific areas such as exemplified by CERN, ESA, ESO there is a machinery which could, in principle, satisfy many of the above requirements. The crucial national concession is made when joining the organisation. Nations agree to be bound by the decisions of e.g. the CERN Council. The alternative is to leave the organisation. In other areas such as ships, synchrotrons for biology or neutrons there is no such decision-making machinery.

⁶ See, *for example*, 'Science and Engineering Infrastructures For the 21st Century' (National Science Board, NSB 02-190, February 2003).

3.2 Decisions

The decision-process for large research infrastructures must provide for mechanisms that ensure in a systematic way that scientific recommendations are taken into account when decisions are implemented.

3.2.1 There is a clear need for European co-ordination of decisions on the establishment of research infrastructures (between member states, and member-states and the EU). To ensure co-ordinated decisions, a 'strategic body' with appropriate authority is needed. ESFRI could evolve into this important instrument in the decision-process, provided that it is given the necessary authority and operational resources to fulfil its remit. Furthermore, to ensure that decisions are based on sound and complete advice, ESFRI must be expanded to include representatives from all present and incoming member-states and also involve relevant actors possessing the necessary scientific and operational expertise in Europe (e.g. from the EIROforum and the ESF), as well as representatives from European industry.

In line with this EURAB's recommendations – and consistent with the findings at the Strasbourg conference – about the relationship between entities set up by the EU and member states (such as ESFRI) and bodies such as ESF, EIROforum and the (future) ERC, these may provide conduits for the active scientific community to express its view on the needs for future research infrastructures.

3.2.2 To ensure a co-ordinated approach at the political level, ESFRI (or the 'strategic body') should report to the European (Competitiveness) Council.

3.2.3 Variable geometry: After enlargement (a Europe of 25+) the dynamic embodied in the notion of 'variable geometry' must be preserved. The ways foreseen to 'reconcile' 'variable geometry' or 'enhanced cooperation' with the communal approach (Art. III-146, III-147 of the Constitutional Treaty) must be devised in such way that they provide realistic, truly implementable tools for development of new research infrastructures.

3.3 Funding

3.3 Funding and organisation schemes for new infrastructures, i.e. for their development and operation, must be adequate to master the full time-scales involved.

3.3.1 In response to the current problems in establishing new European research infrastructures, we suggest to add as a concrete recommendation to ESFRI that it should seek to develop advanced European models and instruments for the variable-geometry realisation of RI, i.e. for the bottom-up collaborative pursuit of RI ideas, for the development of the scientific-technical concept of a RI, for its

technical design, and – if approved and decided – for the realisation of a facility in variable geometry format, covering its siting, funding, construction, operation and user management during its full lifetime.

3.3.2 As a novelty over previous Framework Programmes FP-6 features a dedicated programme in support of new research infrastructures. However, it remains to be seen, whether in the practical implementation of FP-6, the funds effectively available for research infrastructures will actually have increased over FP-5. EURAB recommends to monitor how and how much funding is dispensed under FP-6 in support of research infrastructures and to take the appropriate action. In any case, it seems clear that the means currently available in FP-6 for research infrastructures are woefully inadequate to bring about a significant change in the direction of the ERA.

3.3.3 The four-year cycle of the Framework Programme is not well suited to meet the needs of new research infrastructures which often features lead-times spanning several FPs. Furthermore, operating costs remains an issue, since the success of a new infrastructure is at least as dependent on adequate support for its upkeep. EURAB recommends that a greater financial involvement by the European Union in research infrastructures take these problems into account.

3.3.4 'Alternative funding': Various alternative funding models should be explored, including the involvement of the European Investment Bank as well as the use of previously little or untried mechanisms provided for in the Treaty. EURAB proposes that a study of the feasibility of various financing models, including the EIB, should be undertaken. The role of private foundations (such as the Wellcome Trust and the Volkswagen Foundation) should be included.

3.3.5 In dispensing money from the Structural Funds, the Commission should actively propose to make such support also available for research infrastructure investments on a cost sharing basis.

3.3.6 Certain infrastructures, which can be shared by most or all scientific disciplines (such as Géant and the Grid), should be funded by the Commission.

3.3.7 When setting priorities, those fields where Europe is or might be in a world-wide leading position should be given high consideration while at the same time enabling the development of new and emerging fields of research.