EIROforum

Serving European Science

EIROforum response to the ERA Framework Consultation

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Europe's Intergovernmental Research Organisations

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1. Introduction: the European Intergovernmental Research Organisations and the ERA

With the strong support of their member states, the eight European Intergovernmental Research Organisations (EIROs) that are members of EIROforum, provide some of the best research infrastructures in the world. The EIROs were operating within their scientific disciplines in a way that is mirrored by the European Research Area (ERA) concept long before the notion of the ERA was formally launched.

The location of the headquarters, and in most cases the facilities, of the EIROs in Europe has a significant impact on the ERA and results in considerable benefits to Europe. Aspects which have contributed to their long-term success include:

- The membership of the intergovernmental organisations is determined at national level. The countries that support the intergovernmental organisations do so because the EIROs reflect the explicit research interests of those countries. This provides a guarantee for stable, long-term support on the one hand and for a high degree of efficiency and effectiveness of the organisations on the other.

- The organisations are all based on international treaties or conventions. These have legal status and thus remove or alleviate a number of problems with respect to cross-border mobility, transfer of funds, etc.

- International agreements of this kind imply a **top-down approach**. However, all of these organisations have come about because there was a **pronounced need for them, expressed by the scientific community**, to develop and maintain scientific leadership.

- The **involvement of the scientific community at all levels of decision-making** has been crucial in harnessing the enthusiasm, the energy, and the creativity of the scientific community in **support of commonly perceived goals**. A key to the high standing in the research world of these research facilities – and their scientific communities – has therefore been to **successfully bring together the top-down and the bottom-up approach.**

- While formally being research infrastructure operators, many of these institutions have become the **main focal point for their particular research discipline**. They have been shaped by and have also themselves shaped their respective scientific communities. This has proven to be an immensely powerful way of advancing, structuring and focussing research within the relevant field.

- **Interdisciplinarity** is promoted through **bilateral cooperation** between individual EIROs and through the EIROforum partnership itself. Moreover, for the analytical facilities, inter- and multidisciplinarity is quasi 'built into' the system.

Scientific excellence and international dimension of the ERA

The EIROs strongly believe that a fundamental requirement for the delivery of the commitment to 'complete' the ERA by 2014 is the creation of a favourable environment within which excellence can flourish.

The success of international scientific cooperation must be rooted in the quest **for scientific excellence**, and therefore **scientific cooperation must be driven by scientific needs**. Retaining this as a baseline criterion is fundamental if the ERA is to be seen as a player both from an external perspective and as an integral part of a common European approach to addressing global challenges.

All EIROs have developed and maintained scientific excellence and world leadership. Benefitting from stability and continuity of funding, they have long acted as nuclei around which clusters of expertise and interests have formed and in which researchers collaborate closely in trans-national research teams, driven only by research objectives to conduct cutting-edge research.

The benefits to the ERA are a consequence of them achieving this. The EIROs already have increasing non-EU membership, and as centres of excellence they act as magnets for global expertise in their respective fields. This is of major benefit to the ERA, which should strive to be an environment that is attractive not just to infrastructures with European membership but to global organisations, so that international actors are attracted to Europe and contribute their excellence in science, engineering, and other areas.

It is necessary to recognise that the global role played by the EIROs generates a different perspective towards EU policy in the context of implementing the ERA. It is therefore essential to find a modus operandi with those organisations which are global in membership while having a significant European component.

From the perspective of the EIROs, key areas in need of major improvement to facilitate the full implementation of the ERA are:

- Mobility and training
- Development of scientific instrumentation
- Data management and access to research results
- Broader access to research infrastructures

Each of these is addressed in one of the following sections.

2. Mobility and training

Any scientific activity involves both scientists and supporting functions. The more complex and expensive the research, the more interdependent these actors become. Excellent science needs to be supported by the development of complex instrumentation and by sound project management and administration during the construction and the operation of research infrastructures.

While scientists are mobile – to a large degree, they expect to spend at least part of their scientific career in another country – the same is not commonly true of other professions involved in research. Yet the availability of highly qualified engineers, technicians, project managers, and administrators with knowledge and experience in the efficient and cost-effective management of research infrastructures is essential to free the scientists to focus on delivering world class scientific discovery and innovation.

Difficulties encountered in recruiting and retaining people who are able and motivated to perform well in professions which support science can have a negative impact on research performance. This is compounded by an increased demand for staff, stemming from the growth in the number and size of research infrastructures in Europe (e.g. ESFRI Roadmap[1]), while new research infrastructures have the additional problem of attracting key professionals from outside their immediate location.

Key measures to address the issues of entry to the profession, career progression, and staff mobility – in order of urgency - would be as follows.

2.1. Facilitation of staff transfers between research infrastructures

The EU sets out an ambitious programme for the strategic development of research infrastructures under the ESFRI Roadmap. Lack of the appropriately qualified and experienced personnel required in the design, construction and upgrade phases of these research infrastructures hampers the implementation of their planned development. EIROforum would propose an EC mobility action, to facilitate the transfer of personnel and knowledge between research infrastructures[2] both at the national level and between EU member states.

EIROforum believes that scientific potential can be fulfilled more effectively with better mobility; the EIROs have had some success in attracting staff from a range of member and non-member states. With acknowledged skills shortages[3], mobility will be increasingly important (and lack of it more limiting) in the future. The implementation by the Commission of a simple scheme with transparent application to enhance staff mobility would be a significant contribution to the development of the ERA.

Individual participation would be encouraged by incentives such as (a) "family friendly" packages with provision for dual career partnerships, or compensation when employment is not available for the partner, allowances towards the education cost for children, and relocation costs, (b) security of employment for the personnel transferred, and (c) protection of pension benefits. There needs to be greater flexibility, with express provision in mobility contracts for variation of the length of contract, and for staff integration and repatriation.

1 http://ec.europa.eu/research/infrastructures/index_en.cfm?pg=landscape
2 In both directions – junior staff to established RIs and senior staff to new RIs
3 https://www.deloitte.com/view/en_US/us/press/Press-Releases/c5646af74daec210VgnVCM1000001a56f00aRCRD.htm

Finally sending and receiving institutes need adequate compensation[4] for the disruption staff transfers engender.

On a broader level, greater pressure from the EC on the reduction of administrative barriers to mobility, such as wider/more uniform acceptance of professional qualifications between member states, tax, social security and pension, would be welcomed.

2.2 Skills training and professionalism

EIROforum members' success is underpinned by a strong culture of staff professionalism. The EIROs provide their personnel with specialised training and a clearly structured, well-managed career path. The result is improved performance – a benefit for employees, the research infrastructure, and for science in general. It also improves staff retention.

The definition of competency levels, plus the adoption of accreditation schemes recognised across national boundaries would raise professional standards and the visibility of the science support professions, thereby attracting (better) qualified personnel and allowing greater confidence when making staff appointments. EC interventions to promote universal recognition of professional training and qualifications across Europe would bring greater employment opportunities and raise the recognition for these support professions, including science management.

The Commission should fund targeted support actions to improve the level and quality of training provision and of the management of personnel.

- **Facilitating Knowledge Transfer**: For example, workshops to raise awareness of IPR (intellectual property rights) potential and routes to exploitation, plus training in entrepreneurial skills, would improve innovation and knowledge transfer performance. Events involving both research institutes and industry would further improve innovation and knowledge transfer awareness by enabling the cross-fertilisation of knowledge and skills.

- **Training and development of science managers and leaders**: Offer activities, workshops, schools or on-the-job training schemes for existing science managers and administrators, and for individuals with appropriate background and experience who are seeking a change of career direction. Such training should be concrete, practical and regular, rather than abstract, theoretical and infrequent; it should involve not only advanced-career science managers and administrators as trainers, but also trainers from industry for specific topics (e.g. controlling, project management, etc.).

- **Training and support for engineers and technicians**: Support activities to increase the exchange of experience and know-how in all domains, including, for example, safety/security, instrument support, and project-oriented and operations-related needs of research institutions.

- **Promoting gender equality and diversity**: Training should be given in the recognition and the reduction of conscious and unconscious discrimination; and the introduction of best practice with regard to transparency and equality of opportunity. This would address issues within cultural, educational and working environments that inhibit the progress of women and of minorities, in particular in science and engineering.

4 The host institute would reimburse the sending institute the salary costs of the personnel transferred. The Commission would contribute towards the cost of arranging cover at the sending institute (30-50% direct costs); and towards the mobility costs of personnel transferred including relocation allowance, extra schooling expenses, and support for orientation/integration.

2.3 Targeted outreach activities to attract new entrants

Europe needs more scientists, and staff to support their research. The measures above present short and medium term solutions. In order to solve the problem in the long term, Europe needs a strategy to foster scientific enquiry at a very young age, to support science education, and to encourage interest in careers in science. Although attitudes to science are changing, there is still a residual lack of interest in and aspiration towards careers in science amongst young people. This could be partly reversed by bringing the innovative science and exciting results achieved at infrastructures, and their application to societal challenges, to the notice of society through more imaginative and ambitious outreach activities.

3. Development of Scientific Instrumentation

3.1 Innovation potential of Research Infrastructures

Cutting-edge science relies on cutting-edge instrumentation, which depends not only on the application of some of the most advanced technologies in the world, but also on the development of new technologies and techniques. New scientific instruments require substantial investment on the part of a research infrastructure, including the development of underlying technologies that may possess great potential for wider usage. Research infrastructures, collectively and individually, thus constitute both a significant market for Europe's hi-tech industry, not least SMEs, and a source of innovation and further potential for exploitation. The high initial costs and long development times can deter European industry from becoming involved in the area of scientific instrumentation, while at the same time driving research infrastructures (and research institutes) towards carrying out R&D activity in-house. This leads to diversification of a market with high potential for both innovation and financial turn-over.

To build a strong ERA and to fully exploit the innovation potential, it is essential to reduce the gap that exists between research infrastructures and industry in the field of R&D of scientific instrumentation. Additional funding is needed to better coordinate and support joint strategic research and development projects, which imply closer collaboration between research infrastructures and industry, thereby promoting **knowledge transfer** and **innovation**.

At the same time, the need for continuity of funding obtained via grants for promising instrumentation R&D projects, thus allowing them to evolve to their full potential, should be addressed. Too many projects fail to reach their final goals, brought to a halt by lack of financial support when a grant comes to an end. Provision for the extension of grants with additional funding, thus permitting selected promising projects to progress to completion, should be considered.

3.2 Need for better coordination between the stakeholders

A number of research institutes may work individually, but simultaneously, on similar projects, e.g. the development of core technologies. This unnecessary duplication of efforts, wasting both human and financial resources, has to be avoided. Integration of

efforts, including potentially the pooling of resources, is the logical solution to optimise costs and combine expertise across the ERA. The strengthening of support for integrating activities[5] which bring communities together in support of major instrumentation R&D projects is a necessity. In addition, improved coordination of national priorities within international projects will cultivate and build upon synergies that exist across the various national programmes. A case in point and a good example is the development of particle and photon advanced pixel detectors, where efforts in the high-energy physics, the light sources, the astronomy/astrophysics and the medical imaging communities are often performed separately, and without the indispensable critical mass needed to tackle very challenging technological issues. This is also an area in which industrial involvement is necessary (see below in Section 3.3).

Another related aspect is the inter-operability of instruments and scientific data. The huge amounts of data produced by these instruments require appropriate handling, storage, archiving and metadata management. The development of common standards and protocols for the management of and access to scientific data to allow for the multi-disciplinary exploitation of research infrastructures, and their instruments, by researchers is essential. This is further addressed in Section 4.1.

3.3 Closer involvement of European industry

Industry plays a key role in bringing to fruition new technological solutions and in the conversion of ideas from basic research into unforeseen applications that constitutes innovation. Research infrastructures, storehouses of scientific excellence in academic research, offer industry unparalleled tools to explore, understand and engineer new technologies. The technology behind one-of-a-kind scientific instrumentation may well provide the basis for new mass-produced instruments or, through the lateral thinking that is a feature of the most innovative industries, into completely new product possibilities. Consequently, closer involvement of industry during the development stage, or subsequently, through knowledge transfer of such technology, can be of benefit to European society as a whole, e.g. technology used in pixel detectors has application in medical detectors. Today, industry is often reluctant to engage with research infrastructures as R&D partners for a number of reasons:

- **Confidence**: the absence of proven benefit to the bottom line makes industry hesitant to invest time and resources in developing relations with these facilities;
- **Awareness**: often the capabilities, new analytical tools, experimental procedures and technologies developed at these facilities are not well known to industry;
- **Perception**: funding mechanisms and institutionalised systems of operation, optimised for fostering academic scientific excellence, contribute to the perception that access to, and/or engagement with, research facilities is a slow and complicated process;
- **Resources**: opportunities to develop both turn-key solutions and longer-term R&D partnerships with industry cannot be seized or leveraged since, as it is often the case, they do not form part of Research Infrastructure core missions.

5 Implemented under the EU Framework Programme for Research and Innovation

The critical mass required to remove these barriers can only be achieved with targeted actions at the European level, including support for the creation of more efficient processes for industrial partnerships with research infrastructures. This support should allow the infrastructures to engage in such additional activities without detriment to their core missions. The establishment of closer relations amongst the R&D programmes of research infrastructures and industry will promote knowledge transfer and contribute to the acceleration of the innovation cycle, as well as boost the competitiveness of European companies in the field of scientific instrumentation where today, in many cases, the market is either not considered interesting enough by these companies or is dominated by non-European countries.

4. Data storage and management and access to research results

EIROforum strongly agrees that the circulation of scientific knowledge in the form of (i) scientific data and (ii) scientific publications needs to be improved in the ERA, and that open access (free online access) to scientific data and publications can enhance this.

The most important barriers to enhanced knowledge circulation through open access to data and/or publications in the ERA are as follows:

Repositories for data across Europe are not sufficiently interoperable.

- Actors working to advance open access fail to negotiate collectively with scholarly publishers.
- EU copyright and ownership rules do not sufficiently address the specificities of the area of research and science.
- Member States' policies on open access to data and to publications are insufficient and not well coordinated across the ERA.

4.1. Data preservation, re-use, and (open) access

Computer storage and capacity doubles every 18 months[6], and this rate is increasing. This presents a serious challenge for Europe's informatics infrastructure. Currently, there is no real long-term plan in Europe to preserve data. Unused or inaccessible data becomes a wasted asset: it fails to harvest the fruit of scientific research and wastes the resources invested into producing it; and it denies part of our cultural heritage. The ERA also lacks a coherent European wide action that would secure a legacy of ready-to-use access for future generations.

Multiple issues need to be addressed: technical (e.g. standards for the physical format of the data storage, and the handling of increasingly huge quantities of scientific data); legal (e.g. ownership and rights of access that vary significantly across the different disciplines); and financial (lack of dedicated funding streams). All these require attention and the appropriate involvement of all stakeholders concerned, including the EC and European industry.

6 The volume of new data being created in the Life sciences is doubling twice as quickly.

Lessons can be learnt from individual projects. A number of the EIROs are involved in the PaNdata-ODI[7] project, the aim of which is to develop, deploy and operate an Open Data Infrastructure across the participating facilities with user and data services which support the tracing of provenance of data, preservation, and scalability through parallel access. Another example is ELIXIR (European Life-science Infrastructure for Biological Information), an EC-funded preparatory phase project from the ESFRI roadmap. ELIXIR is coordinated through EMBL-EBI in Hinxton, Cambridge, UK and its mission is to construct and operate a sustainable infrastructure for biological information in Europe to support life science research and its translation to medicine and the environment, the bio-industries and society. Once implemented, ELIXIR will help to secure data and related information in the field of the life sciences[8].

Commendable though these projects are, they concern only specific scientific disciplines and there is scope to develop and adopt more widely the standards and protocols they produce. A more coordinated approach across Europe, involving greater investment at the national and EU level to ensure users have access to well documented and carefully archived data, would open up much greater opportunity for secondary analysis. The ERA should nurture and support communities that aim to preserve and share their data, and should provide incentive systems to spread such practice. Licensing obstacles which prevent future research and innovation work being built on scientific data should be avoided. At present, the Creative Commons CC0 waiver[9] seems to be the best possible approach to licensing.

4.2. Open access to scientific publications

There are persisting problems with open access to scientific publications, arising from an obsolete model where the peer-review service and other costs borne by the scientific journals are supported by the sale of content to readers. In addition, the rising costs of journal subscriptions have become unsustainable in many research fields. If the knowledge contained in the publications is to flow freely to everyone who is interested in using it, political and financial infrastructures are needed to directly fund this service. Initiatives or agreements that only grant delayed Open Access to publications, e.g. after an embargo of several months or years, would continue to prevent the timely circulation of knowledge, affecting less privileged scholars as well as other potential users such as SMEs, thus creating unfair gaps and impeding competitiveness within the ERA. Re-direction of library subscription budgets to further support the movement of established, high-quality journals towards Open Access business models[10] may contribute to solving these critical issues in the long-term; but is likely to prove difficult due to the diversity of funding mechanisms involved. A parallel initiative to mandate research funding agencies to support Open Access publications for the research work they fund will be also necessary.

For both publications and data, co-ordination across Member States is indispensable. The bodies involved in the ERA governance should foster and use best practices to harmonize, co-ordinate and spread Open Access for the benefit of all ERA stakeholders.

7 PanDataODI: Photon and Neutron Data - Open Data Infrastructure, FP7 Combination of Collaborative Project and Coordination and Support Action, Grant Agreement Number 283556
8 http://www.elixir-europe.org
9 http://wiki.creativecommons.org/CC0_FAQ
10 Such as the SCOAP3 initiative led by CERN http://scoap3.org/

5. Broader access to research infrastructures

The EIROforum organisations bring together different scientific communities within, and beyond, Europe. Yet, in only a relatively few cases have countries from Central and Eastern Europe joined the EIROs. These countries and their respective scientific communities, whilst being part of the ERA, experience difficulties in accessing the infrastructure that the EIROs provide.
The EIROs are open to full integration of any countries, including those from Central and Eastern Europe, which meet the requirements of the individual organisation's charters and policies, and bearing in mind the need to foster scientific excellence. The EIROs also believe that it is essential that scientists from communities that have limited experience with large research infrastructures are given the opportunity to develop their potential and to become part of a pool of resources from which such excellence might emerge in the future. The EIROs, to different extents, encourage scientists coming from these countries to take part in various programmes within the respective organisations.

Central and Eastern European countries could rely, *inter alia*, on financial support from EU Structural Funds, which can be used for up-grading or establishing national research infrastructures, and in doing so, could build up capacity as well as scientific excellence. By building on local scientific excellence, these countries will be better able to cooperate with, or eventually accede to, the EIROs. It is therefore important that a coherent link between ERA policy and EU regional policy is made. The EIROs strongly recommend that the EC to investigate the possibility of enabling Central and Eastern European countries to use Structural Funds for financing membership in EIROs, should they so desire.

The EIROs are open to sharing their experience as long standing European Research Infrastructures and thereby assisting in the building up of research capacities. Many scientists from the EIRO communities already collaborate with scientists from Eastern and Central Europe; but this could be further developed through, for example, targeted actions aimed specifically at building local capacity and scientific excellence in convergence regions. Such programmes under Horizon2020 would help to unlock the potential of new EU Member States and to strategically increase their human capital and research capacity.

Overall, the EIROs believe that further efforts should be made to enlarge trans-national access to national research infrastructures at European level. First of all, this would increase competition for the resources and opportunities that the facilities provide, offering the potential for improved quality, increased scientific return and added-value for innovation in Europe. Secondly, this would have a positive impact on mobility and finally, it would promote EU-wide integration of scientific communities, in particular those in convergence regions that have fewer research infrastructures. The EU could also play a role in facilitating coordination and networking of national facilities to reduce or avoid duplication. e.g. of instrumentation. This could further improve the cost-efficiency and effectiveness of research polices across Europe.

6. Conclusions

The European Intergovernmental Research Organisations are, by their very nature and by their record of success in their respective disciplines and missions, powerful actors and catalysts for the development of the ERA, and inherently engaged in dismantling national barriers. They are strongly committed to the integration of top-down and bottom-up approaches in the formulation and implementation of advanced research programmes. They are also strenuous advocates of scientific excellence as the primary criterion for all decisions and policies. These values are the same as those of the ERA, and the daily effort towards their practical implementation brings into focus the obstacles still existing to their realisation, and how these obstacles can be mitigated.

In this contribution to the ERA Framework Consultation, the following main areas where obstacles are present have been discussed from the perspective and the experience of the EIROs:

- Mobility and training
- Development of scientific instrumentation
- Data storage and management and access to research results
- Broader access to research infrastructures

For each of these areas, specific suggestions to initiate concrete mitigating measures and actions have been made. The European Intergovernmental Research Organisations, individually and through EIROforum, are ready to contribute further to the discussion on their implementation at the European level and, to the extent possible, also in their own immediate activities.

Annexe – EIROforum publications

Response of EIROforum to the EC Green Paper "From Challenges to Opportunities: Towards a Common Strategic Framework for EU Research and Innovation funding" (May 2011)

Towards the Next Framework Programme for Research, Technology and Innovation – EIROforum Position Paper on FP8 (January 2011)

Establishing New Research Infrastructures in Europe – The EIROforum Experience Position Paper (March 2010)

Letter from Iain Mattaj, EMBL Director General, published in *Nature*, **Vol 465, (24 June 2010)**

EIROforum's Response to the Green Paper "The European Research Area: New Perspectives" (September 2007)

Towards a Europe of Knowledge and Innovation World-class research as the centrepiece of knowledge-based economy (2005)

All of the documents referred to above are available on the EIROforum website: http://www.eiroforum.org/science_policy/index.php