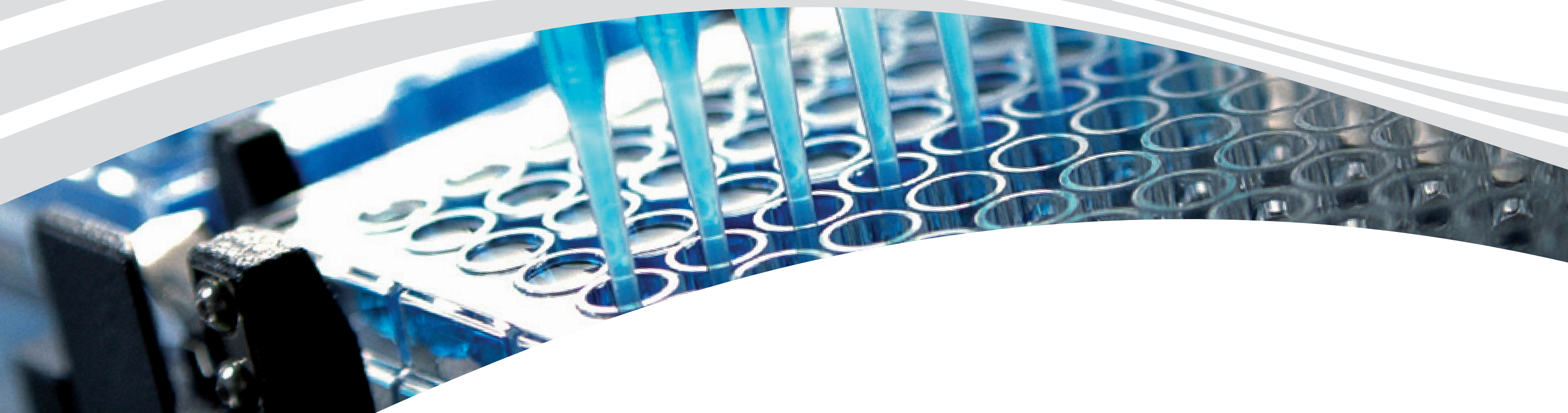
ERA Instruments

Mid-Size Instrumentation in the Life Sciences:

II. Funding Schemes



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Content

Preface

ERA-Instruments is a European project bringing together funding agencies, ministries, charities and research performing organisations to aid in establishing centres for mid-size research instrumentation that meet the needs of the scientific community.

Workshops, meetings and further stakeholder consultation have led to a wealth of results and conclusions that we present as a series of publications under the heading of "Mid-Size Instrumentation in the Life Sciences". The focus of this second issue is on funding schemes.

ERA-Instruments has surveyed and analysed funding schemes for research instrumentation across Europe [1]. Intense discussions with the scientific community served for identifying the needs of the scientists in this regard. The survey and analysis are more or less covering all scientific fields while the scientific community that ERA-Instruments is addressing is primarily in life science research.

The requirements to funding schemes summarized here aim at optimizing the scientific output given a limited budget for investments. Funding schemes typically depend on legal, political and financial constraints, to name a few. The recommendations are meant to provide opportunities for potential improvements to existing or new funding schemes as well as for comparing funding programmes with the requirements of the (life science) researchers.

The paper is addressed to the EUROHORCs, science policy makers, funding organisations and any stakeholders involved in funding schemes in the life sciences.

[1] *www.era-instruments.eu/downloads/funding_schemes.pdf*

Summary

Many fields in the life sciences depend on expensive instrumentation to carry out competitive research projects. Special attention should therefore be given to investment programmes for funding equipment that is enabling research. Continuity of funding is an important prerequisite for building an efficient infrastructure that scientists can use and rely upon.

The very best equipment has to be provided for leading researchers while maintaining access to basic or regular instrumentation for the broad research community. Joint applications and mixed funding should be supported to allow the formation of groups or consortia that can in a flexible manner join forces to pursue an investment. Procedures must be in place for multidisciplinary proposals. Applications should explicitly address international context, human resources and management aspects in addition to the scientific case and the scientific merit of the applicants. When the requested instrumentation is operated in a shared facility, additional aspects of shared access need to be addressed (cf. first issue on "Efficient Operation and Access"). Public-private partnerships could be an attractive way of pooling resources provided that facilities can clearly separate industrial and academic use.

Funding programmes should take a more comprehensive view and should include personnel, running costs, installation costs, maintenance and upgrades as eligible cost items for funding. The diversity of funding schemes and programmes throughout Europe requires funding organisations to respond flexible to the needs of the scientists wherever they come from. This is especially true for user fees, because financial models for operating shared facilities vary broadly in the life sciences.

Mid-size instrumentation should basically always be open to external users and shared access should be stimulated by funding schemes that support and promote access to centres including travel expenses and other costs. Maximal scientific output can be achieved by granting access to the highest quality projects of internal and external applicants and funding organisations have to find appropriate ways to count valid indicators for a vivid and productive use of the instrumentation.

What is mid-size instrumentation?

Research instrumentation can generally be divided into three classes, of which the small and the large scale are easily explained and defined:

Small scale: Instrumentation of local relevance, e.g. lab equipment; this is instrumentation that is typically owned and operated by single laboratories. Organisation of access is purely on the local level.

Large scale: Instrumentation, or rather facilities, of pan-European relevance; such a facility is typically unique in Europe and serves the whole European, or even international scientific community. Typical examples are known from physics, such as CERN, ITER and ESFRI projects, for instance FAIR, XFEL. ESFRI isn't restricted to instrumentation, but has a broader understanding of research infrastructure, including also distributed resources, such as bio banks (BBMRI) and data bases (ELIXIR) or even the European Social Survey (ESS). Large scale facilities require typically an individual and multinational organisational structure and funding agreement.

Mid-size instrumentation lies in between the small local and the large pan-European scale and a sharp distinction either on the lower or the upper limit is difficult. Nevertheless, in the life sciences mid-size instrumentation is at the heart of scientific progress in many fields. This comprises pieces of equipment, such as electron microscopes, nuclear magnetic resonance (NMR) and magnetic resonance imaging (MRI) scanners that have become so elaborate and technically challenging, as well as expensive, that not every laboratory can possibly have its own. Alternatively, single instruments might still fall in the small scale category, but typical settings would include a larger number of pieces, as is the case in genomics or proteomics platforms. These can be as a whole of at least regional relevance and attractive to external users, particularly when the facility can provide special expertise. These examples suggest that life science research is increasingly dependent on the mid-size instrumentation. Typical costs for mid-size instruments range between 0.5 and 20 million Euros.

What is a research infrastructure (RI)?

The term "research infrastructure" (RI) comprises a broad variety of facilities, resources or services that are needed by the research community to conduct research in any scientific or technological fields. The following definition is similar to those used by ESFRI[1] and the European Commission[2] and covers, including the associated human resources,

- Major equipment or group(s) of instruments used for research purposes;
- Permanently attached instruments, managed by the facility operator for the benefit of all users;
- Knowledge-based resources such as collections, archives, structured information or systems related to data management, used in scientific research;
- Enabling information and communication technology-based infrastructures such as Grid, computing, software and communications;
- Any other entity of a unique nature that is used for scientific research.

RIs may cover the whole range of scientific and technological fields. They may be „single-sited", „distributed", or „virtual". This includes singular large-scale research installations, collections, special habitats, libraries, databases, biological archives, clean rooms, integrated arrays of small research installations, high-capacity/high-speed communications networks (e.g. Géant), networks of computing facilities, research vessels, satellite and aircraft observation facilities, coastal observatories, telescopes, 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.

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[1] *ESFRI defines RI e.g. in the ESFRI-Roadmap 2008, page 10, on http://cordis.europa.eu/esfri/*
[2] *The European Commission describes RI on http://ec.europa.eu/research/infrastructures/*

Instrumentation and research infrastructure

There is a clear tendency in the life sciences to make shared use of instrumentation and to run it in centres like core facilities. Once such a core facility has grown to a certain size and developed an organisational structure, it is quite reasonable to consider it a research infrastructure.

The resulting research infrastructures may or may not grow to the level of a mid-size facility. So far there are no agreed criteria to mark the transition from local to mid-size RI and the factors promoting or hindering the foundation of mid-size centres need to be investigated more deeply.

Problem:

- Life scientists generally do not have the tradition to work in shared central facilities.
- Mid-size instruments are usually bought, when possible, by each single institute or laboratory. This practice has many disadvantages (economically, but not only).
- A major hidden cost is often associated with acquiring the know-how to run the instrument successfully, not the investment of the instrument itself.

Recommendations:

- Promote the visibility of user-friendly centres that offer shared access, e.g. by a public inventory.
- Develop funding strategies encouraging life scientists to carry out part of their experiments in national or European facilities.
- Actively inform young scientists about new experimental approaches relevant to their research based on the use of leading edge instrumentation.

Funding schemes

What should a call for instrumentation look like?

It is very important to have continuity in funding of research infrastructures from national programmes in the framework of the national plans for Research & Technology, with continuous up-grading of the existing infrastructures and funding of new infrastructures. The very best infrastructure has to be provided for leading researchers while still maintaining access to basic infrastructure for the broad research community. Funding schemes will typically rather focus on instrumentation than comprise a call for a full research infrastructure. The following will therefore focus on equipment.

Instrumentation related proposals should usually be linked to research projects or research concepts. Both the quality of the science served as well as the research conducted on the technology or the methods need to be considered. Even strategic investments will have to justify what scientific projects or goals they would serve. On the other hand, project related instrumentation should fit to the existing infrastructure and be accompanied by a comprehensible concept for access.

Further important aspects are:

- The definition of the calls should be based on the needs of the scientific community.
- Evaluation should be by peer review.
- Coordinated and joint applications should be supported at various levels (regional, national, European, international).
- The possibility to assess multidisciplinary proposals should be considered and corresponding procedures be established.

The evaluation could be depending on the cost range of the equipment. International peer review is encouraged in the upper limit of the cost range and otherwise national peer review by different panels can be sufficient.

Applications should explicitly address international context, human resources, management and innovative aspects. The user profile and access rules should be described. Mid-size RIs should basically always be open to external users.

The preferred language of the proposal should be English to allow for international peer-review, and optionally also in national language. Parts with administrative information can be requested in national language to allow administrative processing of the proposals by non-English speaking staff at the funding organisations' headquarters.

Independent from the scientific evaluation of project or instrumentation proposals, it appears useful to introduce minimum requirements that a shared RI has to fulfil to be eligible for RI related funding. These quality standards should not form a bureaucratic hurdle, but should ensure that access and operation of all RIs adhere to some basic quality standards that should be easily agreed upon[1].

1 See, for example, the first issue "Efficient Operation and Access" of this recommendations series

Funding schemes have to consider more than the single investment

Efficient use of equipment is not guaranteed by funding the initial investment. If sufficient financial support is not available for follow-up costs, conditions for operation and consequently scientific output will be less than optimal. Discussions with scientists and facility managers have shown that the capacity of an RI, at least in the life sciences, frequently is limited by the availability of instrument scientists or technical staff that attend to the user. This might even be true, if the instrument time is fully booked. Support by experienced staff from the facility, also in the preparation stage before access, will often help to avoid wasting time with trial and error experiments and will ensure optimal use of the equipment. On average well supported experiments will need less experiment time or produce better results than those that cannot be supported sufficiently by the facility due to limited availability of technical or scientific personnel.

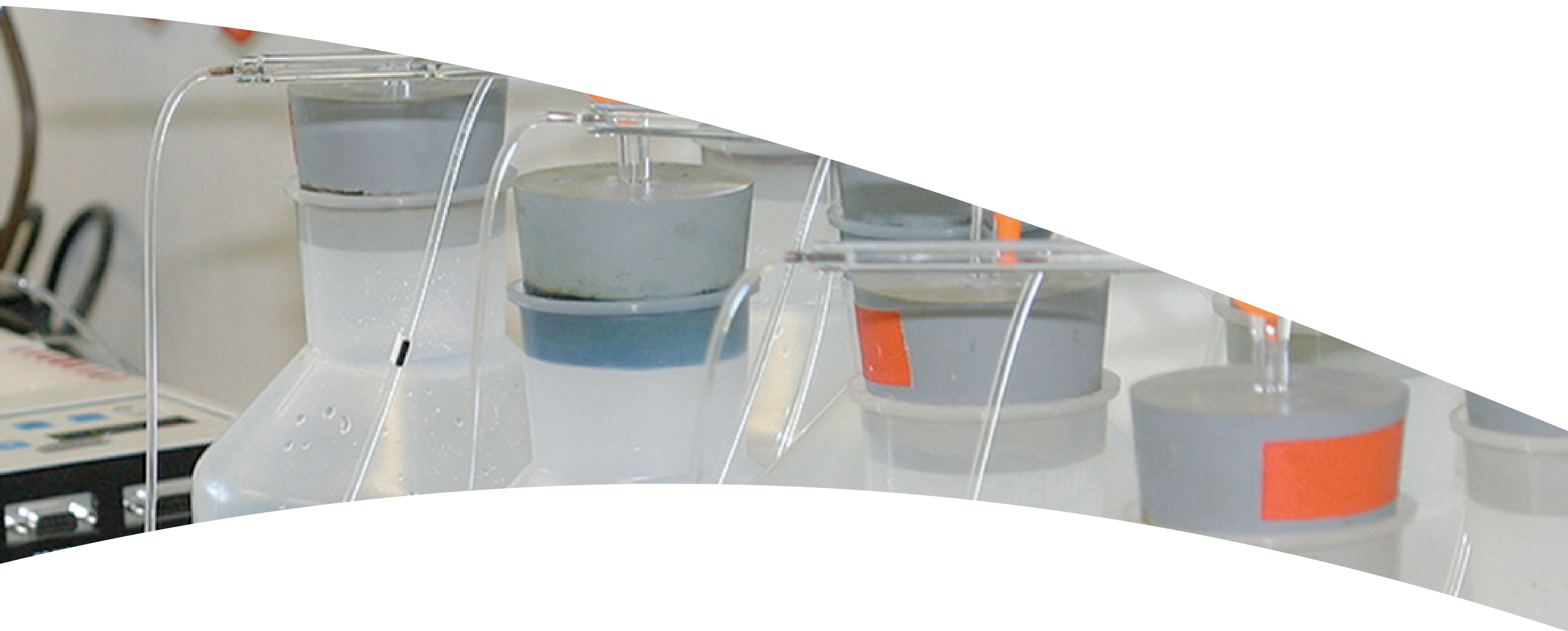
Therefore, a more comprehensive view of funding RI is highly desirable. Personnel and running costs, installation costs, maintenance and upgrades should be included in funding programmes as eligible cost items. Unfortunately, to date this is not the case in many EU countries.

The analysis of funding schemes and financial models has shown large variation between European countries. Hence it is necessary to accept different schemes in different countries and funding organisations need to respond flexible to the needs of the scientists irrespective of which RI they need for their investigations. User fees are an important factor and models range from free access to full cost-recovery.

Facilities that are free to the user at point of access can only be supported if sufficient institutional funds are available, for example in facilities funded by subscription, like ESRF. Full costing models can provide maximum financial flexibility for a facility, but may result in a lack of competitiveness.

Funding schemes should foresee an option for including variable user fees in project proposals, potentially in the form of vouchers that can be granted. Facilities funded through central or national schemes may be expected to offer reduced cost access to 'home' users funded by the same organisation.

In the life sciences the majority of scientists appear to be in favour of a graded user fee model, where users from industry pay full costs while academic groups contribute to running costs with more moderate fees. This is in obvious contrast to the physics community where the free access based on fast-track evaluation (locally by the RI) of applications for measurement time is favoured. A likely explanation and justification for this difference is that large facilities, as they are typical in physics, are well visible and can attract sufficient institutional funds whereas the smaller and distributed life science RI facilities often do not find sufficient financial support to provide free access to external users.



Sharing research infrastructures

Sharing of centralised facilities allows maximising the usage of existing RI. Maximal scientific output can be achieved by granting access to the highest quality projects of internal and external applicants. Funding agencies should try to stimulate shared use of RI by providing funding schemes that support and promote access to centres including travel expenses and direct as well as indirect costs. Funding schemes need not cover all costs, but should give an incentive to use existing facilities within Europe. Travelling should only be supported where necessary.

On the European level funding schemes supporting access to large facilities, e.g. synchrotrons, have been successful. Some positive experience was gathered even with distributed RIs or mid-size centres (e.g. within EU-NMR, a network of high field NMR centres). A major shortcoming of most existing schemes is that access of a scientist to facilities in the same country cannot be funded - a gap that obviously needs to be filled.

Additionally, it would be valuable to promote fellowships and courses with the purpose of informing about experimental approaches based on new mid-size instrumentation.

Assessment of investments

Efficient use of instrument time is of paramount importance for running a shared facility successfully. Efficiency cannot be measured by the number of users or experiments alone. Especially for highly sophisticated RIs the availability of cutting edge instrumentation does by no means guarantee high quality research. Adequate sample preparation, expertise and experience with the experimental methods as well as data treatment are indispensable components for successful and efficient use of measurement time. Shared facilities should explain and justify what level of support or training the facility offers to external users. Only if this meets the requirements of the users, can shared access to the facility be successful.

Co-authorship of publications is only warranted for the staff of the facility when substantial scientific input of that person contributes to the publication. Just providing the instrumentation or service is not sufficient for a co-authorship. Nevertheless in all cases, usage or service of a facility has to be acknowledged in appropriate ways, e.g. in the acknowledgement section of a publication. Funding organisations have to find appropriate ways to count such acknowledgements as valid indicators for a vivid and productive use of the instrumentation when evaluating investments or deciding on renewal/extension proposals for running facilities.

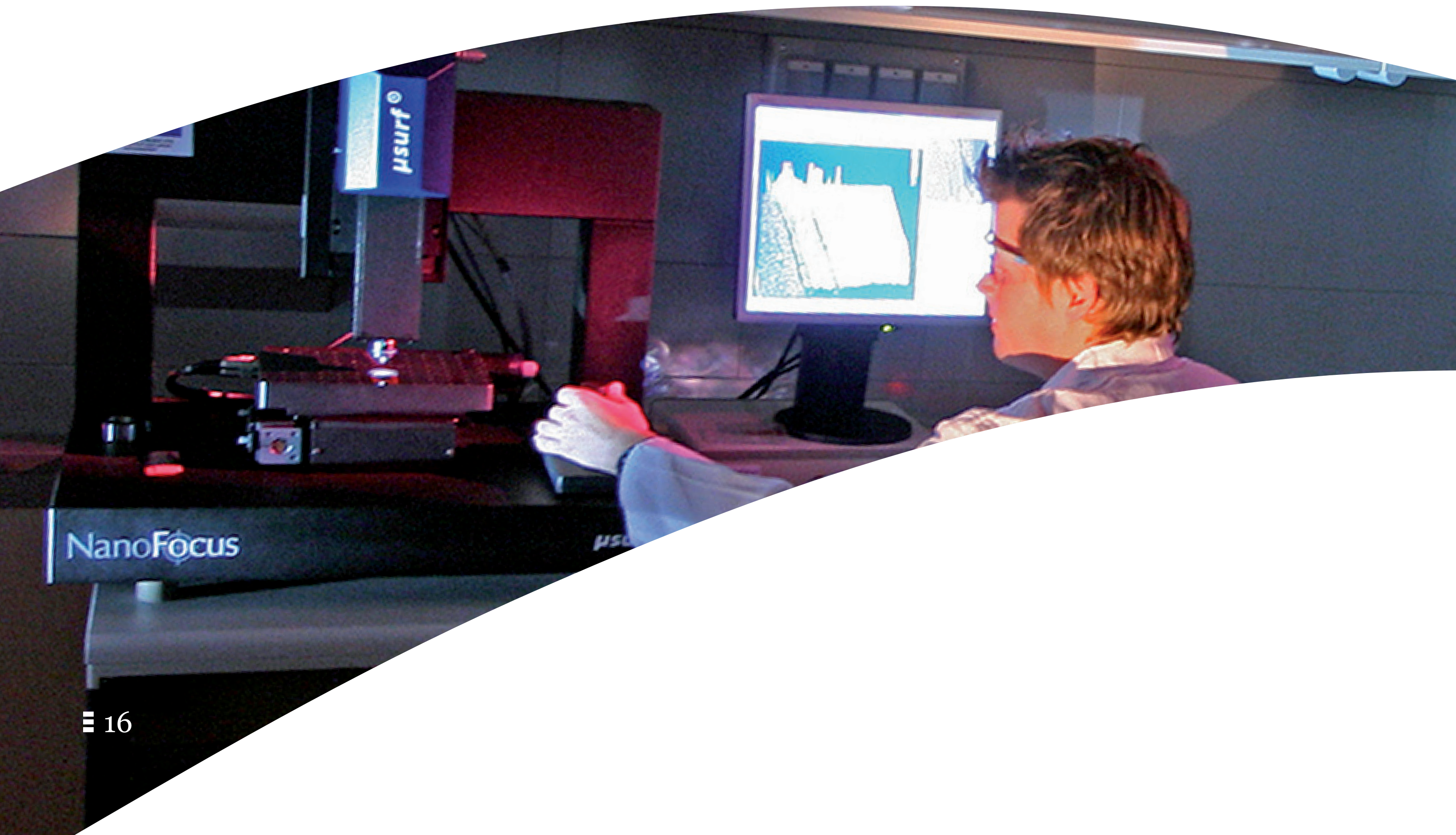
PPP – RI in industry

Modern and expensive equipment is not only required in many areas of basic life science research, but also in R&D departments in industry, sometimes even in quality control steps. Both, industry and academia, share the desire for latest cutting edge technology and the restriction by limited financial and human resources. While the use of instrumentation at research facilities by companies is common practise, the opposite way, i.e. access of academic researchers to a company's RI, is only rarely explored. But exploiting available RI in companies by academic researches might be beneficial to both sides and should be encouraged.

Consortia agreements are required that address sharing of access and of running costs as well as intellectual property issues and non-disclosure agreements. Full cost recovery financial models can be employed in order not to mix funding streams. To allow pooling of resources funding organisations should foresee mixed funding in their schemes provided that facilities can clearly separate industrial and academic use.

Conclusions

The funding situation throughout Europe is heterogeneous as one would expect. ERA-Instruments tried to identify some general aspects that funding programmes should address or include for providing the best support to scientists. By moving towards this goal funding schemes will become more similar and more compatible with each other and with the needs of the scientists. Changes will not be brought about easily or rapidly, but agreement on a common goal will be a first step. New funding programmes have a unique chance to address the requirements presented in this paper from the outset.



About ERA-Instruments

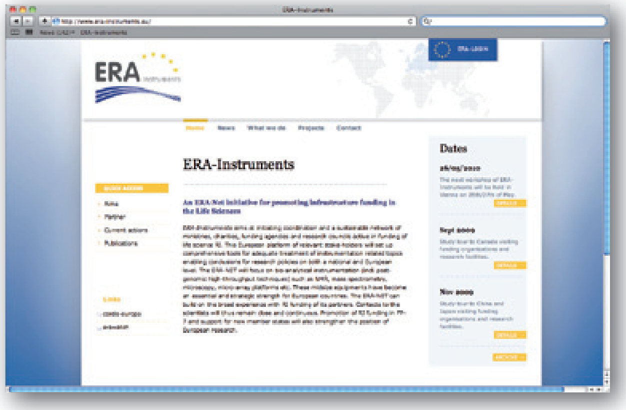
The programme

It has become increasingly obvious that concepts and strategies for research infrastructure (RI) funding should be harmonised and coordinated within the EU. ESFRI has determined requirements for European RI funding and has presented a roadmap. Growing attention is paid to life sciences that rely on RIs of a less centralised, but more networked dimension. There is a clear need for action in the interdisciplinary area between physics, chemistry, biology and medical sciences as cutting edge instrumen-tation becomes increasingly expensive and, yet, indispensable for world-class research.

However, promotion of research policies, apart from the ESFRI projects, has been restricted so far to national efforts without managing these actions with a European view. Funding and research organisations cannot afford to remain at the national stage with world-wide competition for the best scientists and the most promising projects. Frontier research is international since long and funding organisations have to follow scientists to the European level.

The ERA-Instruments website

www.era-instruments.eu



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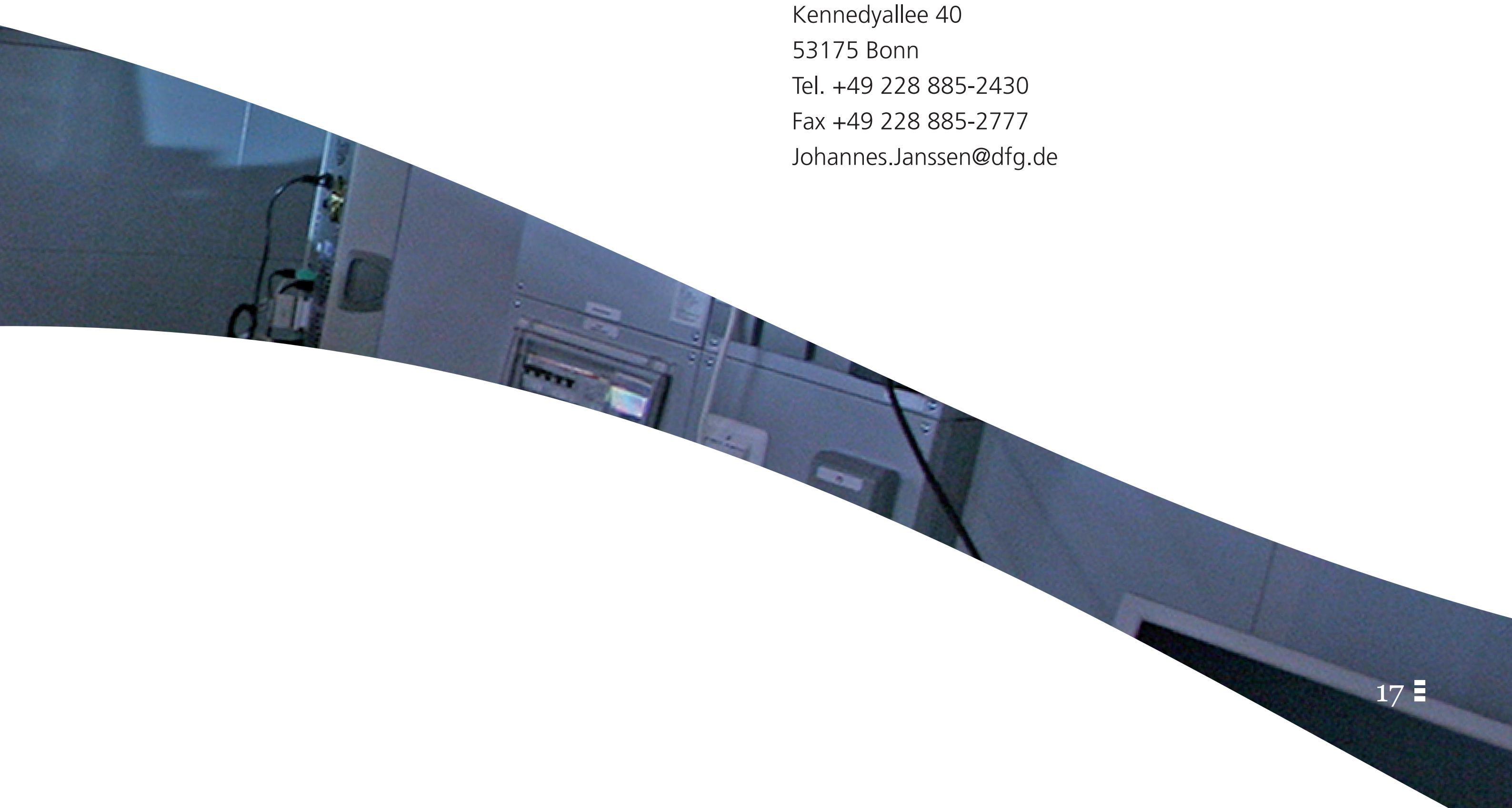

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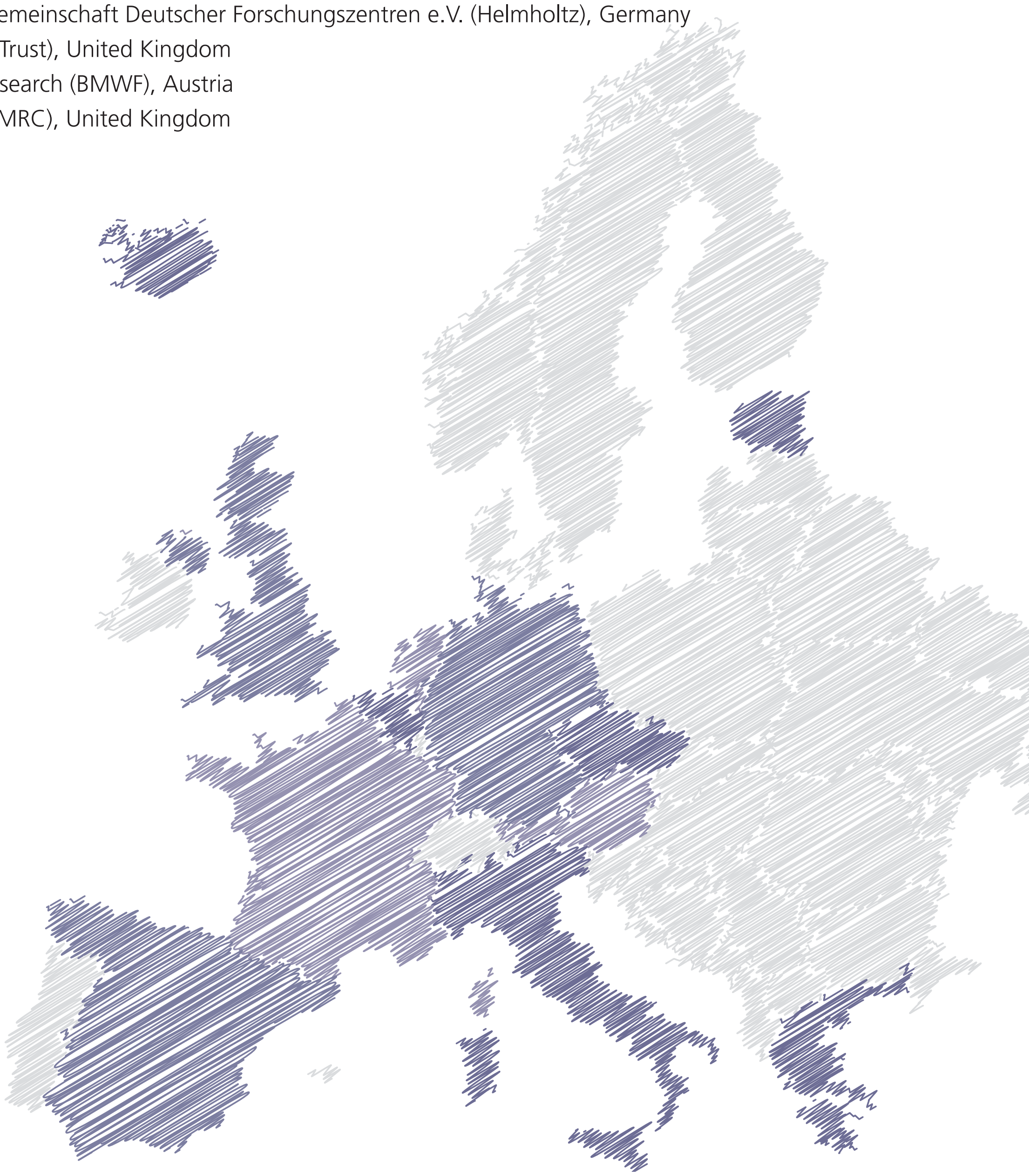

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SEVENTH FRAMEWORK
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