

# FINDINGS & RECOMMENDATIONS



ERID Watch



Funded by the European Commission under FP6.

The findings and recommendations presented here do not necessarily refer or apply to the infrastructures illustrated in the photos.

*Cover background:* Double-slit diffraction pattern. Source: DESY, Hamburg.

# Preface

Events of the early 21st century confirm that we are living in an important period of transition. Globalization affects every sector of our daily life, and the recent financial crisis reveals the profound weakness of short-term thinking. It is time to refocus on long-term thinking and on visions emphasizing the necessity of global balance in all actions taken. Hence, Europe proposes to develop a long-term vision of a knowledge society as a basis for competitive, modern economies.

A key point for success is the development and use of world-class research infrastructures, where users can participate in well-coordinated research programmes, share knowledge, and develop strong cooperation with industrial partners.

The quality of these relationships is important. The EU Commission has funded the FP6 programme called ERID Watch, which aims to contribute to mutual improvements in the policy mix of the Member States, to enhance the efficiency of public investments in European Research Infrastructures, and to develop public-private partnerships.

ERID Watch has confirmed that research infrastructures are key resources for enabling scientists to remain at the forefront of science. These infrastructures stimulate technology transfer and – with an annual budget

approaching 9 billion euros – are clearly an economic force in a marketplace.

The analysis presented here calls for reinforcing professional knowledge and technology transfer, the heart of the innovative process. It also supports improving employment conditions, enabling science to maintain a high level of human capital.

A main recommended action would be the creation of an Observatory of Research Infrastructures, based on a website repository containing key information on scientific roadmaps, future markets, and employment opportunities for scientists and engineers.

I hope that this work will be helpful as we prepare for the future, and that the European Research Infrastructures hosting future ESFRI projects will implement some of our recommendations. Concurrently, I hope that the long-term vision of the scientific world and wisdom-based analysis will be able to enhance faith in science among our citizens.

Thanking everyone in the ERID Watch teams who worked to accomplish this huge task, I look forward to a constructive dialogue on the findings presented.

*Philippe Lavocat*  
*ERID Watch Coordinator*



# ERID Watch 2006–2008

Research Infrastructures are key resources for supporting and funding research activities, thus enabling scientists to remain at the forefront of science and technology. European Research Infrastructures not only provide unique opportunities for world-class research and training but also stimulate knowledge exchange and technology transfer, which in turn boosts European competitiveness through the development of new products and new markets.

However, the Research Infrastructures form a diverse community, with differences in size, organisation, users, and of course scientific areas. It could be, it was argued, that the policies of member states might be revised and aimed at an increased efficiency with regard to the public investment and at a development of the industrial relations and the public-private partnerships.

With this in mind, the consortium of six partners, from France, United Kingdom, Germany, Czech Republic and Sweden, set out to investigate the situation, present the findings and give some recommendations to member states, research councils and European organisations working with the Research Infrastructures, such as ESFRI, the European Strategy Forum for Research Infrastructures.

The ERID Watch project, European Research Infrastructure Development Watch, as it was called, got EU funding and a timetable with a final report and conference towards the end of 2008.

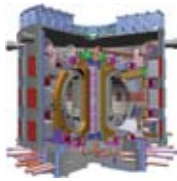
Two major studies were started in early 2007, one regarding the facilities themselves in terms of technology transfer, human resources and organisation, and the other a market analysis for industrial partners and suppliers. Both studies have included a large number of interviews with Research Infrastructures, governments, industrial users and suppliers.

The samples of Research Infrastructures and companies for interviews have been selected with the objective to represent as many countries, scientific fields and organisational forms as possible. Furthermore, they are all among the 300 medium-sized and large facilities in Europe. Hopefully this reflects the actual situation in Europe very well, even though the statistic data may not be complete.

The ERID Watch project is now finished. It leaves behind reports with findings and recommendations, as well as website where all material can be found – [www.eridwatch.eu](http://www.eridwatch.eu) – and this handbook, where the main findings and recommendations can be found.

*For more information, analyses and background material – please see the complete reports, [www.eridwatch.eu](http://www.eridwatch.eu)*

# The ERID Watch surveys



Research infrastructures constitute a diverse community.

EC has tentatively defined “research infrastructures” as: “Essentially single-sited, mobile, distributed, virtual facilities, or joint resources that provide unique access and services to research communities in both academic and/or technological domains.”

Over 300 facilities have been identified as “medium-sized and large research infrastructures”, i.e. those with construction costs exceeding 20 m€ and a pan-European group of users. Examples of research infrastructures include research vessels, large laboratories, facilities such as CERN and JET, research stations, synchrotrons, botanical gardens, telescopes, and large libraries of research data, e.g. for social science studies of populations.

The ERID Watch project conducted two major surveys – a benchmarking study on technology transfer and human resources in research infrastructures, and an extensive market study on the commercial market approach used by infrastructures. In addition, a smaller study specifically targeted synchrotrons, showing a specific example of the market interaction between research infrastructures and industry.

During the course of the project, several key findings were established as cornerstones of the analysis.

Research infrastructures create market value and impact in at least four dimensions:

- Directly or indirectly commercial products and services based on research results and other outcomes of infrastructure-based activities. Indirectly commercial products and services are based on outcomes from the facility, which are exploited by industry and complemented with further added value, e.g. software.
- Purchase of leading-edge technology to operate the infrastructure, e.g. magnets and instrumentation. These activities are generally connected with technology development and cooperation between the facility and suppliers.
- Services and data used for policy recommendations or as a basis for public decisions, e.g. concerning environmental issues.

- As users, the scientific community and industry constitute important target groups. Potentially, the status and scientific level of external users could generate significant input, beyond financial support, to the facilities.

The research infrastructure sample used in the surveys was selected from the 300+ medium-sized and large infrastructures identified, e.g. by the EC's survey in 2005. These infrastructures are characterised by construction costs exceeding 20 m€ and activities of a clearly European dimension. All EIROFORUM and ERF members were included. Several infrastructures were selected to cover as many countries as possible and all scientific fields (using ESFRI Roadmap definitions, see also page 10).

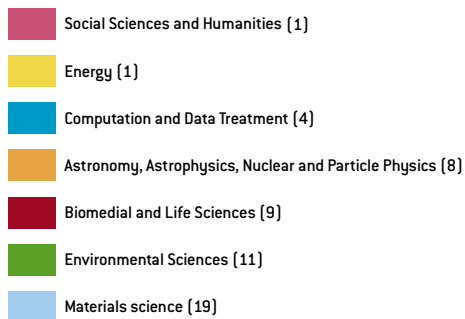
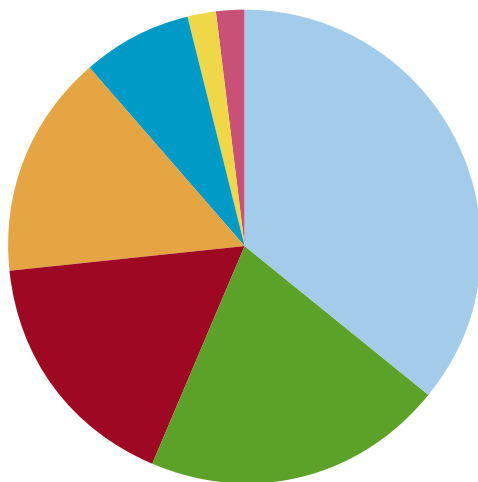
Ultimately, 53 research infrastructures were selected along with some 30 governmental institutions and 175 industrial suppliers. Personal interviews were conducted in all infrastructures. The number of responses may vary by question since not all interviewees answered every question.

***The following figures must be interpreted within the context presented above. However, the statistical data may provide some quantitative indicators to the qualitative issues discussed.***

**1**

**A diverse  
community**

## Interviewed infrastructures by scientific sector



n = 53

European research infrastructures form a landscape with many differences. About half of the interviewed infrastructures are categorised as research institutes, agencies, or university departments under public law; the other half are either intergovernmental or private or public entities under private law. More than half of the research infrastructures in the sample were founded during the past three decades. Although the oldest dates back to 1750, many were founded between 1950 and 1980.

Many facilities in the environmental and energy sectors were built in the 1980s, while the most recent decades have witnessed a considerable increase in research infrastructures for biomedical and life sciences.

In general, routines and systems for data collection regarding industrial and scientific users are less developed than would be advisable. Only 6 of 10 were able to provide such data. Data on the home countries of visiting researchers were normally not recorded.

## **RECOMMENDATIONS**

Uniform registration of key data would be valuable for the further exchange of best practice and the development of a clearer and more visible profile and "corporate identity" for research infrastructures.

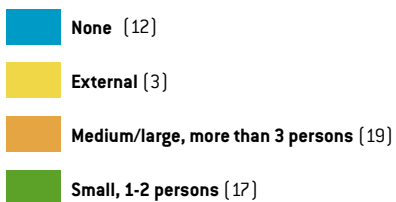
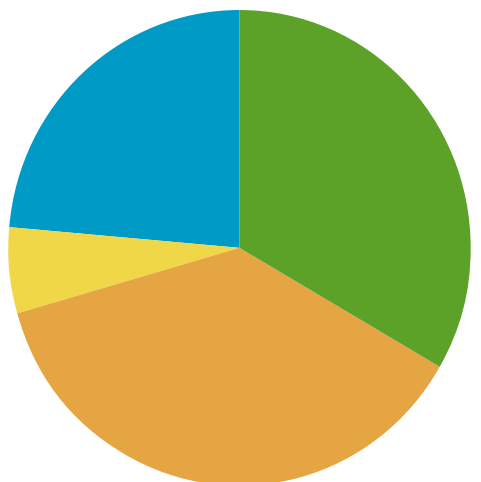


JET interior showing vacuum vessel

2

Potential for  
know-how and  
technology transfer  
improvements

## Size of technology transfer offices at interviewed infrastructures



n=51

It appears that a large share of European research infrastructures generate no net income from commercial users. This applies to 45 percent of the study sample, even though 95 percent of the interviewed infrastructures have access to some form of technology transfer unit or staff.

Large discrepancies in the approaches to technology transfer – both between and within different scientific fields – and the absence of common standards and procedures lead to inefficient use of resources and time-consuming preparations for possible projects. ”The wheel has to be invented again and again” complained one interviewee.

There appears to be further potential for technology transfer through licensing agreements. The average income generated from royalties is less than 200 euros per full-time employee, and the annual number of patent applications is four times higher than the number of new licenses.

## **RECOMMENDATIONS**

Strategies, experiences, and best practices need to be discussed among research infrastructures. Individual facilities may want to consider a more business-like approach to licensing, pro-active marketing, and organising a technology transfer office to be profit-oriented. A set of commonly accepted standards and procedures could simplify the process, not least for industries working with several research infrastructures.

Photo: Suzie Gibbons (from "Garden Photographer of the Year 2008")

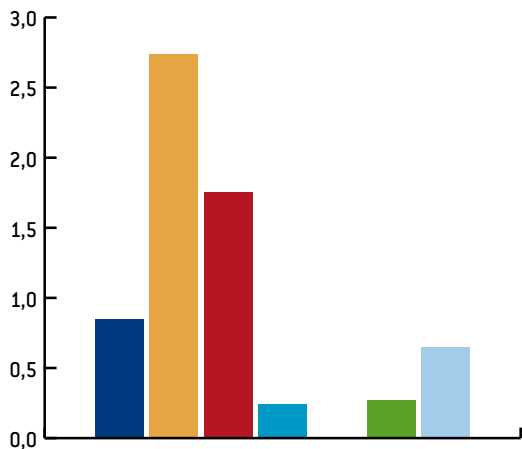


The herbarium and the Jodrell Laboratory at Royal Botanic Garden, Kew, were interviewed as infrastructures in the Environmental science sector.

3

Lack of marketing  
knowledge and  
industrial experience

## Spin-offs per 100 full time employees (FTE) and scientific sector



n=35

Most infrastructures offer services to industry "in principle". But often it appears that these industrial offers are not necessarily based on in-depth market studies, or designed with industrial needs specifically in mind. Few research infrastructures invest in professional marketing knowledge, including product design and services likely to be of major interest to the industrial sector.

In most cases, research infrastructures place minor importance on potential patents and licensing. This, however, varies between individual research infrastructures and also between and within scientific sectors.

Although spin-off companies are found in most scientific sectors, many research infrastructures have had no spin-off companies. Spin-off companies are important vehicles for knowledge and technology transfer and are often supported in various ways by the scientific sector.

## **RECOMMENDATIONS**

Market analyses are necessary to design products and services for industrial users. A specific contact person or group of persons who can act pro-actively as a "liaison office" with a clear strategy and may be profitable. Long-term relationships with industry can contribute to creating spin-off companies as specific needs for products and services become evident over time.

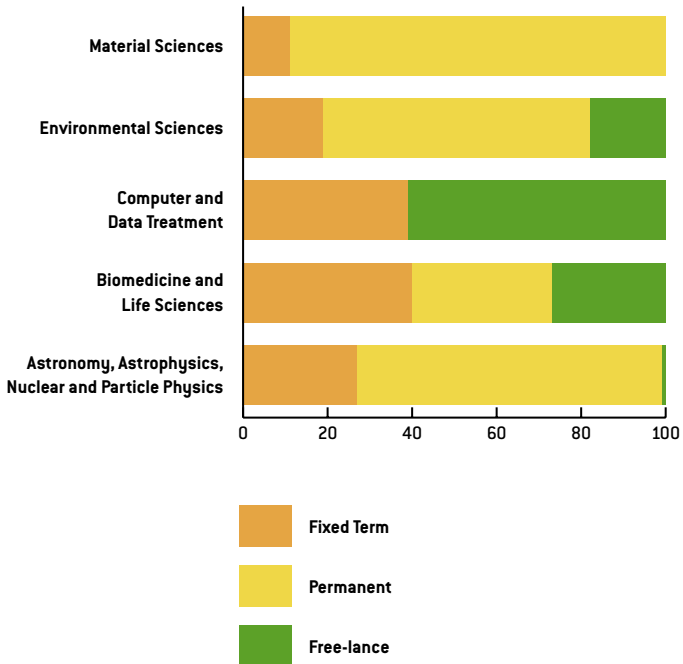
Photo: G. Chapelle / Alfred Wegener Institute for Polar and Marine Research



4

Recruitment difficult,  
and little support  
for mobility

## Employment contracts by scientific sector

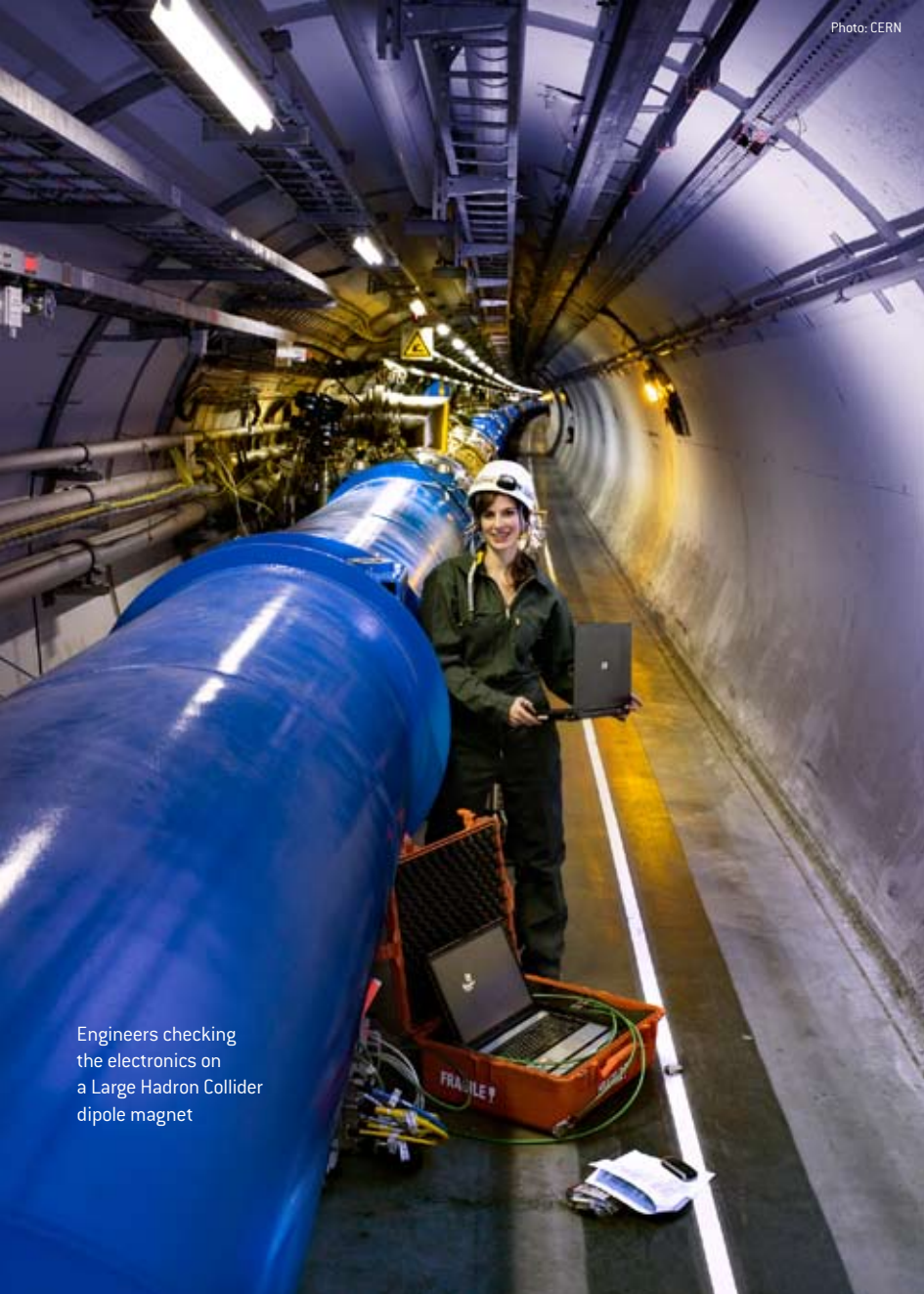


Human resource issues generate discussion in the research infrastructure community. Low salaries compared to industry and fixed-term contracts create difficulties in recruiting operational staff. The interviewees did not mention any exchange programmes for staff between research facilities and industry. Scientific personnel who leave the academic sector for industry seldom return.

The research infrastructures interviewed employ, on average, over 700 persons, with the largest employers found among infrastructures in the sectors of materials science, environmental sciences, and astronomy, astrophysics, nuclear, and particle physics. Between 11 percent and 35 percent of staff are employed on fixed-term contracts, with the least number in the materials science sector. In many places, this is perceived as a major obstacle in attracting employees to research infrastructures.

## **RECOMMENDATIONS**

**On the European level: a standardised social security system for scientists would make a job offer easier to evaluate and avoid risks of losing already gained advantages or conditions. On the local level: exchange programmes and incentive schemes could contribute to the creation of more attractive positions.**

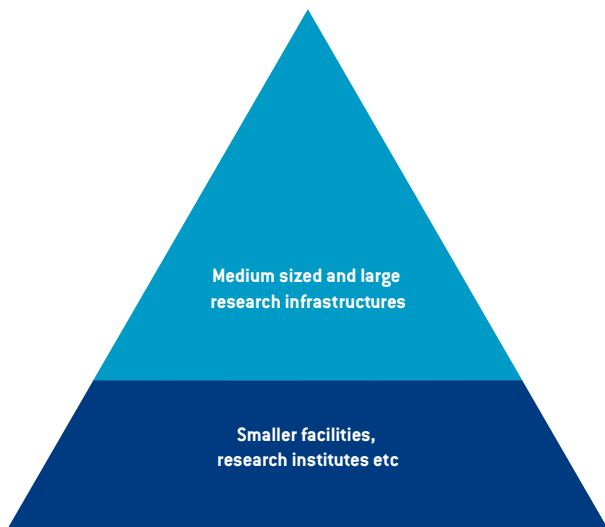


Engineers checking the electronics on a Large Hadron Collider dipole magnet

5

Research  
infrastructures  
premium segment of  
scientific market

**The 300 medium size and large research infrastructures constitute a 8–9 b€ market**



Europe has approximately 300 medium- and large-sized research infrastructures. Viewed as a pyramid, the top layer would consist of extremely large, unique, facilities, e.g. the Large Hadron Collider (LHC) at CERN and – on a global scale – the ITER facility being built in the south of France. The middle layer would include several of the synchrotrons, and the base would include the remaining medium- and large-sized infrastructures from all scientific fields.

Part of the pyramid would also consist of several hundred smaller facilities, working primarily at the national or local levels, but which still play important roles in the European research landscape as resources for the scientific community.

Research infrastructures are perceived to be the premium segment of the "research market" as the requirements of the sector are demanding and challenging, often forming the basis for innovative solutions.

## **RECOMMENDATIONS**

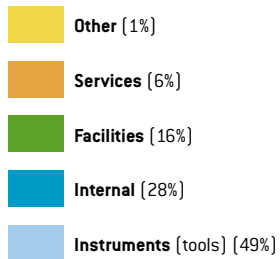
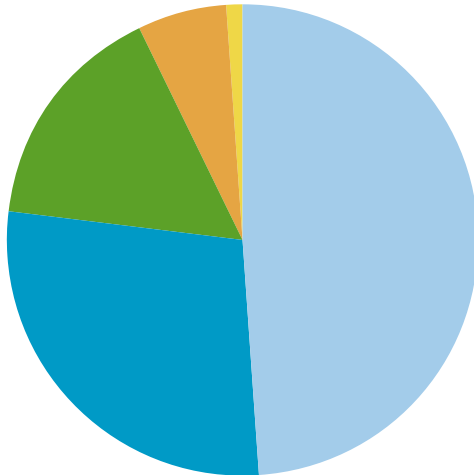
Significant supply opportunities exist for industry in present and future research infrastructures at national, European, and global levels. However, supply and collaborative R&D opportunities need to be better communicated to industry and should be collected in a European portal (e.g. a website repository of data) to increase industry awareness.



6

Research  
infrastructures  
constitute  
a growing market

## Breakdown of expenditure – interviewed infrastructures



Taking inflation into account, the annual budget for existing research infrastructures (excluding ESA) has shown an average increase of 5.5 percent per annum over the past 10 years. In addition, the ambitious development plans, as presented primarily in the ESFRI-Roadmap, add substantial budgets for construction and operation of several new research infrastructures. Opportunities for industry to be suppliers to planned ESFRI facilities and to new national research infrastructures are expected to expand this market substantially in the medium term.

The total annual budgets of European research infrastructures are in the region of 8 to 9 billion euros (b€). An estimate of the total annual budget for instrumentation procurement by the European research infrastructures is approximately 4.0 b€. This is expected to grow in the short to medium term. The instrumentation market thus constitutes about half of the total budget.

## **RECOMMENDATIONS**

Industrial suppliers should pay close attention to prospective sales opportunities in the research infrastructure market since this domain is expected to grow considerably in the short to medium term.

Photo: J. Fickert / Alfred Wegener Institute for Polar and Marine Research

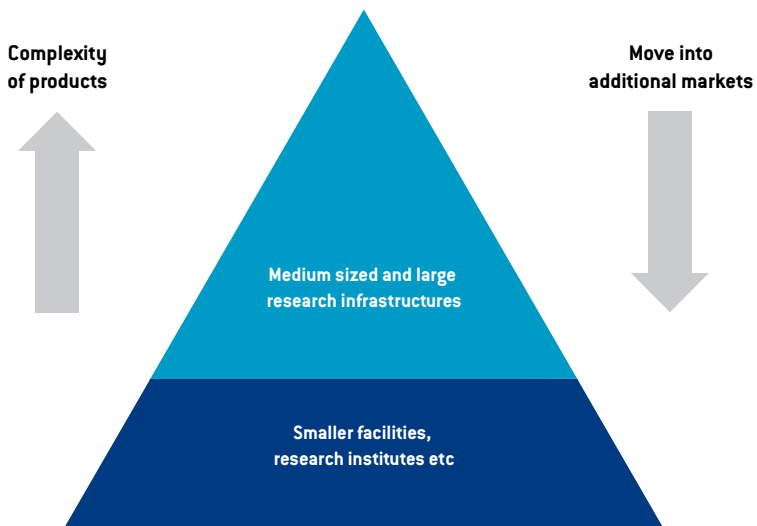


Neumayer Research Station in the Antarctica



**Companies benefit  
from diversity and  
research infrastructure  
experience**

## Suppliers to infrastructures experience benefits in sales to other markets



Almost two thirds of the interviewed companies involved in collaborative R&D contracts reported that company activities in other market segments have benefited from experiences and technologies first developed for research infrastructures. Companies report that advanced technology developed in cooperation with research infrastructures may be key factors for further economic development in other markets on a global scale.

Concurrently, both large companies and small and medium-sized enterprises (SMEs) that work successfully with research infrastructures are often active in multiple sectors of industry, indicating that a diverse range of products and services is attractive to research infrastructure procurement offices. Also, SMEs report positive reactions on offers to deliver complete systems, rather than specific parts.

## **RECOMMENDATIONS**

Companies should look for opportunities to incorporate complementary technologies in their product portfolio to become more competitive systems suppliers. This can also be viewed as investing in global market development.

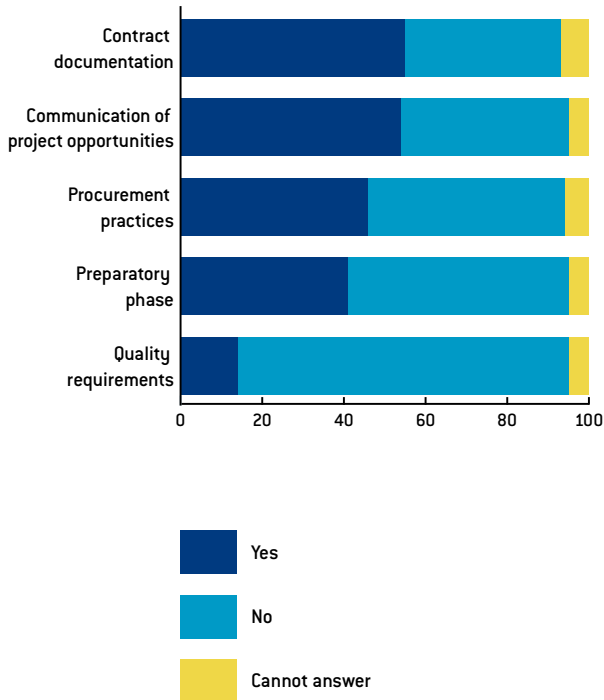


Experiment with free electron laser FLASH at DESY

8

Procurement practices,  
documentation,  
and communication  
can be improved

## Can improvements be made regarding contracts, practices etc?



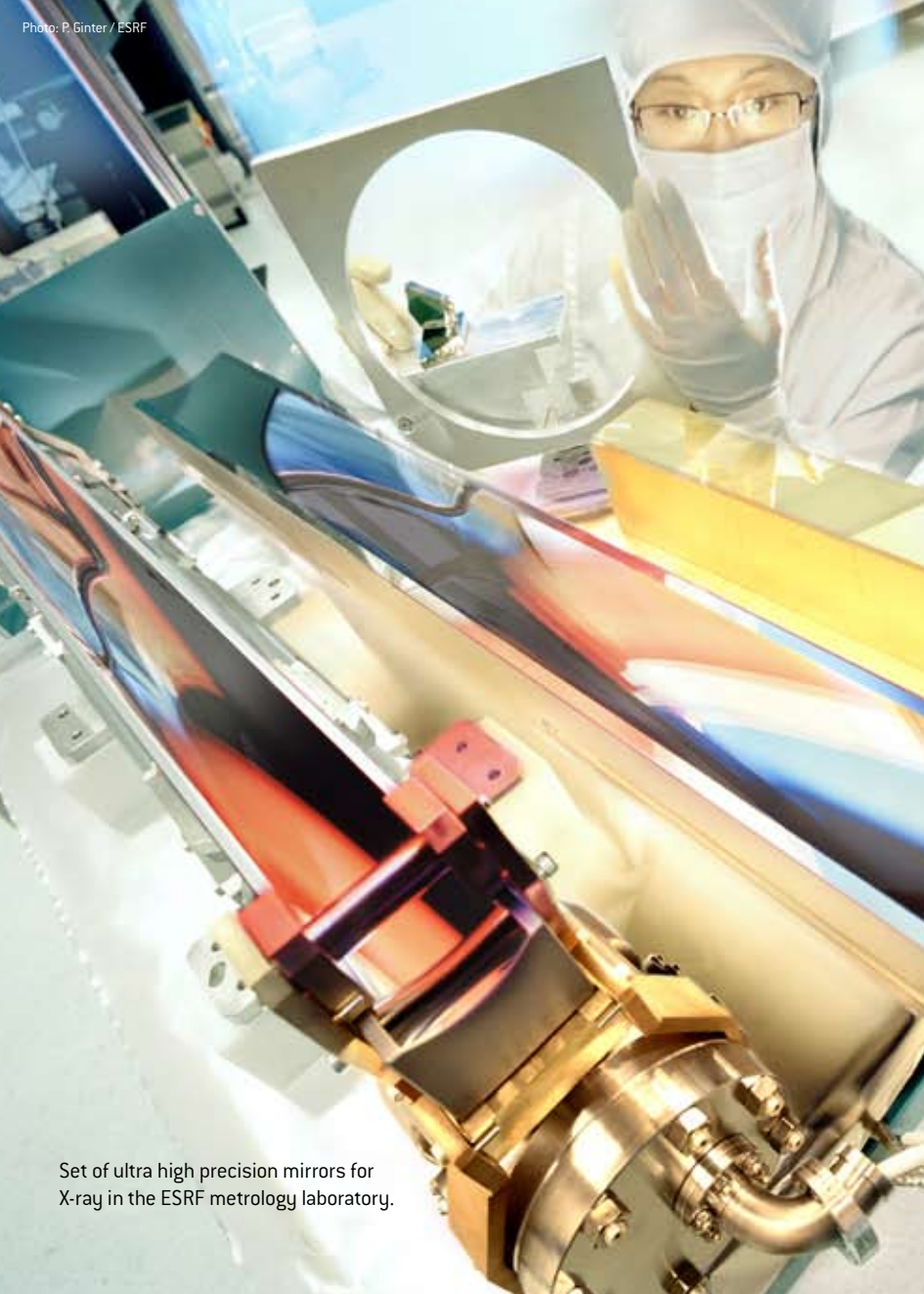
Suppliers believe that their interactions with research infrastructures could improve in the areas of contract documentation, communication of sales opportunities, preparatory phases, and procurement practices in general. Approximately half of the interviewed companies responded that these areas are most important. Eighty-five percent of the companies regarded the quality requirements to be sufficiently documented and needed no further information.

However, procurement processes are complex and diverse across the range of research infrastructures surveyed, adding to the complexity of the market. Full harmonisation is unlikely to be possible, but industry representatives would welcome steps towards greater comparability and transparency. Simpler procurement rules would be desirable, not least for small and medium-sized companies.

Procurement practices could also involve discussions on risk sharing concerning the technology to be developed. Many companies are prepared for and interested in relationships beyond the conventional customer-supplier form.

## **RECOMMENDATIONS**

Procurement practices in several areas should be improved. Information on the specific situations and needs of research infrastructures could be distributed through European and national exchange forums.

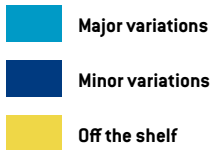
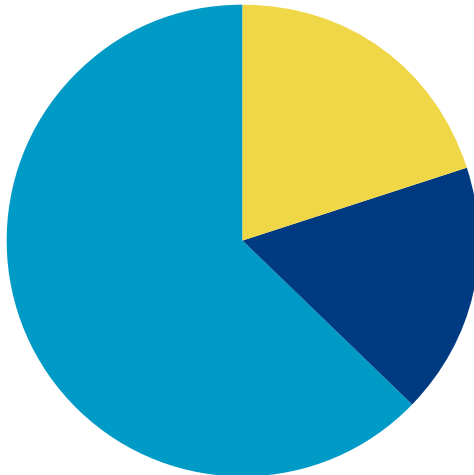


Set of ultra high precision mirrors for X-ray in the ESRF metrology laboratory.

9

Early involvement  
decreases risk of  
technology  
show stoppers

## Categorisation of products sold to interviewed infrastructures



Technology show stoppers are the technologies that future research infrastructures require to achieve their scientific objectives, and where industrial involvement is often necessary. The study rarely identified technology show stoppers, mainly because the decision on a technical platform either had not yet been taken or had already been solved.

The window of opportunity to address technology show stoppers is limited, but could occur on several occasions during the design and construction of a research infrastructure. To optimise the construction process, it is important to identify these needs for technology development at an early stage.

## **RECOMMENDATIONS**

It is reasonable to expect that funders and research infrastructures will benefit from creating partnerships with industry at an early stage of planning, not least for potentially necessary technology development.

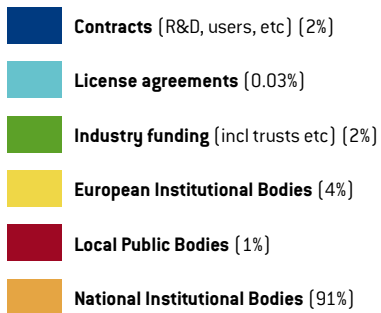
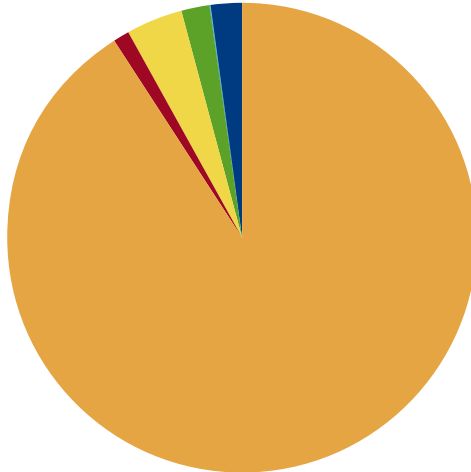


The European Social Survey (ESS) is a study designed to measure Europeans' attitudes, conceptions, and behaviour.

10

**Networking  
may be the road  
to success**

## Contribution breakdown – interviewed infrastructures



On a European scale, research infrastructures reveal a fragmented pattern of industrial contacts, intellectual property rights (e.g. patents and licences), and support for spin-off companies. The study noted some country-related differences, e.g. Germany and the UK report more patents per employee than do other countries.

Industrial companies are in favour of developing viable, communicative, and trusting relationships with research infrastructures for long-term cooperation. This includes involvement in the early planning stages to foresee needs for technology development and adapt industrial capacities.

The research infrastructures themselves emphasise the importance of networking and indirect marketing at scientific conferences and similar events.

## **RECOMMENDATIONS**

It is essential to increase knowledge about the research infrastructures' market, not least among small- and medium-sized enterprises. This can be done in several ways. Good examples include the existing national and European exchange forums, e.g. KTN in the UK.

# ERID Watch team

## main partners

### **CEA, Commissariat à l'Énergie Atomique, France**

Philippe Lavocat, *coordinator 2007–2008*  
Jean-Pierre Caminade, *coordinator until 2007*  
Christine Porcheray  
Odile Bourdoiseau

### **DESY, Deutsche Elektronen-Synchrotron, Germany**

Karsten Wurr  
Katharina Henjes-Kunst

### **STFC, Science and Technology Facilities Council, UK**

Peter Fletcher  
Penny Woodman  
Victoria Wright

### **VR, Vetenskapsrådet, Swedish Research Council**

Finn Karlsson  
Jan Riise

### **Institute of Experimental and Applied Physics, Czech Technical University**

Ivan Stekl

### **Nenner Conseil, France**

Irène Nenner

### **Work Package 1, "Benchmarking"**

Karsten Wurr,  
Katharina Henjes-Kunst and  
Katja Kroschewski  
All from *DESY, Germany*

### **Work Package 2, "Market studies"**

Peder Bylander,  
Nathan Hill and  
Craig Sawyers  
All from *Qi3, UK*  
Gildas Bouffaud,  
Claire Noël Bigay and  
Sylvie Joly  
All from *CEA-BEM, France*

### **Work Package 3, "Dissemination"**

Jan Riise, *Vetenskapsrådet, Sweden*  
Christian Mrotzek, *DESY, Germany*

# Partners

coordinator:



**nenner.conseil**



**Vetenskapsrådet**



**Science & Technology  
Facilities Council**

ERID Watch is a Coordination Action that aims to mutually improve the policy mix of the Member-States in order to increase the public investment efficiency for European Research Infrastructures and develop Public/Private Partnership (PPP) in this context. It is funded under the 6th Framework Programme.



**European Research Infrastructure Development Watch**

[www.eridwatch.eu](http://www.eridwatch.eu)