EUROPEAN COMMISSION

Third European Conference on Research Infrastructures

Nottingham, UK - 6 and 7 December 2005

Main Conclusions
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Development of scientific and technological research capacities:
research infrastructures

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Foreword

Robert-Jan Smits and John Wood

Europe's centuries-old tradition of excellence in all fields of science and technology has always been fostered by state-of-the-art support to its scientists.

Whether national facilities or intergovernmental research organisations, localised in strategic positions both within and outside Europe, these research infrastructures are at the forefront of technology. To push forward the boundaries of knowledge, to provide new products or new medicines, such infrastructures continuously renew and upgrade themselves, and new ones are continuously planned, a process which in itself generates new knowledge, new technology with a very real impact on the everyday life of the European citizens.

The Commission and the Member States, however, are not resting on their laurels. To meet the needs of its scientific community, to keep Europe at the forefront of science and technology, to build and increase capacity in Europe, action is needed.

The Third European Conference on Research Infrastructures was one of many steps in this direction

In both plenary and parallel sessions, themes of relevance to research infrastructures in all fields of science were addressed, such as the challenges posed to both policy-makers and the scientific community by the increasing need for new research infrastructures at international (global) level, or the important aspect of capacity building in Europe. During the two days of the conference it was possible to discuss issues of particular importance to users in fields ranging from physics, engineering and space sciences to environmental, medical, and socio-economic sciences.

The conference was attended by 350 research policy planners, senior managers of research infrastructures and researchers, and brought a significant contribution to the debate on the future of research infrastructures in Europe.

Robert-Jan Smits
Director, Structuring the ERA
European Commission DG Research

John Wood
ESFRI chairperson

Programme

Day 1

[6 December 2005]

Opening

With the participation of

- Professor Sir Colin Campbell – Vice Chancellor of the University of Nottingham
- Sir Keith O'Nions – Director General of the UK Research Councils representing the British Presidency of the EU
- Commissioner Janez Potočnik – EU Commissioner for Science and Research
- Mr. Jerzy Buzek – Member of the European Parliament, Member of ITRE (Committee for Industry, Research, Energy)

The international dimension of research infrastructures: managing the emergence of new Research Infrastructures

Parallel sessions

Day 2

[7 December 2005]

■ Capacity building in Europe: actions towards pan-European research infrastructures

■ Parallel sessions

User needs in physics and engineering: pg 8
- development of multi-user analytical facilities

User needs in environment: pg 12
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- the case of earth monitoring, including global climate change and biodiversity

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The international dimension of research infrastructures: managing the emergence of new RIs

Participants:

Robert Adam, Director General, Department of Science and Technology, South Africa;
Mitsuhiro Nemoto, Director for Research, Environment and Industrial Cooperation, MIST, Japan;
Carol Nicoll, Department of Education, Science and Training, Australian Government, Australia;
Sir Keith O'Nions, Director General of the UK Research Councils, UK;
Raymond L Orbach, Director of the Office of Science, DOE, USA.

Raymond ORBACH

Science is without borders, and it is the scientist's everyday experience to forge working collaborations with peers anywhere in the world, if the political and social situation allows it. As the frontiers of science are pushed back, research infrastructures are also increasingly becoming more complex and more expensive, to the point where a single government, or indeed a single continent, cannot find within itself the financial resources for their realisation. The construction and management of new research infrastructures thus become a global endeavour. Aligning funding cycles and priorities, setting up governance structures, concluding political negotiations on site-selection issues are only a few of the unique challenges that policy-makers face due to the emergence of international research infrastructures. In this section, an overview is given of how this process is seen from four players outside Europe, namely the United States of America, South Africa, Japan and Australia.

The views of third countries

The USA's 'Twenty Years Outlook' from the Department of Energy's Office of Science is a classic case of how priorities for large-scale research infrastructures should be set to ensure the growth of a country in terms of technology, innovation and knowledge. Continuing the traditional American policy of openness, these new or upgraded facilities will serve a wide range of scientific communities not only in the USA, but also throughout the world. Some of them, like ITER and the international Linear Collider, will be global projects from the start.

A complementary and fresh perspective on the emergence of new infrastructures of international relevance is given by South Africa. Collaboration and possibly hosting for new research infrastructures (such as large telescopes in Namibia - HESS) is seen as an indispensable tool for national growth, in terms both of material wealth and of knowledge and education and, as such, is indispensable for any developing country. On the contrary, disciplines apparently detached from worldly concerns, such as astronomy, can be important to foster technological advancement and attract the young to further education and to pursuing an academic career.

See also CD-Rom

Japan has always traditionally invested in S&T development, and has developed a unique partnership between industry and academia for research. This tradition is set to continue in the future, with steady investment and the next-generation large-scale infrastructures in the pipeline. Investment is going to concentrate on facilities with a large multidisciplinary user community. Particular emphasis is given to the development of a peta-scale supercomputer and on the Earth Simulator which is going to be applied to a wide range of problems.

The Australian perspective to the development of new large-scale facilities is naturally focused on its unique geographical position. The Australian government is also engaged in the development of a roadmap, with criteria broadly similar to those of the other major international players. Participation in international projects is seen potentially as key to accessing state-of-the-art facilities, especially in those disciplines where the Australian scientific community is traditionally strong or where there is potential for growth.

CONCLUSIONS

Within the limits of national budgets for science and technology, priorities must be set for funding new research infrastructures, and different funding agencies are thus engaging in or have just completed a process not unlike that undertaken by ESFRI to establish a roadmap for new facilities.

Criteria may be adapted to the local requirements, but the fundamental principles are the same: scientific excellence through a strong peer-reviewed science case, a large community backing it, a demonstrated need for this new facility to make significant progress in the field, the potential for growth and innovation, and the potential beneficial impact on local communities and on fostering a knowledge-based society.

It is generally recognised, however, that the increasing complexity of the next generation of large-scale research infrastructures needed to make significant new discoveries in any field of science is likely to impose that some will comprise an international effort from the outset, such as ITER, both in terms of human resources and capital investment.

The challenges that this poses to international funding agencies should not be underestimated, in terms of synchronisation of funding cycles and decision-making processes, of site selection, and of governance and management. This led to the final conclusion that there is a need for senior policy-makers from Europe, the USA, China, Africa, Japan, India, Russia and other major players to meet regularly to take stock of these projects which will serve our planet and societies as a whole. The European Commission is encouraged to continue its catalysing efforts in this domain.

Physics and engineering

Participants:

Massimo Altarelli, DESY, DE; **Michel Blanc**, CESR, FR; **Carlo Rizzuto**, ESFRI; **Hervé Consigny**, ONERA, FR; **John Renner Hansen**, University of Copenhagen, DK; **Wolfgang Kaysser**, GKSS Forschungzentrum, DE; **Rainer Koepke**, Federal Ministry of Education and Research, DE; **Norbert Kroo**, Hungarian Academy of Sciences, HU; **Rudy Lauwereins**, IMEC, BE; **Bruno Leibundgut**, European Southern Observatory; **Hervé Pero**, DG RTD, European Commission; **Denis Raoux**, SOLEIL, FR; **Richard Schilizzi**, International SKA Project Office, NL.

Carlo RIZZUTO

Traditionally, Europe has always been strong in the physical sciences, both at university level and in large institutes of European or world-wide relevance. The physical and engineering sciences are one of the pillars of the knowledge-based society and, as such, it is important that its growth is fostered and encouraged. Progress in the physical sciences and engineering however also comes with a high price tag: increasingly, individual Member States recognise that they do not have the resources to build and run the next-generation large-scale infrastructures needed to make significant progress in the field. We are then assisting an evolution in the way the next generation of research infrastructures of European relevance for physics and engineering are conceived and built, as a European, and sometimes worldwide, joint venture.

Astronomy and space sciences

Astronomy and space exploration are fields of science which, like no other, touch directly the mind and the heart of the average citizens, However, they are also very technology driven, and need the continued development of new cutting-edge technologies which ultimately will also benefit the European citizen. For the European astronomical and space community to remain globally competitive, key needs have been identified both in terms of new facilities and services. The next-generation observatories are clearly an ELT and the SKA, with strong and continued support to ESA's exploration of the solar system; further opening of access to "service collected" data, long-term planning and predictability of commitment, better coordination between space and ground facilities; advanced analysis tools, intensive data analysis and flow, enabling technologies; and continued efforts in educational and public outreach.

Development of multi-user analytical facilities

Synchrotron and neutron sources, lasers and FELs are apparently very different, and they serve a broad scientific community that needs beams of different wavelengths and energies according to the objects under investigation. From fundamental physics to crystallography,

See also CD-Rom

to biology and pharmacology right through to nanomaterials and archaeology, multi-user analytical facilities are the most versatile tool at the disposal of the researcher and should be more readily available to them. Open access is required; good use must be made of specificities-complementarities through networking and more integrated schemes; use should be increased through interface laboratories or programmes; development of detectors, instruments and numerical tools should be continued; and nanotechnology should be integrated as an important multipurpose user.

Engineering sciences

Sustainable growth in Europe also depends on its ability to create and exploit new technologies, products and services. Engineering development therefore goes hand in hand with scientific endeavour. Important aspects for engineering are test beds for new technologies – instrument spin-offs and communication between technology platforms and various high-tech infrastructures. Research infrastructures should be organised in public-private partnerships, while the opening of industry-owned infrastructures to public research is seen as an important advantage for both sides.

CONCLUSIONS

The European scientific community in physics and engineering requires state-of-the-art infrastructures and application of cutting-edge technologies that are increasingly beyond the financial means of one individual nation. Increasingly, research infrastructures are seen as a European, and sometimes international, joint venture, with its challenges and potential rewards.

Technology transfer, spin-offs of R&D as well as education and public outreach are very real contributions the physical and engineering sciences make to the European knowledge-based society, thus helping to reach the Lisbon objectives.

Existing infrastructures should not be forgotten: better and more open access to existing and potential new user communities, better coordination and exploitation of existing complementarities and of multidisciplinarity are common themes.

Exploitation of existing and future research infrastructures also demands intensive investment in the tools needed to use these facilities: state-of-the-art detectors and instrumentation should not be forgotten, together with better and more powerful analysis tools, software and hardware development for data analysis and flow.

Nowadays, the physicist and engineer is one of many collaborators spread across the planet – the solitary pursuer of knowledge carrying out experiments in a laboratory within a small group is very much a thing of the past. Sharing knowledge, forging links with peers throughout the world, accessing facilities outside national borders, being members of big collaborations undoubtedly have their benefits, especially for young researchers. Nevertheless, the individuality and creativity of the single scientist should also be encouraged.

Clinical research and biomedical sciences

Participants:

Jan Marek, Research and Development Council, CZ; **Jean-Emmanuel Faure**, DG RTD, European Commission; **Christian Bréchot**, INSERM, FR; **Stephan Günther**, Bernhard Nocht Institute, DE; **Richard Frackowiak**, University College London, UK; **Graham Cameron**, EMBL, UK; **Lucia Banci**, (CERM) University of Florence, IT; **Jaanus Pikani**, University of Tartu, Estonia, **Ruth Barrington**, ESFRI.

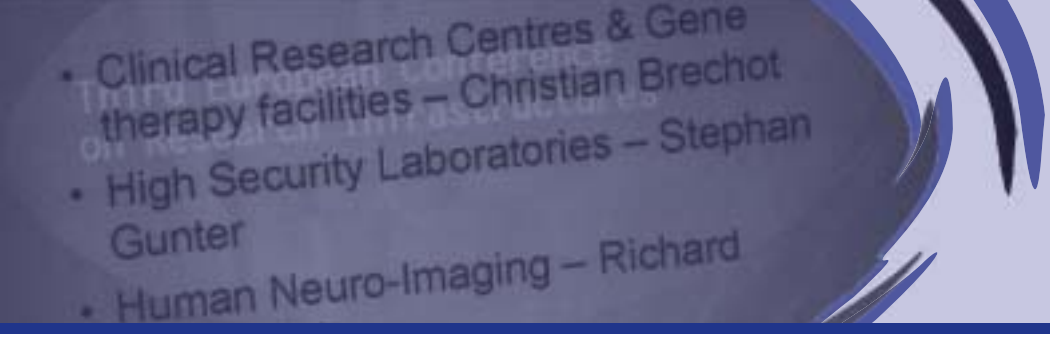
Ruth BARRINGTON

Life sciences have undergone dramatic changes during the last 15 years with the wide spread application of molecular biology in almost every research laboratory, and with the refinement of imaging tools on all scales. These elements, together with other very fast technology developments, now directly impact the needs of researchers for research infrastructures. In a field where new discoveries often lead to new treatments and new drugs with patents and industrial interests, it is critical to answer these needs continuously. The two sessions devoted to biomedical research consisted of six presentations and, as such, were unable to cover all the needs for research infrastructures in this vast field. However, the six presentations and linked discussions did allow a number of clear and important conclusions to be drawn on horizontal issues relevant for the building/upgrading of capacities in the years to come.

Main horizontal issues

It would appear from the various presentations that infrastructures for biomedical research are no longer small projects in terms of investments, maintenance costs and time frame. This seems to be even more the case given that user needs are increasing quickly. Access time to instruments for resolving molecular structures is one example of such a rapid increase. Another example shows the amounts of biological information generated by the scientific communities, from gene sequences to brain images, increase exponentially. Bio-informatics is thus becoming a critical component of many projects (see box).

These rapid increases lead to a number of major challenges. First, project structuring must be fast, and funding bodies must be responsive. Fast actions will be instrumental in not missing opportunities in areas where Europe is or can be a leader, e.g. bio-banking and bio-informatics. Also, types of financial support need to be established for long-term periods in order to preserve and curate data in the long run.



See also CD-Rom

The projects for maintaining research infrastructures, upgrading or constructing new ones are advanced more or less depending on the scientific communities. Some dedicated centres with strong infrastructural commitments already exist in Europe, such as the European Bio-informatics Institute (EBI-EMBL). Some other single-sited infrastructures are under construction, like the 'NeuroSpin' imaging centre near Paris, with the scientific case being strongly supported by scientists from other European countries. Alternatively, other projects comprise networks either needing to be enlarged, such as the 'ScanBalt' initiative in the domain of bio-banks, or currently under establishment, e.g. 'ECRIN' (European Clinical Research Infrastructures Network). In some specific fields, structuring still requires further work, with position papers to be prepared, such as under the Forum for European Structural Proteomics.

CONCLUSIONS

A clear message from these two sessions on biomedical research infrastructures is that one size/format of infrastructure does not fit all, and that rapid actions are required. Approaches to be followed in this vast field of science must be kept diverse and flexible. The format should range on a case-by-case basis from centres that are single-sited but with a strong European dimension, to networks of distributed sites, and up to linked centres of excellence. The participants stressed the need for including training and education as a strong component of the infrastructure projects. They stated that having local human competence in research topics strongly interlinked with the infrastructural aspects is instrumental. Infrastructures are indeed strongly dependent on technology developments which occur rapidly, such as imaging techniques, NMR instruments, sequencing methodologies or phenotype protocols. In all cases, the discussions outlined that all major upgrades or new infrastructures to come, with a clear European dimension, will need to be accessible Europe-wide.

→ The growing importance of Bio-informatics

Life sciences generate a vast array of data from molecules to systems. It is essential to collect, archive and curate these data as a few hours of computer work comparing sequences, expression profiles and others now can cut years of lab work. For example, all the European Bio-informatics Institute (EBI) databases have captured data from several billion euros worth of science, and they now serve a research community of perhaps a million users in all fields of biology. This extremely broad usage from academic science to industry is crucial to human well-being, from medicine to agriculture. Europe is a strong component of a worldwide effort towards preserving data and developing bio-informatics tools. However, there is an exponential increase of the amount of data to be stored and curated – a new nucleotide sequence is entered in EBI databases every second. Not only must this rapid increase in volume be faced, but database interconnections must also be maintained or established. In particular, one major challenge in years to come will comprise being able to link data, such as gene sequences, molecular structures or brain images, with clinical/patient information.

Marine sciences, geosciences, earth monitoring and biodiversity

Participants:

Sylvie Joussaume, CNRS, FR; **Eeva Ikonen**, Academy of Finland, FI; **Roy H. Gabrielsen**, Research Council, NO; **Catherine Maillard**, IFREMER, FR; **Domenico Giardini**, Swiss Seismological Service, CH; **Jochem Marotzke**, Max Planck Institute for Meteorology, DE; **Hervé Jeanjean**, (CNES) OASIS, FR; **Vanessa Pike**, The Natural History Museum, UK.

Eeva IKONEN

The importance of earth sciences is illustrated by the intensity of the discussions on global climate change occurring at different levels, from that of the ordinary citizen to the highest political sphere. Understanding Earth, monitoring it and predicting its change, require the study of space, surface and underwater systems and parameters. The presentations from the two sessions on user needs in environment clearly highlighted that aircraft, satellites and ships are necessary components for doing so, but are not enough. Some very important tasks are also carried out by field campaigns and through observation platforms, such as the polar stations. Also, ecotrons and collections in natural history museums are needed. Such collections should indeed be viewed as true repositories of biodiversity on our planet, with the possibility of bio-monitoring climate change through species distributions, or by the spread of invasive species and disease vectors in Europe. In other words, natural history collections can be viewed and used as good models of earth's biodiversity over time.

All these facilities and platforms must be complementary. They need to be integrated into very complex overall subsystems and global systems in order to face the diversity and extension of space and time on which studies must be made. A good example is probably the study of polar regions, as was presented during these sessions. Indeed, this requires a flexible system of observation platforms and modelling tools that includes moveable platforms such as ships, drifting buoys, satellites, aeroplanes and balloons, combined with ground-based installations like fixed buoys and automatic or manned observation stations. In other domains, such as marine and seismic monitoring, integration is especially critical, with hundreds of parameters being measured by hundreds of laboratories using sensors installed on the research fleet and other platforms.

See also **CD-Rom**

CONCLUSIONS

Due to the complexity of these infrastructures, and the very high investments necessary, national states cannot carry such loads alone. International co-operation, long-term planning and merging of scientific forces and abilities are therefore becoming essential, even more so as many studies now require observations that span over vast territories and ecosystems. In that regard, the European Strategy Forum for Research Infrastructures (ESFRI) should induce a better and more permanent coordination between national facilities, and push for best practices. In particular, it should help to facilitate the accessibility of data collections beyond state boundaries, and to open the proprietary networks (strategic, national, and commercial).

However, coordination and networking are not enough. New infrastructures and installations are also needed, which are not necessarily single-sited, very 'visible' infrastructures. For example, major new requirements are linked to the need for supercomputing. Data analysis, synthesis of the measurements and the consequent modelling and conversion into predictive capabilities require enormous new computational resources, in terms of both hardware and software. In addition, all information and data collected need to be archived in the long term.

User needs in socio-economic sciences and humanities, including cultural heritage

Participants:

Bjørn Hendrichsen, Norwegian Social Science Data Services, NO; **Kevin Schurer**, UK Data Archive, UK; **Roger Jowell**, City University, London, UK; **Tamas Varadi**, Hungarian Academy of Sciences, HU; **Jana Kolar**, National and University Library, SI.

Bjørn HENDRICHSEN

Social sciences and humanities cover a large range of disciplines, some vastly different from each other, but all equally important for the tissue of European society. It may be argued that the research infrastructure requirements of this broad area are very different from other scientific fields. They may, however, share a distinct set of infrastructure needs centred on resource discovery, creation, sharing, access and preservation. In this session, critical examples from sociology, linguistics and cultural heritage explored the status of research infrastructures in their respective areas of competence, their particular requirements, and what needs to be done in terms of infrastructures.

Assessing research infrastructure needs in the social sciences and the humanities

The European Research Observatory in the Humanities and Social Sciences (EROHS) model was presented. It has been suggested that this theoretical model, building initially on existing infrastructures, might serve to create greater interoperability and a basis for an enhanced information environment for the European Research Area.

The European Social Survey – a new research infrastructure

The European Social Survey, winner of the Descartes Prize 2005, is a biennial multi-nation survey designed to measure changing attitudes and values throughout Europe and to set up a European reference database.

See also CD-Rom

It aims to contribute to the development of European social indicators. Its methods are rigorous and all its activities and protocols are transparent and widely disseminated. Its first-round dataset has already attracted 7 000 users and its second round has now been deposited. The project is on the ESFRI list of opportunities of 2005.

Language technologies - underlying technologies for RIs in the social sciences and humanities

The importance and potential of language technologies in facilitating research infrastructure for conservation, digitisation analysis and dissemination of cultural heritage and social science results has been discussed. Language is undeniably the modality of choice in seeking access to data and conducting popular as well as professional debates. Language technologies and related research infrastructures present key enabling technologies to process textual data.

Research infrastructures for cultural heritage

For years, synchrotrons, lasers and neutron sources have played an important role in cultural heritage preservation. However, the inherent features of cultural heritage make it unique in its analysis. In many cases, research equipment should be brought to the site to enable advanced research. Our cultural heritage thus requires an approach whereby large RIs are complemented with specific instruments to serve the uniqueness of a non-renewable source.

CONCLUSIONS

In social sciences and humanities, the fragmentation of the scientific argument is an obstacle to the cases for new infrastructures. This means that this large community has more difficulties than others in agreeing and expressing their research infrastructures needs. There is also a big concern related to data, information and knowledge which are scattered in space and divided by language and institutional barriers. More than ever there is an urgent need to pool efforts, better coordinate the potential of the existing research infrastructures, and to work together on identifying the needs for new ones.

User needs in IT and information infrastructure: facing increasing needs for high-capacity virtual infrastructures

Participants:

Ulf Dahlsten, DG INFSO, European Commission; **Malcolm Read**, Joint Information Systems Committee, UK; **Vasilis Maglaris**, National Technical University of Athens, EL; **Andrea Granelli**, Fondazione Rosselli, Italy; **Richard Boulderstone**, British Library, UK; **Peter Tindemans**, KB Task Force on the Preservation of Science, NL; **Luigi Fusco**, European Space Agency, Italy; **Maggie Jones**, Digital Preservation Coalition, UK; **Dany Vandromme**, RENATER, FR; Liz Lyon, University of Bath, UK; **Henk Harmsen**, Data Archiving & Networked Services, NL; **Manuel Delfino**, Port d'Informació Científica (PIC), SP; Brindley, British Library, UK; **David Nicholas**, University College London, UK; **Leo Waaijers**, Platform manager ICT and Research, SURF, NL; **Robert Campbell**, Blackwell Publishing, UK..

Generic challenges of e-Infrastructures

E-Infrastructures have been presented as very complex fabrics; to build and maintain them requires that special attention be given to a number of complementary aspects which include networks, computers, access controls, middleware, finding tools, digital libraries and research information and data. GÉANT and Grid Infrastructures, with their global dimension, address both the needs of individual researchers (millions) and support the demanding requirements of e-Science projects. However, there was a perception that such infrastructures should reach out further to new communities: libraries, learning, health, administration. Furthermore, more needs to be done on HPC (capability computing at peta-scale performance) and aspects of Authentication and Authorisation mechanisms should be continuously stressed. In the area of digital archives, the need to support the deployment of a shared European infrastructure was identified; in this process, the adoption of critical technologies, the availability of new competences and new design paradigms were considered as key.

Data preservation

Beyond the three more 'classic' aspects of e-Infrastructures (network, grid, supercomputers) Europe needs to address data preservation as an infrastructural element. Long-term preservation of raw data and data correlation are fundamental aspects of a broad set of communities. There are several examples of national organisations that are enhancing the digital preservation capacity of the Member States. However, it is vital to ensure a pan-European dimension to this work. The UK Digital Preservation Coalition (DPC), should not be seen as a 'simple' technical infrastructure as it addresses the more complex and rich set of social and organisational issues related to preservation.
In this domain, gearing up at European level can best be done by focusing on 'records of science', as there is good momentum around these activities, currently experimental in a broad set of scientific fields. The adoption of the principles underlying the concept of "records of science", e.g. in digital cultural heritage, leads to an evolution that can be characterised as going from 'records of history of science' to 'records of science in operation'.

See also CD-Rom

Ulf DAHLSTEN

Data curation

Data curation was identified as a key element in a reinforced e-Infrastructure strategy. Its requirements stem from all the important phases of the scientific cycle (from data creation/capture/collection, to knowledge extraction/data mining/modelling/analysis/synthesis). A crucial aspect of data curation (conceived as an enrichment virtuous cycle) is the generation of added value to a trusted body of digital information for current and future use. In searching for a European solution, UK Data Curation Centre (DCC), Dutch Data Archiving and Networked Services (DANS) and Spanish Port d'Informació Científica (PIC) are very relevant examples as they already address global challenges embodying a large number of innovative concepts.

Scholarly communications

The definition of a strategy in the domain of scholarly communications needs to be based upon evidence – the reason why a study has been presented evaluating the behaviour of millions of users in accessing digital libraries. The digital consumers and their behaviour should be the driving forces.
The example of the Dutch DARE (Digital Academic Repositories) shows that it is possible to deploy digital academic repositories in practice, through an innovative approach, with the support of researchers and encouraging open access. A political 'push' through, for example, a 'European Charter on open access to publicly funded knowledge', stating the principle and defining the responsibility of universities and research institutes could play an important role.

CONCLUSIONS

Current deployments in the area of e-Infrastructures give Europe a leading position and open new avenues to be further exploited in FP7. In this context, Europe needs to provide the scientific community with world-class high-end computing capability, to deploy storage facilities able to generate value for researchers, to support the deployment of digital archives (in which digital repositories of scientific information could be front runners), to preserve, curate and facilitate open access to scientific results, and to deploy pan-European reinforced AAA mechanisms. It is expected that the best results for Europe can be achieved by addressing, in a coherent way, the deployment of new infrastructures (e.g. HPC) and the incremental and continuous evolvement of 'virtual' infrastructures. Building on the successful work done by early adopters (e.g. high-energy physics and biology communities), a new set of communities (e.g. humanities and social sciences) is showing a greater interest for e-Infrastructures, raise very sophisticated requirements. Europe has to achieve a set of competences, experience and national/organisation initiatives in the field of e-Infrastructures, to guarantee the success of future European endeavours.

Policy and management

Participants:

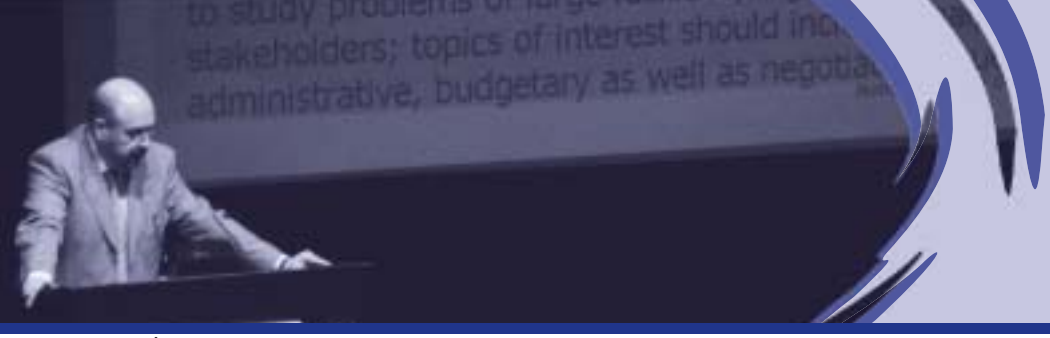
Carlos Alejaldre, Ministry of Education and Science, ES; **Felix Amberg**, Hagerbach Test Galleries, CH; **Colin Carlile**, Institut Laue-Langevin, FR; **Eckardt Elsen**, DESY, DE; **Costas Fotakis**, Foundation for Research and Technology, EL; **Jacek Gierlinky**, Ministry of Scientific Research & Information Society Technologies, PL; **Eeva Ikonen**, Academy of Finland, **Joergen Kjems**, RISØ National Laboratory, DK; **Robert McGreevy**, Rutherford Appleton Laboratory, UK; **Jean-Jacques Mertens**, European Investment Bank; **Yves Petroff**, Ministère de la Recherche, FR; **Carlo Rizzuto**, ELETTRA, IT; **David Schildt**, CCLRC, UK; **Anneliese Stoklaska**, Ministry for Education, Science and Culture, AT; **Hervé Péro** and **Robert-Jan Smits**, DG Research, European Commission.

Towards better coordination between Member States

A common strategy is needed, whereby different countries with similar scientific priorities get together to explore the possibility of funding actions together. Different ways to approach the problem have to be explored, such as ERANET as a possible scheme for coordinating the work of public authorities or for analysis of preparatory work; the increasing role of the 'open method of coordination' as developed by ESFRI in shaping Europe's future for RIs; the strong potential of Community research actions, such as the I3s, to support not only coordination but also integration of resources; and the need for synchronisation of financial instruments linked directly or indirectly with research, such as the Structural Funds.

Optimising the use of research infrastructures

Europe already has a wealth of world-class infrastructures but, are existing resources managed and used in an optimised way? The discussion was based on different case studies which highlighted that the current facilities need to be made available to a wider range of researchers and communities, the underpinning issues being the lack of awareness of the benefit of using such facilities and the costs of using them. This includes not only the 'large-scale infrastructures' such as synchrotrons, but also the existing extensive networks of data-collection systems. For new research infrastructures, design studies should help in preparing the future, not only from a technical point of view, but also looking at legal, administrative and operational issues. For existing infrastructures, I3s should continue to help to increase the overall efficiency of the European research fabric. Discussions also showed that life-cycle management of the facilities, including business plans, where appropriate, often need to be developed.



See also CD-Rom

Hervé PÉRO

Optimising financial instruments

In the context of new research infrastructures, as well as in managing existing ones, costs and ways to finance them are paramount concerns and constraints. This is all the more true for international facilities where different sources of financing are used. This sub-session focused on how best to synchronise different funding schemes for the benefit of European research. In the planning of new research infrastructures, the discussion also showed that consideration of scientific excellence is necessary but not sufficient. In particular, the discussions highlighted the need for clear analysis of cost-benefit at European level, and for a well-thought out preparatory phase, encompassing what, very often, are complex financial engineering issues.

Towards large international research infrastructures

The next generation of new research infrastructures, in certain fields, is evolving towards facilities created as 'global' and funded by a number of international partners outside Europe. The issues discussed focused on the need for the coordination of different roadmaps and for synchronisation of funding mechanisms. This sub-session highlighted the two main models according to which international research infrastructures based in Europe are currently set up, i.e. following intergovernmental agreements (CERN, EMBL…) or according to a private status (ILL, ESFR…). For some projects, however, the situation is more complicated, as is the case for ITER.

CONCLUSIONS

- The development of a European policy is crucial today, based on effective **coordination** between the different stakeholders, Member States, the European Commission and the research actors, including industry. However, there is a need for well-understood **principles**, in particular when different schemes are involved, e.g. national, regional and European, such as the SFs, FP, EIB, etc. It will take time to raise awareness and knowledge.
- **New management** approaches must emerge. Too many facilities currently have difficulties opening themselves up to the growing competition in the research 'business'. Consequently, many of them will have to evolve from national and public based bodies to international and distributed organisations.
- Day-to-day **financial management** also needs to be improved, from grant-based to life-cycle management, considering the possible provision of benefits which, in turn, will enable self-funded upgrades. Discussions highlighted the need for continued Community efforts for integration and harmonisation of best practices.
- **Financial resources** to support the construction of large facilities are, paramount. This implies the optimal use of **different** funding sources, while **transcending** national interests. In this process, the role of **Member States** will remain central, that of the **EIB** is often welcome, and that of the **private sector** challenging. The role of the **European Commission** will be necessary as a catalyser of national and/or sectoral efforts.

ESFRI and the pan-European research infrastructures

ESFRI European Strategy Forum on Research Infrastructures

Background information

ESFRI, the European Strategy Forum on Research Infrastructures, was launched in April 2002. The idea of developing a more coordinated approach for policy-making in the field of research infrastructures in Europe emerged from the first conference on research infrastructures, in September 2000, in Strasbourg. In June 2001, the Research Council invited «the Commission, in close collaboration with the Member States, to explore the establishment of new arrangements to support policies related to research infrastructures". Responding to the Council's invitation, and having considered the recommendations of a high level expert group for the creation of a 'European Strategy Forum on Research Infrastructures', the former Commissioner Busquin asked the research ministers to nominate representatives, who first met, as ESFRI, on 25 April 2002. The following activities may be carried out by the Forum:

- Joint reflection work applicable to the development of strategic policies on research infrastructures;
- Exchange of information on national, multinational and EU policies, on institutional arrangements, management and resources, and on existing or planned national research infrastructures open to international use;
- Identification of gaps in research capacity associated with research infrastructure on pan-European level and of related strategic needs;
- Joint development and continuous update of an European roadmap on research infrastructures and capacity building;
- Analysis of the socio-economic returns of research infrastructures;
- Exchange of views on new funding instruments and institutional arrangements for pan-European research infrastructures, including access to them;
- Recommendations on management of research infrastructures and related human resources: integration and training aspects, increase of exchanges, and involvement of user communities, including industry;
- Communication to a wider public about the significance and importance of research infrastructures, etc.

The ESFRI roadmap

In September 2004, ESFRI decided to launch its roadmap process, which was welcomed by the Competitiveness Council of November 2004. The objective is to provide a mid- to long-term overview of the need for research infrastructures of pan-European interest, open to use by – and corresponding to the needs of – the European research communities, covering all scientific areas, regardless of possible location.
Potential new research infrastructures (or major upgrades) identified could have different degrees of maturity but should be supported by a relevant European partnership or intergovernmental research organisation to be created in

the next 20 years. By publishing the roadmap, ESFRI will act as an incubator for concrete negotiations and decisions on specific projects by (groups of) Member States, (groups of) National Research Councils, the Commission and any other relevant stakeholder. The first ESFRI output on the roadmap will be available by the end of summer 2006. In the meantime, a 'list of opportunities' was produced early in April 2005, providing concrete examples of new, large-scale infrastructures which the scientific community in Europe will need in the coming decade.

The ESFRI roadmap is an ongoing process which will be periodically updated. It is also important to remember that ESFRI is NOT a decision-making body.

CONCLUSIONS

The conference underlined the importance of both ESFRI and its roadmap.

Europe is in need of a strategic plan for the identification of the various large-scale RIs which its scientific community will need in the 15 to 20 years to come. Since, in many areas, Europe is or could be the leader (e.g. bio-informatics), but to prevent opportunities being missed, fast actions (in particular, project structuring and responsiveness of funding bodies) are needed. The ESFRI roadmap exercise was therefore welcomed as a coherent approach to policy-making on research infrastructures in Europe.

The conference also recognised that the term "research infrastructure" is now very broad, ranging from the traditional large-scale facilities, such as Free Electron Lasers, right down to datasets and collections, and including service-type activities. Different formats are required for different infrastructures (some are distributed and require networking, some are single-sited, while others are linked to centres of excellence). Under the Seventh Framework Programme, and on the basis of the ESFRI roadmap, how the construction of new, large-scale RIs could best be supported should be explored.

The conference also called for an open, transparent and ongoing roadmap process.

The various scientific communities are very different in terms of the number of researchers and the degree (and type) of their organisation. For these reasons, some communities can express their research infrastructure requirements much better than others. In other areas, such as social sciences, progress is hindered because the cases for new infrastructures are impeded by fragmentation of the scientific argument. The possibility of new communities emerging must be allowed for. It is therefore important that the ESFRI roadmap becomes an ongoing process which is multidimensional, and non-exclusive.

Conclusions

The conference

1 → **Confirmed the importance of research infrastructures for 'capacity building'.**

The subject of capacity building was raised by numerous speakers and was felt to be one of the most important issues to be addressed. Nearly all RIs are effectively test beds for the development and application of new technologies, instrumentation and materials, thereby providing companies with an efficient means of developing their competitiveness. Speakers also underlined the important contributions RIs make towards training young researchers, generating knowledge or supporting regional, national, European as well as international development.

2 → **Recognised the broadness of the term 'research infrastructure'.**

The term 'research infrastructure' is now very broad ranging from the traditional large-scale facilities, such as Free Electron Lasers, right down to datasets and collections and including service-type activities. Different formats are required for different infrastructures: some are distributed and require networking, some are single-sited, and others are linked to centres of excellence.

3 → **Underlined the importance of the ESFRI roadmap.**

Europe is in need of a strategic plan for the identification of large-scale RIs required in the next 15 to 20 years. Europe is, or could be, the leader in many areas, (e.g. bio-informatics) but, to prevent opportunities being missed, rapid actions (in particular, project structuring and the responsiveness of funding bodies) are essential. The ESFRI roadmap exercise was therefore much welcomed.

4 → **Called for an open, transparent and ongoing roadmap process.**

The various scientific communities differ significantly in the number of researchers they have and the way in which they are organised. This means some communities can express their research infrastructure requirements better than others. In other areas, such as social sciences, the fragmentation of the scientific argument is an obstacle to the cases for new infrastructures. Also, new communities must be allowed to emerge. It is therefore important that the ESFRI roadmap becomes an ongoing process, multidimensional, and non-exclusive.

5 → **Highlighted the need for continuous support to existing RIs.**

Research infrastructures need long-term public and private support both for their operation and for continuous upgrades. In particular, an urgent commitment must exist to provide funding for the strategic upgrade of existing facilities. Relatively minor upgrades could do much to improve their quality and capacity.

6 → **Insisted on the need for the 'opening-up' of existing RIs.**

The current facilities have to be made available to a wider range of researchers. The full range of communities that could benefit from such ac-

cess is not being fully exploited, the underpinning issues being the lack of awareness of the benefit of using such facilities and the costs of using them. This includes not only the classic 'large-scale infrastructures' such as synchrotrons, but also the existing extensive networks of data-collection systems, often scattered in space and divided by language and institutional barriers. In this context, a strong plea was made for the continuation of current research infrastructure activities on 'access' under the Seventh Framework Programme.

7 → **Stressed the growing importance of better 'data storage and security' at EU level.**

User needs in some areas are growing exponentially which, when combined with the demand for ever-more sophisticated requirements, is presenting new challenges for data collection, interpretation, manipulation and storage. There is therefore a convergence of needs in both the physical and in the e-infrastructures domain. In this context, Europe has to develop world-class high-end computing capabilities. There is also an urgent need to support the deployment of digital scientific repositories as well as to facilitate their open access to researchers.

8 → **Recommended that ESFRI and the EC, together with relevant stakeholders, take the initiative to study legal and management aspects of research infrastructures.**

There is a lot to be done in parallel to the ESFRI roadmap activity if its full benefits are to be realised. Consideration must be given to best practice, methods of improving cost-benefit/cost-returns, access and security policies, management policies, legal aspects and the creation of better and more permanent coordination between national facilities.

9 → **Proposed reflections on an action plan for 'global projects'.**

Several of the RIs needed in the years to come, such as ITER, will have a global dimension. The conference confirmed the need for senior policy-makers from Europe, USA, China, Africa, Japan, India, Russia and other major players, to meet regularly to take stock of these projects which will serve our planet and societies as a whole. The European Commission is encouraged to continue its catalysing efforts in this domain.

10 → **Recognised that coordination is directly linked to information.**

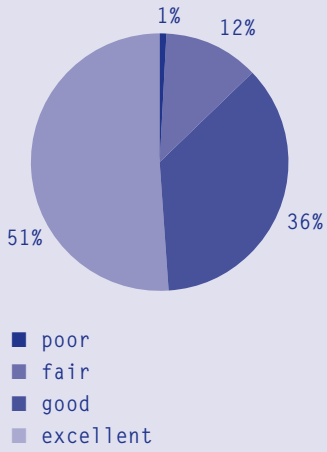
Increased efforts in this area are needed during the coming months with the aim of bringing the theme of research infrastructures closer to all possible stakeholders. These will include the organisation of the fourth conference on research infrastructures.

→ Following the invitation to the delegates to fill in a survey concerning the conference, 70 answers have arrived.

The response concerning the logistics, the overall organisation, as well as the design of the event, has been very positive. It is believed that such a conference should be organised every two years as it has an important role to play in stimulating discussions on the future of European research infrastructures.

Most delegates were familiar with the aims and objectives of ESFRI and recognised the potential impact of the ESFRI roadmap on the planning of new pan-European research infrastructures. They expressed concern on issues such as the lack of vision and coordination within Europe, as well as the lack of funding.

Overall satisfaction



Conference added value