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A EUROPEAN RESEARCH AREA FOR INFRASTRUCTURES

Executive Summary

The present Document is intended to stimulate the debate on a European approach to research infrastructures. It starts from the analysis of some of the achievements and of the present shortcomings related to research infrastructures in Europe.

It then recommends some concrete actions that could improve the European approach to research infrastructures. In particular, the following issues are examined:

- new mechanisms for Europe-wide scientific advice and policy decision for infrastructures;
- combining resources for the development of new key infrastructures;
- how to best exploit existing research infrastructures.

The European Union can contribute to sustain this overall approach, where appropriate and justified. In this respect, the present Document is also meant to accompany and illuminate the forthcoming proposals for infrastructure support in the Framework Programme for Community R&D.

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I – ACHIEVEMENTS AND SHORTCOMINGS OF THE EUROPEAN RESEARCH INFRASTRUCTURES POLICY

Member States have, over the past fifty years, built and operated, with great success, a large variety of research facilities serving various scientific communities. In many cases, research infrastructures have been built through transnational agreements (e.g. CERN, ESA, ESO, EMBL, ESRF, ILL). In the areas covered by these "success stories", Europe has been able to develop and maintain a clear scientific leadership. However, it is perhaps significant that the above examples of international research infrastructure have all been set up ten years ago or more. This is in itself an indication of an increasing difficulty of Europe to project itself as a competitive player in the complex domain of science and technology, as shown, in a wider context, in the Commission Communication on a *European Research Area*[1]. A research community operating at the cutting edge of science and technology needs state-of-the-art infrastructures. This, in Europe, is increasingly difficult, due to several shortcomings:

- **Co-ordinated mechanisms to assess needs and priorities across nations and disciplines do not exist.** The assessment of needs and priorities regarding new or enhanced research infrastructures has become very complex and uncertain. The absence of an overall picture of the needs for infrastructures at the European level, often aggravated by a low level of information exchange across different national authorities, may lead to a duplication of investments. At the same time disciplinary fragmentation makes it extremely difficult to set priorities among infrastructures serving diverse research communities.

- **Europe's voice is fragmented.** European countries lack a coherent position also in "*world-wide*" issues. Participation to world-scale undertakings (e.g. the Global Bio-diversity Information Facility, the Ocean Drilling Programme) is too often reduced to a sum of individual contributions and efforts, resulting in a loss of influence in the strategic input and reduced scientific benefits for European participants.

- **Multinational funding agreements are difficult to establish.** The financial burden due to the funding levels and long-term commitments required to establish and operate key infrastructures are often beyond the capabilities of a single country (e.g. the next generation European neutron beam sources). But the mechanisms to facilitate a distribution of this burden across different countries or different players in society are still unclear, and therefore slow, compared in particular with the fast advancement of science. The recent difficulties in funding the European Mutant Mouse Archive (EMMA) are another illustration of some of the problems linked to the creation of new Europe-wide services that are nationally established and operated. Another critical issue, both at national and multinational scale, is the *ageing* of existing infrastructures and how to allow for their closure.

- **Obstacles remain to transnational access to facilities.** National involvement in the construction and operation of infrastructures produce also obstacles to the transnational mobility of researchers (e.g. due to high "user fees" charged to non-national users), with a consequent isolation of national scientific communities and an under-exploitation of costly facilities.

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[1] COM (2000)6.

- **Technological development related to infrastructures is handicapped by a lack of critical mass.** The low level of co-ordination among infrastructure operators and the consequent lack of critical mass, are obstacles to the development of related key technologies (e.g. “next generation” detectors, optical systems, ultra-fast electronics) and of a correspondingly competitive industry. This lack of co-ordination can also become a severe handicap in relation to the development of common standards and norms (e.g. in the shared use of frequency bands for radio astronomy) or of innovative breakthroughs (e.g. in the clinical testing of new medical products).

- **The potential of electronic communications networks is not yet fully exploited.** The challenge in this context is to maintain state-of-the-art interconnections at the level required by the public and private research community in Europe in the next decade. European scientific communities across different disciplines, moreover, are not yet fully aware of the potential benefits of advanced information and communication technologies, in particular in connection with the new concept of computational Grids.

In conclusion, it can be said that despite major advances in fostering the transnational dimension of research infrastructures in Europe, a number of shortcomings remain open. Most of these shortcomings are direct symptoms of a lack of good co-ordination at the European level.

II - THE PLAYERS AND THE OBJECTIVES

1. An essential asset for R&D and for socio-economic competitivity in Europe

Research infrastructures play an increasingly important role in the progress and application of science. The “raison d’être” for most research facilities is their direct impact on the advancement of fundamental and applied knowledge. But many research infrastructures have also a direct influence on technological innovation and socio-economic competitiveness and contribute to the wider objective of Europe becoming the most dynamic knowledge based economy, as defined by the Lisbon summit.

Providers of essential services for the research community. The concept of research infrastructure has steadily evolved in the last few decades. Starting from large facilities dedicated almost exclusively to a specific discipline or research area (e.g. particle accelerators), many science and technology infrastructures have developed into service facilities for a broad variety of scientific communities, including scientists from industry (e.g. synchrotron radiation sources). These establishments are capable of providing essential services to the research community through a unique combination of techniques, services and know-how (i.e. single pieces or series of instrumentation, together with their scientific environment).

The vital role that research infrastructures play in research, is illustrated by several examples:

- *Synchrotron radiation sources*, already for many years an essential tool for physicists and chemists, are fast becoming vital instruments in the biological and biomedical sciences[2]. Other spectrometric facilities (*neutron beam sources, nuclear magnetic resonance (NMR) spectrometers, laser spectrometers*, etc.) provide complementary characterisation techniques, which are available to scientists working in many diverse disciplines (biotechnology, nano-scale materials, etc.).

- *Satellite facilities and remote ground observatories* play a unique role in the areas of environmental monitoring, astronomy and astrophysics, with important repercussions on our understanding of diverse subjects such as the origin of the Universe, the structure of solar systems, the earth environment and climate, weather conditions, etc.

- *Biological collections, aquaria or green houses, repositories of genetic structures and of animal species* (including endangered or lost species) have an essential role in various areas of basic and applied science, with vast repercussions on human health and environmental protection.

- Europe needs also a *wide knowledge processing fabric* based on data repositories, distributed processing facilities, and distributed teams, all of which are *supported by electronic communication networks and publishing*. Such "immaterial" infrastructure should be further developped, e.g. by including the production and management of data to be stored in information repositories, as well as the leasing of the most advanced equipment to established advanced test-beds, both of which should be made available and accessible across Europe. Support efforts should strive to aim for data repositories with remote access capabilities and processing ability. Support for such immaterial investments is the best way forward to establish tangible foundations for the so-called "virtual" laboratories.

- *High performance computing facilities* have an enormous and ubiquitous impact on a multitude of disciplines, enabling scientists to simulate physical, chemical, biological and even social systems with almost unimaginable precision. Another important opportunity is the recent development (in particular through work done at CERN) of the concept of advanced computational *Grids*. Such advanced computational facilities can greatly enhance applications that handle a substantial amount of data (e.g. research on ecosystems, genome research, atmospheric research, socio-economic studies). On a world-scale, Grids are meant to connect multiple regional and national computational networks, creating a universal source of pervasive and dependable computing power that can unlock really new classes of applications.

- *Socio-economic sciences and humanities* make also an increasing use of research infrastructures such as, e.g. systematic and well-documented databases, libraries, collections of cultural artefacts or natural specimens in museums and anthropology data archives. Such facilities have an enormous cumulative value as repositories of knowledge enabling scientists to maintain a vision of social behaviour and human cultures through space and time.

Poles of technological innovation. Research infrastructures are often found to act as active poles of technological innovation in areas related to their own functioning (e.g.

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[2] See, as an example, the Study Report of the European Science Foundation on the "Review of the needs for European synchrotron and related beam-lines for biological and biomedical research" (1998) (available on http://www.esf.org).

instrumentation, detector technology, optical systems, fast data acquisition, etc.). Key technologies that can be applied also to industrial activities are often shared by researchers working in, or close to state-of-the-art facilities, particularly when these are located near science parks or other industry oriented activities.

Regional growth poles. High standard physical infrastructures for research and development are among key strategic elements for creating new regional growth poles. They are particularly important for the less developed regions, which still largely suffer from a gap in this respect. For integrated approaches for regional development improving the structural factors underlying competitiveness (research and innovation, information technology and human capital) tailor-made R&D infrastructures are a prerequisite[3].

Centres of training. Training and mobility of researchers is an extremely important function that many research infrastructures play in relation to economic activities and social progress. The knowledge and experience accumulated by researchers in their period of postgraduate or post-doctoral training in complex and sophisticated research facilities may constitute an extremely valuable asset for industrial oriented activities and product development. Even the general culture and practice of quality management and complex system analysis that can be assimilated in a research facility may be as valuable, in this context, as any specific scientific and technical know-how.

2. Responsibilities of national authorities and the role of the private sector

Research infrastructures are frequently characterised by investment or operating budgets that are relatively high in relation to those budgets in their particular field (e.g. a particle accelerator in high-energy physics or a database in bio-informatics). But, who supports them, and why?

National authorities have a significant and direct responsibility in the construction and management of research facilities as it is the case also for universities and research agencies. As instruments for the advancement of knowledge and basic science, research infrastructures are the direct expression of public funding and public oriented policies.

Many infrastructures support research in general (e.g. National Research and Education Networks), others are also dedicated to social functions (e.g. research hospitals), environmental protection (e.g. satellite and airborne remote sensing facilities), regulatory tasks (e.g. engineering test facilities) or defence (military test facilities).

The responsibility of national authorities is also implicit in the international dimension of many large-scale facilities. Long-term research programmes, often covering areas of research of world-scale relevance (e.g. the Global Ocean Observing System) require the direct intervention of government bodies (funding agencies or ad-hoc bodies) in order to guarantee the necessary financial and long-term commitment as well as the representation of national interests. In some cases, international scientific organisations can act as forerunners of subsequent larger political agreements (e.g. CERN).

3 In 1998, 41 % of projects under the Framework Programme involved at least one participant from an Objective 1 region. This was up 14 points compared to 1994, underlining the progressing synergies between the Community R&D and cohesion policies.

The private sector is showing an increasing tendency towards a greater involvement in research infrastructures. This occurs at various levels:

- **Several large industries operate their own research facilities** (e.g. testing facilities for transport systems), which are more and more often made available, with mutual benefits, to researchers from academia ("dual use" of industrial facilities).

- **Industries may also build or use part of a facility** of particular relevance to their particular interest (such as a specific beamline on a synchrotron source). Industries may also benefit indirectly from the use of research facilities by academic researchers with whom they collaborate.

- **Science parks** have often developed next to areas where a relatively high concentration of research infrastructures is found, in order to maximise the "knowledge sharing" with scientists working at such infrastructures. In these cases, industrial groups are often among the direct "sponsors" (sometimes "shareholders") of these facilities, contributing financially or in kind to their investment and operation budgets.

- **Private foundations or trusts and banking institutions** are becoming active players in funding new or enhanced research facilities. This is motivated either by the social function of these facilities (e.g. in the case of cancer research and other types of research hospitals) or because of the possible impact on industrial activities (e.g. in the area of pharmacological R&D).

3. Towards a European approach for research infrastructure

The European Commission and the Member States have recognised the central role of research infrastructure in the progress and application of science and technology. Research infrastructure is on the agenda of the *European Research Area* since the Commission Communication of early 2000[4]. The Council resolutions of 15 June and 14 December 2000 underlined the need for a new European approach towards research infrastructures, including the establishment of a Europe-wide network of electronic information communications. Initial thoughts on future practical steps were presented in the Commission Communication *"Making a reality of the European Research Area: Guidelines for EU research activities (2002-2006)"* of 4 October 2000[5].

Following the spirit of the Lisbon Council, activities concerning research infrastructures at national and Union level should be better integrated and co-ordinated to make them as efficient and innovative as possible, and to ensure that European research and research infrastructures in particular, offer attractive prospects to the best European scientists. The instruments under the Treaty and all other appropriate means, including voluntary arrangements, should be fully exploited to achieve this objective in a flexible, decentralised and non-bureaucratic manner.

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[4] COM (2000)6.

[5] COM (2000)612.

The European Commission held, in co-operation with the French Ministry of Research and the European Science Foundation, a *Conference on Research Infrastructures*[6]. The Conference demonstrated that a widespread consensus exists, both in scientific circles and at the political level, on the need to forge a more co-ordinated European approach to key research infrastructures. As a way of stimulating the debate on these issues, the present Document goes a step further by suggesting concrete ways in which Europe could move towards this goal. The next sections suggest future actions that could be taken at national level as well as some supporting actions that the European Union itself could take to sustain the overall process.

III - CREATING A EUROPEAN RESEARCH AREA THROUGH INFRASTRUCTURES

1. Mechanisms for Europe-wide scientific advice and policy decision-making

The present fragmentation, both in geographical and disciplinary terms, of policy and funding decisions surrounding major research infrastructures should gradually give way to a more co-ordinated process of scientific and political prioritisation at European level. There are two essential steps in this process:

- **scientific advice underpinning infrastructure**, which should be self-organised, independent and come from the research community;

- **a recognised mechanism to support infrastructure policy decisions**, bringing together all parties involved in decision making and funding issues.

(i) Scientific advice. The starting point for a European approach to the provision of key infrastructures is to set up clear mechanisms to perform an independent scientific assessment of the needs and opportunities for infrastructures (the “scientific case”) in a systematic way and on a Europe-wide scale. In doing this, the large diversity of perspectives that exist among different scientific domains should be taken into account. Such independent assessments should involve major European scientific organisations, e.g. the *European Science Foundation (ESF)* and other relevant bodies, capable of mobilising the necessary scientific expertise, based on international consultations including, whenever appropriate, experts from outside Europe. The ESF, in particular, already carries out studies on the scientific case for large research facilities[7]. The ESF could in future serve as a “scientific advisory board on research infrastructures” where scientists would prepare the scientific evaluation, analysis and impact assessment of new or enhanced research facilities. The ESF could also draw expertise from other institutions (e.g. CERN, ESA) and should take account of the international context.

The body(ies) arranging for independent scientific assessments should be able to respond to requests from ‘bottom-up’ initiatives, European research organisations, national Governments and the European Commission. The requests for scientific advice should, in a transparent fashion and to the extent that is available, provide relevant guidelines and

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[6] The conference proceedings can be found on Internet (http://www.cordis.lu/improving/infrastructure/events.htm).

[7] Available on the dedicated ESF web site on Internet (http://www.esf.org/policy/LRFs.htm).

resources availability. The European Commission could provide financial resources through the Framework Programme to support the scientific advisory bodies.

(ii) Support to policy decisions. In order to be effective, a mechanism of support to policy decisions should be as close as possible to the actual decision making process, whether at national or multinational level. Examples of such supporting mechanisms at the national level exist already in several European countries[8]. Consultation schemes at multinational level have also been introduced regarding some classes of research infrastructures. What remains to be developed, however, is full-scale co-ordination at the European level, including a wider involvement of all national authorities wishing to participate.

The ideal instrument for a European approach to research infrastructures would be a dedicated **"High-Level Panel on Research Infrastructures**" of representatives of Member States and Associated States. Such a panel, which would also be a natural focus for European participation to "global" infrastructures, should have three main tasks:

- to guarantee mutual and transparent **information** to all participating authorities and to the other relevant bodies, including the European Parliament, national Parliaments and relevant international organisations (e.g. CERN, EMBL, ESA, ESO);
- where appropriate, to request **independent scientific advice**, according to the modalities illustrated above;
- to catalyse the spontaneous creation of **ad-hoc "variable geometry" associations** wishing to proceed to an implementation phase (e.g. on a bilateral or multilateral basis, with or without support of the European Union, etc.). Such ad-hoc associations of interested parties should be set up at the most efficient level of interaction (intergovernmental, interagency, etc.) capable of reaching a joint process of funding.

Such a panel should direct its own recommendations for funding and implementation to the most appropriate level. When large-scale projects are dealt with, this could be at the European or multilateral level, whereas for relatively smaller scale infrastructures, the relevant decision-makers might be found at the level of national funding agencies.

The **European Commission** could contribute to establishment and to the autonomous operation of such a panel by providing a permanent secretariat. It could also provide ad-hoc financial resources through the **Framework Programme**, both to support the panel in its own work and to catalyse subsequent "variable geometry" funding instruments (see the next section). In general, this work could involve acting as a "broker" to approach different potential partners (e.g. funding agencies, industry, private foundations, banking institutions, etc) with the goal of producing a final "package" with all the necessary resources to a given infrastructural project.

2. Combining resources for the development of new key infrastructures

The development (and operation) of large research facilities within Europe will likely remain mainly the responsibility of the **Member States** (and, where appropriate, Associated States, candidate countries and other third countries). This system has led to the existence of

8 See, as an example, the recent report by the French Parliamentary Office for Science and Technology Policies: "Les conditions d'implantation d'un nouveau synchrotron et le rôle des très grands équipements dans la recherche publique ou privée, en France et en Europe" (Mr. C.Cuvilliez, Député et Mr. R.Trègouet, Sénateur) (2000) (available on http://www.senat.fr/opecst/rapports.html).

several world class national facilities and, by various ad-hoc arrangements, of several multinational facilities.

Financial support from national authorities, however, could be combined with other sources to achieve a wider distribution of financial responsibility across different players in society. In particular, national authorities could encourage a wider participation of the **private sector**, e.g. private foundations and charities, or commercial organisations having a direct interest in the subsequent exploitation of research infrastructures.

In order to attract more direct contributions from the private sector, and without prejudice to Community rules on State aids, national authorities could introduce various forms of incentives, for instance in the form of tax exemptions for private investments in research infrastructures (a form of incentive already used for other types of private investments). Appropriate schemes for intellectual property rights might also be introduced to facilitate the commercial exploitation of the innovation produced in research infrastructures.

Direct participation by private industry in new undertakings would improve the service facilities available through a commercial system. In these cases, the researchers would be free to use their own funds to secure access to the most appropriate facilities in a “bottom-up” approach (as in the “ticket” system introduced in some countries). The value for money would be improved, as the full access budget (including amortisation of capital investment) would be revealed. An undue generalisation of this system, however, would neglect the social function of public research and might result in excessive administrative complexity (e.g. from the perspective of the “users”).

The **European Union** (EU) can be a valuable partner in this context. The strategic importance of research and innovation for regional competitiveness, and thus for the long-term growth perspectives, was recently underlined by the Second Cohesion Report[9]. There was considerable progress, but research and development is still largely concentrated in the central and most prosperous regions. By putting further emphasis on the regional dimension of R&D, the **Structural Funds** will contribute to making the European Research Area a concrete reality, covering also lagging regions as full partners. Investment in research infrastructures remains a key element in regional development programmes for the current programming period 2000-2006, particularly for the less favoured regions.

Advantage can also be taken of the participation of banking institutions in order to amortise the necessary investment over a longer duration. In particular, the **European Investment Bank** (EIB) has launched its “Innovation 2000 Initiative” (I2I)[10], a new ad-hoc financial instrument introduced to facilitate the bank’s interventions in a number of sectors related to the knowledge society, including research and innovation.

Finally, if a new infrastructure undertaken by one or a number of Member States (in a “variable geometry” mode) has a clear European dimension and interest, a contribution to the corresponding development from the next **Framework Programme** (FP) for

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9 The Second Cohesion Report is available on a dedicated web-site on Internet (http://www.inforegio.cec.eu.int/wbdoc/docoffic/official/report2/contentpdf_en.htm)

10 Information on I2I is available on Internet (http://www.eib.org/pub/news/i2i/overview.htm).

Community R&D could be foreseen. In practice, the FP funding mechanisms could cover the participation in **feasibility studies and technical preparatory work**, on a case by case basis. In this case, the Member States would need to fund a significant part of the budget to ensure interest at a national level.

In appropriate circumstances, a **capital contribution** by the EU towards the development of new infrastructures could also be considered (alongside with other funding agencies, industry, private foundations, banks, etc.)[11]. The total national funding would need to be a major fraction of the total budget to ensure a strong national interest.

Funding from the Framework Programme should be limited to the minimum necessary to catalyse the financial package, leaving the main funding to national sources. In general, the scientific, legal and financial scope and possibilities of such interventions (e.g. choice of possible areas of support, level of funding, etc.) would need to be clearly defined and justified. The same would apply to the implementation rules (access to results, etc.). Support for research infrastructures should be available for all area of science and technology, including the thematic priorities defined by the Framework Programme. Where relevant, funding for research infrastructures should be considered in articulation with the other available forms of support of the Framework Programme.

3. Optimising the exploitation of research infrastructures

The opening to the outside world of research facilities should be controlled primarily by scientific excellence. Often, however, non-scientific guidelines may hamper greatly the use of large-scale facilities by scientists from nations that have not contributed to their construction or operation. This situation reduces considerably also the scope of co-operations with similar facilities in other countries. National authorities should alleviate limitations to transnational co-operations so as to achieve the right balance between the need to show return for national investment and the intellectual and scientific benefits that come from international co-operation.

Several options can be considered by national authorities for a better co-ordinated approach including, e.g. the more widespread use of ad-hoc "**mutual opening**" agreements for given classes of infrastructure (on the model, e.g., of the agreement between FR, DE and UK to share certain oceanographic vessels). This approach could also be strengthened by measures encouraging the spontaneous transnational networking of research infrastructures (e.g. through European Economic Interest Groups (EEIG) or other forms of networking). On the basis of "in kind" participation to some of the investment or operating budget, this system could be extended also to research teams from countries that do not participate financially to the investment.

Independently of these options, investments into more efficient "**remote access**" technologies, typically (but not exclusively) information and communication networks can also prove particularly effective in reducing some access budget. This applies particularly in the case of access to databases and collections but also increasingly to facilities used for the characterisation of samples (e.g. biological samples and synchrotron radiation facilities).

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[11] EU participation could be in line with the concepts established in Article 169 of the Treaty. Implementation of these concepts could draw useful lessons from the management of the "Association Agreements" within the Euratom Framework Programme.

The contribution of research infrastructures to Europe's capacity for **innovation** could be tested and improved by benchmarking their capabilities in technology transfer. Benchmarking among comparable organisations helps each of them to gain a better understanding of their own processes in contributing to technology transfer and innovation, to see where there is room for improvement, and to identify 'good practices' which could be implemented in order to effect such improvements[12].

Information and Communication Infrastructures and Networks in general differ in several ways from the other forms of networks and infrastructures described previously, notably by their distributed nature, i.e. they are not located in a single place but connect other infrastructures. The major challenge at the European level in this context is to **raise awareness** among European scientific communities across different disciplines about the benefits of using advanced tools to perform their tasks. Additional future work in this context both at national and EU level, in line with the "*e-Europe 2002 Action Plan*"[13], should focus on two aspects: (i) spreading the use of information and communication networks to all scientific disciplines in Europe, moving from best practice pioneered by leading edge users towards common practice for all members of the research community; and (ii) supporting improved usage of such networks by research institutes and exploring the potential of virtual institutes and research *Grids*.

The present **Framework Programme** (FP), in particular the action "*Access to Research Infrastructures*" has contributed to the *transnational access* to many of Europe's research infrastructures for researchers from everywhere across Europe. It has also actively stimulated *co-operation networks* of research infrastructures, by bringing together operators of similar facilities along with their users in order to pool resources. *Research projects* into new instruments and technologies have also fostered a climate of transnational collaboration for infrastructures. Moreover, *thematic areas* have been identified where research infrastructures may receive support through research projects. Moreover, thanks to FP support, all research institutions and universities in the EU (and to some extent, private sector entities) have automatically access to the European high speed telecommunications backbone *GEANT,* which will run at 10 Gigabit/s in 2001 and will be continuously enhanced in the future.

The present forms of research infrastructure support in the Framework Programme are however, somewhat restrictive in two areas. First, the time-scales and funding levels to research infrastructures may require a stability of funding which is not possible under the present actions. Second, new developments can occur quickly and priorities in a certain area of research infrastructures can change, requiring a more flexible utilisation of funds.

In future it would be desirable, in many cases, to support **"Integrated Initiatives"**, combining, where appropriate, the existing FP funding instruments (transnational access, co-operation networks, research projects) with the provision of services at the European level. These integrated initiatives could be undertaken, on a competitive basis, by unique

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12 Useful lessons in this context can be drawn from a recent 'innovation study' published by the Commission under the title "*Getting more innovation from public research. Good practice in technology transfer from large public research institutions".* The text is also available on Internet (ftp://ftp.cordis.lu/pub/innovation-smes/docs/f_policy_studies_appendix3_en_200001.pdf)

13 Information on the "e-Europe 2002 Action Plan" is available on a dedicated web-site on Internet (http://europa.eu.int/comm/information_society/eeurope/actionplan/index_en.htm).

multinational facilities providing high value services to a Europe-wide research community, or by consortia of infrastructures featuring, collectively, the same characteristics. These integrated initiatives should hold for a relatively long period of time (say 5-10 years). They could be supported by the FP in return for the achievement of a wide-scale but flexible scientific and technological programme of European dimension.

Individual “transnational access” contracts should nevertheless be kept for areas not yet sufficiently mature for an “integrated initiative” or where such an initiative is not appropriate.

In the case of the Information and Communication Networks where the national infrastructures are sufficiently developed (through the nationally funded research and education networks, NRENs), on the other hand, the incremental effort to ensure a complementary European dimension can be precisely identified, implying the continuous upgrading of a European backbone for research (post-GEANT). Such incremental effort to ensure the European dimension should be fully supported by the FP. This fundamental infrastructure, in fact, is crucial for the successful development of networks of excellence willing to establish themselves as distributed facilities operating as a virtual laboratory or for interconnecting advanced equipment or prototypes to be used by researchers from all over Europe.

IV – THE NEXT STAGES

The process of policy debate on research infrastructures, which started with the Communication on a *European Research Area* and continued with the *Conference on Research Infrastructures*, has already demonstrated a certain degree of consensus on the need to forge a more co-ordinated European approach in this domain. The present Document goes a step further. In analysing the critical issues related to research infrastructures, it does recommend concrete actions at national level, which can take Europe closer to the goal of a *European research area for infrastructures*. The Document should stimulate a long-term and in-depth debate on policy issues related to research infrastructures.

This Document includes suggestions for those actions that the European Union could contribute to sustain this overall process. It is intended to accompany and illuminate the forthcoming proposal for actions in support of research infrastructures in the context of the *Sixth Framework Programme*. The debate should involve the *European Parliament* and the *Council* as well as the candidate countries. In this way, a better co-ordinated approach to research infrastructures can become one of the main elements in the creation of a *European Research Area*.