

Information Society Research and Innovation: Delivering results with sustained impact

Evaluation of the effectiveness of Information Society
Research in the 6th Framework Programme 2003-2006

May 2008

This report presents the key findings and recommendations of the high-level Panel invited by the European Commission, DG Information Society and Media to carry out an ex-post evaluation of the IST Thematic Priority of the 6th Framework Programme for Research (IST-FP6).

Members of the Panel

Mr. Esko Aho (Chairman) - former Prime Minister of Finland and President of the Finnish National Fund for Research and Development (Sitra)

Mr. Michel Cosnard - Professor at the Polytechnic School of the University of Nice-Sophia Antipolis, Chairman and CEO of INRIA (Institut National de Recherche en Informatique et en Automatique)

Mr. Hans-Olaf Henkel - Professor at the University of Mannheim and former CEO of IBM Europe, Middle East and Africa as well as former President of the Federation of German Industries

Mr. Luc Soete - Director of UNU-MERIT (the United Nations University - Maastricht Economic and social Research and training centre on Innovation and Technology)

Mrs. Nicoletta Stame - Professor, Social Policy, University of Rome "La Sapienza" and Co-founder and first president of AIV (Italian Evaluation Association)

Mr. Pavel Telička - former EU Commissioner (Health and Consumer Protection), Co-founder of BXL Consulting and Senior Advisor, European Policy Centre

Acknowledgements

The Panel was supported by a team of evaluation experts from Ramboll Management, who assisted in the collection and analysis of evidence and drafting of the report.

The Panel would like to acknowledge the support and valuable input for this evaluation provided by several senior experts from industry and from the Commission, who gave evidence directly before the Panel, as well as the large number of programme participants and other stakeholders who participated in the interviews carried out on behalf of the Panel.

Table of contents

| | | |
|-----------|--|-----------|
| 1. | Introduction | 1 |
| 2. | Management of the European research investment – key findings and recommendations | 2 |
| 2.1 | Utility & sustainability – The role of IST-FP6 | 2 |
| 2.2 | Effectiveness – the impact of IST-FP6 research | 2 |
| 2.3 | Globalising the Framework Programme | 3 |
| 2.4 | Relevance and strategic impact – IST-FP6 and wider EU objectives | 4 |
| 2.5 | Efficiency – cutting red tape | 5 |
| 2.6 | Simplifying management | 6 |
| 3. | Broader policy recommendations: Realising the full benefit in growth and welfare through the European innovation eco-system | 8 |
| 3.1 | Developing new markets | 8 |
| 3.2 | Improving European infrastructures, standards and interoperability | 9 |
| | Annexes | 11 |
| | Annex 1: Evaluation questions | 12 |
| | Annex 2: Summary of evidence | 14 |
| A.2.1 | Sources of evidence | 14 |
| A.2.2 | Relevance and strategic impact | 16 |
| A.2.3 | Efficiency | 18 |
| A.2.4 | Effectiveness | 19 |
| A.2.5 | Utility | 21 |
| A.2.6 | Sustainability | 21 |

1. Introduction

ICT innovation is vital to Europe's competitiveness and economic welfare

Innovations of information and communication technologies (ICT) are vital to Europe's competitiveness and economic welfare. They form the foundation for a knowledge based economy: their development and use is crucial to sustaining growth and productivity. Investment in information society research and technology development has therefore rightly been a thematic priority in the Sixth Framework Programme for Research and Technological Development (IST-FP6) – allocated €4B from 2003 to 2006.

This evaluation of the IST thematic priority has looked at how effective the research has been at creating new knowledge and innovation, as well as converting these innovations into economic growth and welfare through Europe's broader innovation systems.

The research investment has been well managed and has been effective in reaching its goals ...

The first part of this report deals with the management of the research. The research investment has been well managed and has been effective in reaching its goals. However, improvements can be made in the flexibility and simplification of the funding mechanism, and in strengthening the global impact of European research in this area. More flexibility in programme administration can help attract more new high-growth companies. Most of the Panel's recommendations regarding the management of the research could be implemented by the Commission within the duration of the 7th Framework Programme (in 2010 to 2013).

... but improvements can still be made in the 7th FP.

The exploitation of the created knowledge and skills depends on the innovation "ecosystem" ...

Other recommendations may require a more long-term effort and/or reach beyond the domain of the Framework Programmes at a more strategic and political level. This level is dealt with in the second part of the report which addresses the political and systemic aspects of how information society research can be better translated into growth and welfare. The extent to which new knowledge and skills created in Europe are exploited in Europe depends on a broad portfolio of policies and measures which affect the innovation "ecosystem". Systemic change is needed to remove barriers to innovation and promote stronger interactions between users, researchers and business - notably in regional innovation systems.

..... and more interventions for systemic change are needed.

Greater synergies needed with venture capital, regional innovation strategies, and public procurement, and ...

The evaluation has identified a number of opportunities to improve the environment for innovations from ICT research in the European Framework Programmes. Greater synergies are needed with venture capital investment; with regional innovation strategies and with public procurement. A more strategic, European level, approach is needed to standardisation, lead market development and the mobilisation of public-private partnerships, as in the Joint Technology Initiatives launched as a result of activities in the 6th Framework Programme. These policy measures are urgently needed, and the Panel calls on the Commission, the Council and the Parliament to address the recommendations contained in this report at their earliest opportunity.

... a more strategic approach to standardisation, lead market development and mobilisation of public-private partnerships.

2. Management of the European research investment – key findings and recommendations

The EU has invested nearly €4B in IST research from 2003 to 2006

The European Union has invested nearly €4B in information society research and technology development from 2003 to 2006. The objectives of FP6 were to strengthen the European Research Area and the scientific and technological basis of European industry and encourage its international competitiveness, and to promote research activities in support of other EU policies.

In order to assess whether IST-FP6 was achieving these goals, a set of evaluation questions were agreed by the Panel (Annex 1). The following findings and recommendations provide the Panel's answers to these questions, based on the evaluation evidence.

2.1 Utility & sustainability – The role of IST-FP6

IST-FP6 was important for taking research activities to European and global levels

Much of the research funded by the EU under IST-FP6 would not have been undertaken, or only undertaken in a much reduced form, without European support. IST-FP6 has therefore played a significant role in taking research activities to European and global levels. This is especially true when effectiveness requires critical mass, broad discussions and "new eyes" on a problem, or when research needs to be shared with an advanced group of experts in the field (cf. Annex 2, section A.2.5).

The networking effects are crucial, and ...

The achievements have high sustainability. Participants gain significant benefit from strengthened networks, new knowledge and skills. The networking effects are crucial, with many participants developing long-lasting collaboration. Some of these networks have become stable structures that form the core of wider collaborative environments, such as European Technology Platforms. As a result, JTIs have been introduced as a way of strengthening public-private partnerships in research at the European level (cf. Annex 2, section A.2.6). The new JTIs on nano-electronics and "embedded systems" are good examples of how the Framework programme will have a positive long-term impact.

... some of the collaboration networks have become stable structures.

- It is recommended that efforts are made to continue to consolidate public-private partnerships of a more permanent nature, such as JTIs, from the 7th Framework Programme.

2.2 Effectiveness – the impact of IST-FP6 research

High SME participation, but lack of high-growth companies

Overall, the participation rate of **small companies** (SMEs) has been sustained at over 20%, which is well above the 15% target set by the European Council and the European Parliament. However, the involvement of high-growth companies in the programme remains low (Annex 2, section A.2.3). This raises questions about the degree to which the framework programme is attractive and accessible to high-growth companies, and the degree to which participation in it assists access to venture capital and to European and global markets.

Both small and large firms are needed. Programme instruments should accommodate both.

Both small and large firms are required to create the optimum environment for SME growth, and financing mechanisms should be open to both. Both types of firms have their role in the innovation ecosystem and each is important to the other. It is positive that the collaborative research in the Framework Programme enables small and large companies to work together in most projects. However, the smaller "targeted research" projects must not become a special instrument for SMEs and larger Integrated Projects must not be overly dominated by large enterprises.

- It is recommended to continue the effort to ensure that support for SMEs and for large firms is not "compartmentalised" into different measures or tools.

European research networks increase knowledge transfer and mobility

Research networks created through participation in European projects have increased the effectiveness of knowledge transfer among organisations and the speed of diffusion of information, as well as the mobility of human resources. Changes in research partnerships as a consequence of participation in the Framework Programme are one of the areas where the impact of EU investment is most visible. Many participants report that the strong networks created during the Framework programme will continue as the basis for their future research cooperation (cf. Annex 2, section A.2.4).

Need for platform to link programme participants to venture capital

Much of the research is "far from the market" or basic research, and commercialisation of new products and services is not a direct objective. Little has been done recently to link participants to the venture capital community. A facility to promote such links was beginning to be developed in the period up to the year 2002, but largely vanished with the economic downturn immediately thereafter. It is time to consider reintroducing one or more instruments for this purpose.

- A platform should be created within the scope of the 7th Framework Programme for new and high-growth companies to meet venture capital investors.

In section 3.1 further recommendations are made to strengthen this link and to stimulate subsequent market innovations.

International cooperation has been strengthened, but need to further globalise the FP

International cooperation between the EU and China, India and Africa has been strengthened and 60% of the top-25 global innovation-leaders are involved in the programme (cf. Annex 2, section A.2.4). Integrated Projects have been effective in connecting European IST research to the world innovation system. However, international cooperation should also be used to bring the best science and technology of the world to European researchers, so that they can build upon it. It is therefore recommended to further globalise the Framework Programme, as elaborated below.

2.3

Globalising the Framework Programme

Europe cannot afford to be an RTD "Fortress". European researchers need to be partners with the best in the world, whether they are from inside or outside of Europe. There is a need to open up further to the world so that developing European research and innovation can draw

Participation of the best researchers from around the world can help increase participation of high-growth firms

upon the best minds and the best ideas, regardless of their origin. In addition, some technologies developed in Europe will need to be commercialised in other markets, in collaboration with non-European firms, to the eventual benefit of European companies and consumers.

If the best researchers from around the world participate in the Framework Programme, it will also become more attractive for the best European researchers. This is particularly relevant for highly innovative smaller high-growth firms which are not currently well represented in the programme. Giving them the opportunity to work with the world's best researchers and innovators would increase their motivation to take part in the programme.

Although cooperation, in particular with Asia and Africa, has been strengthened, the Panel recommends that these efforts are taken even further in order to make the programme truly global:

- Encourage **participation from outside Europe in all projects**. Participation from both developing and industrialised non-European countries should be encouraged.
- **Internationalise the advisory system** – e.g. the IST Advisory Group - by including top scientists and engineers from around the world
- Reflect the latest international developments and challenges in the **work programme**. A more flexible approach may be needed to integrate new, interesting developments in the field faster.
- **Focus the research effort** on creating and sustaining world leadership where Europe already has a comparative advantage and where Europe has a new opportunity to take the lead. Europe should be selective and not attempt to become world leader in every area

2.4

IST-FP6 has created world leadership in some areas ...

Relevance and strategic impact – IST-FP6 and wider EU objectives

IST research investments in 2003-2006 have contributed to sustain and create European world leadership in some research areas, although not always translated into lead market capabilities in ICT and applications. IST-FP6 has reinforced market leadership in mobile communications and research leadership in high-speed networking, GRIDs, advanced robotics and audiovisual systems. World leadership has been achieved in the development and use of high-speed e-Infrastructures for science and research. In these areas, opportunities have been created for new entrants (notably SMEs) in addition to the continued participation of leading companies. Support to emerging technologies has created world leadership in quantum communications, nano-electronics and complex systems (for more detailed findings on the relevance and strategic impact of the programme, please refer to Annex 2, section A.2.2).

... including high-speed electronic networks

- The successful development of high-speed electronic networks (eInfrastructures) has demonstrated the importance of European intervention in infrastructure development. These initiatives have created European world leadership.

- The eInfrastructures approach should be expanded to more application-oriented and user-oriented platforms in other sectors.

ERA has been strengthened through IPs, NoEs, and clustering of projects

- The European Research Area has been strengthened, especially through Integrated Projects, Networks of Excellence, and the clustering of projects. European Technology Platforms have extended cooperation beyond the individual projects financed under the IST-FP6. They have fostered wider synergies with national and private-sector initiatives and have been an essential step towards new Joint Technology Initiatives (JTIs). These are an incentive for industry and Member States to increase their R&D funding. They provide a way of creating new partnerships between publicly and privately-funded organisations involved in research, focusing on areas where research and technological development can contribute to European competitiveness and improving the quality of life. They can therefore be seen as a pioneering approach in pooling public and private research efforts and they have become an integrated part of the 7th Framework Programme.

JTIs and living labs can strengthen the innovation process in other areas ...

- Both JTIs and "living labs"¹ have the potential to further strengthen the innovation process in other areas. They represent a more "systemic" approach by bringing together the supply side (enterprises and researchers) and the demand side (users and public authorities). JTIs and "Living labs" could also be used as vehicles for targeted public procurement of innovation. However, the Panel is concerned that JTIs may be subject to overly-strict EU administrative controls which may inhibit innovation and participation of innovative companies, as has been the case for the Framework Programme.

... but excessive EU control should be avoided

- The Panel recommends that accounting control in JTIs is carried out by Member States and participating companies, with a minimum of intervention at the Community level.

2.5

More simplification and reduction of administrative burdens still needed

Efficiency – cutting red tape

It is important to pursue the goals of the research in a cost-effective manner. Further efforts are needed on simplification and reduction of administrative burdens of the Framework Programme, both for participants and for the Commission. They have not been significantly

¹ Living labs are city level centres of innovation and experimentation generally in mobile technologies and applications, bringing together users and developers to create and test ideas and products.

reduced in the 6th Framework Programme, because of the unfamiliarity with the new instruments and the large number of partners in Integrated Projects and Networks of Excellence. Some improvements have been made in the transition to the 7th Framework programme, but there is a need for further simplification and increased flexibility (cf. Annex 2, section A.2.3). The Commission should explore options for further simplification.

2.6 Simplifying management

Cumbersome procedures and processes may inhibit the programme from reaching its full potential

The measures taken by the Commission to ensure responsible use of public funds can often inhibit the programme from reaching its full potential, for example many of the most innovative companies – in particular high-growth SMEs – are discouraged from participating in the research programme because of the cumbersome procedures for both application and implementation.

The system of evaluation of proposals can discourage newcomers: feed-back on the quality of applications to unsuccessful proposers is reported by participants as poor compared with communication from private sector funding sources; a consensus-based evaluation process tends to result in projects offering incremental developments rather than radical innovations; and it is difficult to attract the best scientists from industry as evaluators.

While these are common problems in all public research funding, some were exacerbated in the 6th Framework Programme by the introduction of new instruments and increased overheads linked to the management of very large project consortia.

- The Panel strongly recommends developing a more **trust-based approach towards participants** at all stages. The existence of a few unfortunate examples should not be allowed to stand in the way of innovation. Specific elements in the development of such an approach are detailed below.

Efforts should be made to both simplify and introduce flexibility in the three key phases of the project lifecycle – the application, the evaluation of proposals, and the management of funded projects:

At the application stage, it is recommended:

- To require **shorter proposals** with fewer details of work packages and a focus on the appropriateness of partnerships, in particular the inclusion of highly innovative participants.

At the evaluation of proposals stage, it is recommended:

- That **more complete and helpful feedback** is made available to proposers whose ideas are not funded.
- To test a new approach whereby **proposals are not fully evaluated initially**. All applications passing a few basic checks should be given a small amount of "seed funding" for an exploratory phase. After this, exploratory projects with successful results would be selected for full project funding. Financing projects based on actual performance rather than promises and reputation could both reduce the initial paperwork and be a viable way of attracting innovative (small) companies which would not otherwise consider applying for Community funding.
- To explore expanding the **two-step evaluation procedure from the Open part of the "future and emerging technology" area to other parts of the programme** - prospective participants first provide a broad outline of their project idea, and only provide a more refined plan once they are selected. This may increase the workload for the Commission in the early phases, and lengthen the evaluation process, but it will significantly reduce the burden on the research community of preparing proposals.

At the stage of project management, the main problem is the rigidity of carrying out the research according to a fixed schedule and with a partnership established in advance. It is therefore recommended:

- **To optimise reporting**, which is time-consuming and may be untimely, and allow the participants to report when there is something to report.
- To allow **the refocusing of the research** on different priorities if this becomes necessary during implementation.
- Similarly, to allow more **flexibility in the composition of partnerships** during the project, including the possibility of changing partners if the research takes a direction which would benefit from new partners or replacement of partners.

3. **Broader policy recommendations: Realising the full benefit in growth and welfare through the European innovation eco-system**

Reaping full benefits of ICT depends on RTD/innovation "eco-system"

... need for simultaneous push/pull

ICT is an enabling, pervasive technology, whose benefit depends on a dynamic "eco-system" of RTD and innovation. Supply-side support alone to RTD, such as that of the Framework Programme, is not sufficient. It is also necessary to improve the linkage of RTD into the innovation "ecosystem" in Europe. The approach to innovations must be to simultaneously "push" through RTD and "pull" through market demand and public services, with efforts needed simultaneously at national/regional level and at the European level.

For these reasons, the Panel has devoted a significant part of their evaluation to those factors which determine the outcomes and impact of European research. Many of the Panel's recommendations therefore relate to systemic measures which lie outside the Framework Programme management, but which must be associated with it. There are several areas in which an effort should be made, but the Panel has focused on two key issues:

- Developing new markets, and
- Improving European Infrastructures and interoperability.

3.1 **Developing new markets**

Lack of venture capital in Europe compared to US

... and public authorities should promote innovation through procurement

Innovation needs new capital investment. However, venture capital is less available in Europe than in the USA. During most of the 6th Framework Programme, the availability of early stage (seed and start-up) venture capital in the EU15 was approximately half of that in the US (cf. Appendix 2, section A.2.2). In addition, European public authorities do not fully utilise their considerable purchasing power to foster innovation through procurement of innovative services and technologies.

Although knowledge flows in both directions between the EU and the US, there is a net flow from Europe to the US. Thus, while enterprises often choose Europe as a location for R&D, commercialisation of their research results in many cases takes place in the US, a tendency further supported by the fact that the top 50 global companies in the ICT sector are predominantly American or Japanese.

To improve the "ecosystem" of R&D and innovation in Europe, the demand for innovative solutions and the financing of high-growth innovative enterprises must be increased.

Need for demand-oriented effort

Strengthening the demand for innovative solutions

To ensure that R&D results are converted into growth and benefit for society, there is a need for an accompanying multifaceted, demand-oriented effort.

- The Panel recommends a more strategic use of standardisation to create new EU-wide markets. Standard-setting is needed as a tool for pulling through innovations and creating viable markets for new products and services.

Need for new initiatives to encourage public procurement of innovative goods and services

The public sector has the potential to create demand for innovative goods and services. Public procurement currently accounts for approximately 17% of Europe's GDP. Historically, it has been one of the strong drivers of innovation and take-up of new technologies. However, Europe is lagging behind the US, where public procurement plays a key role in innovation. Thus, there is potential for significantly greater value to be generated by the Framework Programme research through increased public procurement of innovation at regional, national and EU level. At the same time, it should be emphasized that research and procurement of innovation should not focus only on products, but also on the development of new, innovative services.

- The Panel welcomes the recent Commission Communication on *pre-commercial procurement*, and recommends that new initiatives are taken to allow public authorities to procure the development of innovative goods and services.

Need for more venture capital for growth of EU firms

Increasing the availability of financing

Europe lags behind the US in the availability of finance to support the growth of companies. Not enough venture capital is available in Europe and many technologies and services with commercial potential, developed by small, highly innovative European firms, attract US investment. The growth benefits of these firms are effectively relocated from Europe to the US. Europe needs to be competitive not only in technology development but also in the availability of capital for innovation and growth. We must secure European resources for these companies to grow. This will also secure a new base of innovative companies capable of participating in Framework Programmes. Business angels, seed capital and full-scale venture capital need to be available in order to have a well-functioning financial market for innovation and growth.

- The European single market needs to be made more effective for business angels and venture capitalists, and European investment funds need to be more effectively utilised to pull through innovations from the Framework Programmes.

3.2

European added value can be achieved through cross-border infrastructures, interoperability and standards

Improving European infrastructures, standards and interoperability

The development of **cross-border infrastructure, interoperability** and, in some sectors, **standards**, is one of the areas where true European added value can be achieved.

In some cases, the market takes care of the development of *de facto* standards through competition. However, national regulations and practices can constitute barriers to the development of European and global standards. This fragments markets and prevents European

companies from reaping the full benefits of a single European market.

- A more strategic approach to **standardisation at the European level**, when this cannot be left to market forces, focused on interoperability and development of standards where there is a well-documented need for coherent innovative services and European leadership, will be in the broader public interest.
- The **interconnection** of large regional and national **eInfrastructures** should be further developed. EU-wide platforms and infrastructures are needed in sectors such as eGovernment (especially procurement), eHealth (cross-border applications), logistics and transport. Framework RTD should be complemented by other measures, in particular public procurement at both national and European level.

Annexes

Annex 1: Evaluation questions

The following evaluation questions were agreed by the Panel:

Relevance and strategic impact:

- Has the IST Thematic priority of the 6th FP contributed to the EU strategic objectives² and policies, notably the Lisbon and Sustainable Development ones? And how?
- Has the IST Thematic priority of the 6th FP contributed to the DG INFSO strategic objectives and policies, notably the i2010 initiative? And how?
- To what extent has the IST Research been complementary and coherent with other i2010 actions and activities?

Efficiency

- Was the IST Thematic priority pursued in a cost-effective manner?³
- Was the legal framework (Rules of participation, Model contract, IPRs, etc.) appropriate to the needs of the stakeholders? Were the implementation measures and processes operated in a clear and transparent manner?⁴
- Have the IST research activities constituted the best way of obtaining the objectives set?

² The objectives of the 6th FP were to strengthen the European Research Area and the scientific and technological basis of European Industry and encourage its international competitiveness, and to promote research activities in support of other EU policies.

³ This question will address the efficiency of management (budget implementation, time to contract, etc.) and of key implementation processes such as the evaluation of proposals. It will also examine: (a) the costs of participation (e.g. preparing a proposal) and management (e.g. project management and administration), (b) progress made towards simplification and (c) reduction of administrative burdens.

⁴ This question will examine whether the rules for participation, 'instruments' and modalities for implementation were well defined and appropriate; whether the processes were defined and operated in a clear manner; whether the levels of funding and other available resources were adequate; and whether the targeted research communities were able to respond appropriately (incl. an analysis of the reasons and factors effecting their participation and non participation).

Effectiveness:

- Were the overall and specific objectives of the IST Thematic priority of the 6th FP, and of the work programmes met⁵?
- How relevant, coherent and useful were the Work programmes?
- How consistent were the work programmes with the objectives of the IST Thematic Priority?
- Were the results of the IST research effectively exploited as commercial products and services, used in developing new regulations or did they support the definition of new or revised policy at Member State, EU or international level?

Utility:

- Has the IST Thematic Priority of the FP6 been relevant to the key scientific and technological advances made in the field during the relevant time period?
- What research outcomes would not have been achieved without the FP IST Thematic Priority?
- Have the IST research activities produced unexpected results?
- Have the research activities funded under the IST thematic priority corresponded with needs, problems and issues over and beyond those embodied in stated objectives?
- Are the results, their effects and impacts globally satisfactory from the point of view of direct or indirect beneficiaries⁶?
- Have some IST research activities had other unexpected positive or negative impacts?

Sustainability:

- Are the effects of the IST research activities likely to continue into future in the absence of EU intervention or support⁷?

⁵ This question will examine the major results in terms of scientific, technological and socio-economic outputs; in terms of international co-operation, knowledge transfer and innovation, human resources development and mobility, and in terms of supporting and enhancing co-ordination and coherence of research activities.

⁶ This question will assess the impacts on the patterns of trans-European interaction within the IST research community, or directly on the IST research stakeholders or on special social groups, economic sectors or regions (inside or outside EU).

Annex 2: Summary of evidence

This Annex is a *supplement* to the Panel's report. It summarises the evidence collected for this evaluation. A full "Evidence Synthesis Report", containing more detailed evidence, will be published as a separate document.

A.2.1 Sources of evidence

This evaluation is based on evidence from three main sources:

- 1) A large evidence-base made available to the Panel by the Commission, in the form of data about programme implementation from the Commission's management units and from the participating institutions, and studies carried out on behalf of the Commission.
- 2) Targeted interviews with programme participants and other stakeholders, carried out by Ramboll Management on behalf of the Panel
- 3) Invited contributors from industry and from the Commission, who gave evidence directly to the Panel at their 3rd and 4th meetings.

The **evidence-base of documents** contained a large amount of material, of which a substantial part was prepared specifically for the evaluation of IST-FP6:

At the **project level**, a summary of output and impact indicators from active projects in 2005 and 2006 (concerning publications and patent applications, and part of a continuing tracking of project-level performance) was made available to the Panel along with the findings of an internal audit of the annual project reviews.

At the level of **strategic objectives**, the material included a synthesis of findings of the impact assessment observatory of IST-RTD projects in the 5th Framework Programme, as well as individual reports. Also included was a "portfolio analysis" of participation in the 6th FP and reports of evaluative studies of the intervention logic in specific IST-RTD themes.

At the **management** level, an important source of evidence was self-assessments prepared by each DG Information Society Directorate

⁷ This question concerns the continued impacts at macro-level (e.g. on economic and social cohesion e.g. employment, competitiveness, better living conditions, etc.) or at micro-level (e.g. infrastructures, productivity, etc.) in the medium- and long-term and at global, Europe, MS, and regional levels. In particular, it concerns the extent to which the IST research activities permanently integrated and strengthened the European Research Area for IST and the impact on IST research collaboration on other EU or national/regional or business initiatives.

involved in planning and implementing IST-FP6. Also included was a summary report of the findings and recommendations from the independent Panels monitoring each major evaluation and selection of RTD proposals. Also extensively used was the Five-Year Assessment of IST research 1999-2003, which contains a thorough review of the last part of 5th FP and the first calls of 6th FP

At the **IST thematic level**, the evidence base included a summary of a series of network impact analyses, and an analysis of the role of innovative ICT SMEs.

A full list of the documents in the evidence base is included in the separate Evidence Synthesis Report mentioned above.

The evidence provided by the Commission was enhanced by data collected by the Ramboll Management team on behalf of the Panel in the form of **targeted interviews** with different stakeholder groups. These included most of the top-25 participants in the IST-FP6 (the most "connected" participant organisations, identified via network analysis of all participant organisations). In order to balance the views collected from these, mainly large, organisations, a number of SME participants were also targeted for interviews. The participant interviews were supplemented by a "control group" consisting of selected highly innovative SMEs not participating in the programme, as well as a number of organisations having participated in a proposal which was evaluated as fulfilling the quality criteria (i.e. above the evaluation threshold), but which were not retained for support due to lack of funding. Finally, the members of the ISTAG and ICT Committees were approached, and a number of these members provided written input on mainly strategic (forward-looking) and programme management issues.

Finally, a number of **experts from industry and from the Commission** were invited to give evidence on selected issues at Panel meetings. These included:

- Mr. Andrej Nabergoj, member of the board of Presidents of the Young Entrepreneurs for Europe and CEO of several leading internet SMEs, on the situation of innovative ICT SMEs in Europe
- Mrs. Gabriella Cattaneo, IDC Government Insights, presenting a study on innovative SMEs
- Mr. Ian Phillips, ARM, a major European electronics company, on the company's experiences with participating in the Framework Programmes
- Mr. Jan van den Biesen, Philips, on setting up the JTI on Embedded Systems
- Mr. Joachim Schaper, SAP, on Living Labs
- Mr. Eric Maurincomme, vice-President for e-Health, Agfa HealthCare, on Lead Markets in e-Health

- Mr. J. Schmitt, Partner in Sofinnova, a French Venture Capital organisation, on the situation of venture capital in Europe, engaging with high-growth firms
- Mrs. Rosalie Zobel, DG Information Society, on the evolution from European Technology Platforms to Joint Technology Initiatives
- Mr. Mario Campolargo, DG Information Society, on research infrastructures
- Mr. Ulf Dahlsten, formerly of DG Information Society, on pre-commercial procurement

In the following sections, the key evidence supplementing and supporting the findings of the main report is summarised.

A.2.2 Relevance and strategic impact

The IST Thematic Priority of the FP6 has contributed to achieving **EU strategic objectives and policies**, as its research investments have contributed to create and sustain European world leaders in some areas. In particular, with respect to e-Infrastructure, FP6 has contributed to promoting the Géant and GRID ICT-based infrastructures. Géant is a cornerstone of the European Research Area (ERA) and its broadband aspects set an example for the eEurope initiatives on broadband. GRID, initiated under FP5, resulted in a new Strategic Objective for "*GRID based Systems for Complex Problem Solving*" introduced in the IST priority for FP6.

Within the Future and Emerging Technologies area, the ERA has been strengthened by structuring and strengthening the research capacities in areas such as nano-electronics and robotics. The introduction of new instruments (IPs and NoEs) has contributed to creating **more intense and more complete collaboration** than in the previous FPs. Further, FP6 has provided the basis for forming nine European Technology Platforms (ETP), two of which have now become JTIs and an integrated part of the 7th Framework Programme.

The overall objectives for the information society (such as the Lisbon and Sustainable Development Objectives) cannot be achieved through research alone, as development to market usually relies on complementary policy instruments. In this respect, it is important to further investigate how the current positive development in venture capital funding and patent filing can be further supported.

A 2006 study by the World Economic Forum demonstrated that ICT was a driver of competitiveness, showing a very close correlation between national economic competitiveness and the development of ICT⁸. However, Europe lags behind other leading economies when it comes to investment in ICT, which includes the availability of venture

⁸http://www.weforum.org/en/knowledge/Industries/InformationTechnologies/KN_SESS_SUMM_17994?url=/en/knowledge/Industries/InformationTechnologies/KN_SESS_SUMM_17994

capital for enterprise development, ICT expenditure and investment in R&D. During most of FP6, the availability of early stage (seed and start-up) venture capital in the EU15⁹ was around 0.02% of GDP, while for the US this figure is around 0.04% of GDP. In 2006, this spending in the EU15 jumped to 0.05% of GDP. However, there are no new figures to show whether this higher level was sustained in 2007. In addition, European public authorities do not fully utilise their considerable purchasing power to foster innovation through procurement of innovative services and technologies.

ICT R&D investments in the US in absolute value from 1999 to 2005 have consistently been twice as high as the investment level in the EU15. The EU is also lagging behind the US and Japan when it comes to ICT expenditure, as the EU27 is on average spending 2.7% of GDP on ICT, compared to 3.3% for the US and 3.4% for Japan. While the EU is still behind the US and Japan in terms of number of ICT-related patents as a percentage of total PCT-filings, the growth in the EU25 (16%) actually outperforms that of the US (10%), although Japan is still ahead of both.

Although knowledge flows in both directions between the EU and the US, there is a net flow from Europe to the US. Thus, while enterprises often choose Europe as a location for R&D, commercialisation of their research results often takes place in the US.

US enterprises often choose Europe as a location for R&D, which is a sign of Europe's attractiveness for scientific research. However, the question remains why US, and not European, firms commercialise these research results, a topic already recognised by the European Commission in 1995 as the 'European paradox'. In this view, we may also interpret the better US performance as a sign of the inability of Europe to transfer scientific excellence into innovation and commercialisation. The Top 50 global companies in the ICT-sector are predominantly American or Japanese, and among 12 companies that are deemed most efficient, only 2 are from the EU.

In terms of **DG INFSO strategic objectives and policies**, the IST-FP6 has largely contributed to the i2010 initiative, as it has been the source of ideas and motivation for an increased number of policy initiatives in the i2010 framework.

IST-FP6 research has also supported **other EU actions and policies**. For instance, the IST research in eGovernment has provided a basis for policy initiatives in company registration and customs procedures in DG MARKT and DG TAXUD. RTD in the area of environmental monitoring and disaster management has enhanced the interoperability between information systems, and data collection, integration and access as well as monitoring capacities have been strengthened.

⁹ Only numbers from the EU15 are available from Eurostat, however, it does give an indication of the level of venture capital in Europe compared with that of the US.

A.2.3 Efficiency

The overall conclusion is that the IST Thematic Priority was **implemented and managed efficiently** and, according to several stakeholders, was one of the better managed thematic priorities in FP6.

There are, however, concerns relating to key issues, in particular the high oversubscription rates. These are seen as a waste of resources, both on the part of the applicant organisations and the Commission. On average, less than 1 in 6 project proposals were funded, and there is thus a need to consider alternative procedures in order to ease the burden related to the preparation and evaluation of proposals.

The time to contract from proposal submission was reported to be longer in FP6 than in FP5, although it was gradually reduced over the course of the programme. This seems to be largely attributable to the introduction of the new instruments (IPs and NoEs) which turned out to be challenging. The unfamiliarity with, and to some extent the lack of clarity of, the new instruments also added complexities as there were much larger numbers of participants in individual projects. Regarding the cost of programme management, this was assessed as reasonable (corresponding to international standards) early in the programme, but there is insufficient evidence to allow for a more in-depth evaluation of this issue.

The length of the evaluation process was generally considered reasonable by stakeholders, but some concerns were reported regarding the **quality of proposal evaluation**. In particular this included the quality of feedback to proposers who were not funded and, to some extent, the impartiality of evaluators.

Previous analyses of the **costs of participation** have concluded that the application costs and risks of participation in the FP are unreasonably high and the high cost of making a proposal has been identified as one of the main barriers to participation. Stakeholder interviews partially supported this, but also revealed differences between participants. While the larger participants often benefit from previous experience with research programmes and have resources available to prepare the application, smaller participants with less experience and fewer specialised administrative resources perceive the costs and burdens as being much bigger. However, participants generally do not consider the cost of submitting proposals excessively high in relation to individual (successful) proposals - the problem is that many proposals are not successful. Large and small participants have similar experiences in the cost of project management. A large majority state that participation is worthwhile since the benefits exceed the costs, especially in the longer term.

The **administrative burdens have not been reduced under FP6**. Indeed, the burden is perceived by participants as heavier than in previous Framework Programmes, mainly due to the introduction of the new instruments, and changes in implementation.

The **new instruments** (IPs and NoEs) were a challenge both for the Commission and for the participants. Concerns have been raised that the new instruments were not appropriate for SMEs and new Member States, mainly due to the large size of the consortia and the projects. Although overall SME participation increased in IST-FP6, SMEs were under represented in both IPs (slightly) and in NoEs (considerably). Interviewees from the research community directed criticism at the uncertainty surrounding the purpose and functioning of the new instruments. They also noted that the lack of experience in running very large projects and consortia was evident in the beginning of the programme, but levelled out towards the end. Whereas the large size of the NoEs and IPs was criticised by many respondents, it was also reported that when the rules were clarified both, and especially the NoE, became excellent instruments for networking for academia and industry.

Only 22% of **innovative ICT SMEs** have received funding from research and innovation programmes, and only around 5% of SMEs holding highly cited ICT patents have participated in FP6. In IST-FP6, the level of participation of SMEs has been sustained at more than 20% of participants (although fewer in the new instruments, as mentioned above), but interviews with SME participants showed that they were not very growth-oriented. Most of the evidence points in the same direction - that although a reasonable number of SMEs participate in the programme, there are major barriers to involving the most innovative and growth-oriented SMEs. The long time to market and the complexities of participating in FP6 projects are some of the barriers most often cited, but these also include concerns over lack of IPR protection. SMEs from New Member States and third countries also mention lack of trust within the consortium as a barrier.

A.2.4 Effectiveness

The **relevance and utility of the Work Programmes** has been ensured through an extensive consultation processes and the priorities have been influenced by advice from ISTAG, ISTC, industry and the research community, and often built on strong existing initiatives in previous FPs and elsewhere. It has been suggested that the work programmes are sometimes too inflexible and that new developments should be integrated into them faster, especially in fast-moving fields where better outcomes might be achieved with a more flexible approach. However, there are also numerous examples of areas where the Work Programmes were adjusted as a reaction to changes in the technological development or to cover different important aspects of a certain area.

In terms of **scientific and technological** results, 74% of FP6 projects applied for patents or published articles and papers in 2006, up from 69% in 2005. Project participants mostly state that the scientific and technological results obtained are preliminary inputs to their ongoing research, and absorbing (complementary) knowledge from other participants. The majority of the participants stated that the research conducted in the FPs is basic in nature, meaning that satisfactory (and realistic) outputs for the participants were limited to prototypes and new ideas.

International cooperation between the EU and China, India and Africa has been strengthened as the number of participants from these countries has nearly doubled since FP5, funding to third countries increased by a factor of six, and the number of collaborative links has increased tenfold. The total funding allocated to third countries during FP6 reached €40 Million (approximately 1% of total funding), up from only €7 Million in FP5.

IST-FP6 has attracted 60% of the top-25 **global leaders** within innovation. Their participation in IPs has been very effective at connecting European IST research participants to the rest of the world.

At the level of participant organisations, international cooperation gives better access to information and channels for dissemination, in particular for academia. Participants report that international collaboration creates a larger critical mass and more European awareness, and increases the quality of the output. Some respondents consider the international aspect to be the biggest advantage of the Framework Programme.

FP6 research networks increase the effectiveness of knowledge transfer among organisations and a rapid diffusion of information within the network. Networking effects are perceived by numerous interviewees as the most significant impact of their participation in FP6. The big size of IP and NoE consortia provide participants with an increased international network in which to disseminate project results, gain new knowledge and find partners for future commercialisation. The large networks have however in some cases turned out to be counterproductive to innovation for smaller organisations, as they found that being a part of a large consortium reduced their possibilities to contribute to the research or to propose more innovative lines of research.

The picture of whether participants enter **new fields of science and technology** as a result of their participation in FP6 is very mixed. A little less than half of the interviewees had entered new fields of science and technology while others instead expanded their existing fields of research into new directions or improved their existing research.

The **mobility of human capital** between organisations is an important source of knowledge diffusion and recombination. IST-FP6 has contributed to the human resource mobility within the European research community by attracting key actors to the projects. Many of the IST-RTD hubs can be characterised as Mobility Hubs which exhibit a high mobility of researchers and which are strategically positioned in the flows of knowledge, embodied by researchers and scientists.

Most of the project participants, large and small, have experienced enhanced staff skills and knowledge as a result of participation in FP6. The biggest advantage seems to come from the extensive cooperation with the other members of consortia, bringing about complementary expertise, know-how and knowledge exchange. The NoE

especially have proven to be a good vehicle for knowledge exchange and for increasing the mobility of younger researchers.

A mixed picture emerges when it comes to **commercialisation of products and services**. On the one hand, some project participants report that IST projects are too focused on research, leading to a lack of support to deployment activities and market commercialisation. On the other, specific new products or processes did result from IST research projects. In these cases, IST networks have helped project participants gain a better understanding of the market, although some criticism has been expressed about the lack of sufficient infrastructure for supporting market introduction of the applications created in the IST project.

The indications that some of the research is "far from the market" is supported by the fact that the "patenting intensity ratio" (the ratio of patents to investment in RTD) in the IST programme is very much lower than for ICT research in general, and that the ratio has actually decreased considerably from FP5 to FP6.

A.2.5 Utility

Much of the research conducted within the framework of the IST Thematic Priority would not have been conducted at all if the projects had not been selected for FP6 support. This is often directly related to the need for funding, but participants also mention that some results require critical mass, broad discussions or to be exhibited early to an advanced group of experts in the field, and that Community research programmes are a very important means for accessing these. Interviews with unsuccessful proposers also show that in many cases, ideas are readjusted to a smaller scale, perhaps without (or reduced) international co-operation, and funding applied for from national programmes. In some cases, elements of the unsuccessful proposals have been realised with in-house funding.

In terms of utility of the programme to the research community, impacts on patterns of trans-European interaction can be identified within the IST research community. These patterns present themselves in the form of research networks and "networks of innovation". The IST programmes create linkage additionality by adding new and complementary links to existing linkages. Taking part in FP6 has been a significant connecting factor for the participants from the new Member States, who through their participation have been able to multiply their connections within the European research community.

A.2.6 Sustainability

Most participants in the IST-FP6 benefit significantly from their participation in terms of strengthened and broadened networks, new knowledge and skills as well as an improved reputation through their participation in the programme. These impacts will not disappear immediately after the EU support has ceased. Again, the networking effects seem to be crucial, as many participants have developed long-lasting collaboration and conducted projects together after FP6. Many of these networks (which in some cases originated in earlier

FPs) have by now become stable structures that form the core of wider collaborations, such as European Technology Platforms.

An interesting result from FP6 is the introduction of JTI as a way of realising public-private partnerships in research at the European level, mainly arising from the European Technology Platforms. The first two JTIs, ARTEMIS and ENIAC, combine a critical mass of national, EU and private resources and are excellent examples of how the IST research activities will have continued impacts in the long term at European level.

