

Evaluating the European Union's Research Framework Programmes: 1999-2003*

Erkki Ormala

Vice President, Technology Policy
Nokia Corporation

Nicholas S. Vonortas

Center for International Science and Technology Policy
&
Department of Economics
George Washington University

Pre-publication Copy: Science and Public Policy

This paper summarizes the results of the third Five-Year Assessment of the Research Framework Programmes carried out by a Panel of 13 independent, high level experts from a range of different fields in science, technology and the social sciences and coming from different Member States of the European Union including the New Member States. For the original Report see "Five-Year Assessment of the European Union Research Framework Programmes 1999-2003", European Commission, DG Research, XXXX. In summarizing, however, the paper depends on the views of this author who is solely responsible for any misconceptions and misrepresentations.

1. Introduction

In the second half of 2004, an international expert panel carried out a five-year assessment of the EU Research Framework Programmes for the third time in the history of the Programme. The expert panel's report reviewed the implementation and achievements of the Framework Programmes over the period 1999-2003, made recommendations for the remaining part of the Sixth Framework Programme up to 2006, and suggested improvements over the nature and orientation of future Programmes.

This paper summarizes important findings of that evaluation. While the paper follows the general layout of the panel's report, it is not trying to be comprehensive. For a more complete view of the panel's opinions and official position the reader is urged to consult the original report.

The paper unfolds as follows. The next section recounts the general socio-economic and cultural context in which the Framework Programmes have operated in the past few years. Section 3 discusses some of the main findings of the panel regarding the implementation and achievements of the programme. Section 4 discusses important ways in which the Framework Programme interacts with other policy areas of the European Union and its member states that should be taken into consideration when planning and evaluating the Programme. Finally, Section 5 concludes and offers recommendations on future strategies.

2. Context and Challenges

The period covered by this five-year assessment was an important one for Europe, reflecting significant developments, including:

- The establishment of the “Lisbon” process for establishing the most competitive and dynamic knowledge-based economy in the world by 2010.
- The definition of the “Barcelona” objectives for raising research and technological development (RTD) investment in the European Union to approximately three per cent of gross domestic product (GDP) by 2010.
- The introduction of the European Research Area (ERA) concept and the launch of the Sixth Framework Programme (2002-2006) addressing it explicitly.

These developments must be viewed in the context of broader changes in the global economic and research landscape. Knowledge-based competition is changing fundamentally the environment in which European research and industry operate. Europe and the rest of the industrialised world can no longer take their technological leadership for granted. While Europe still maintains leadership in certain industrial areas, concern about the future arises from the rapid expansion of the European private sector RTD outside Europe and the inability to attract the best talent into Europe from around the world. There is a widespread impression that increasing availability of high-quality, industrially relevant knowledge and efficient, market-friendly innovation environments outside Europe are contributing to a gradual loss of European competitiveness.

Well publicised recent documents, such as the Sapir (2003) and Kok (2004) reports, stress that Europe has been unable to keep up with the fast pace of its main competitors. Europe’s performance, in terms of growth, productivity and job creation appears to be insufficient to maintain prosperity in the future. There is broad consensus that research, education and innovation are at the heart of any response to these challenges.

European universities and research institutions have traditionally been able to develop and maintain the European knowledge base. In many fields this is still the case. Taken as a whole, Europe even accounts for a larger volume of scientific publications than the United States

today. However, only a few European universities are recognised as world leaders. This is, at least in part, a result of insufficient resources combined with the fragmented nature of the European RTD landscape. European universities and institutes have yet to fully respond to global competition for knowledge and talent.

All parts of the triple helix are important for advancement in a knowledge-based economy. Innovation nowadays depends critically on collaborative networks involving academic and business enterprise research as well as on the participatory involvement of intelligent government. The conventional view of a linear process of academic-based knowledge creation subsequently picked up and exploited by industry has given way to a new practice of interactive innovation facilitated by public/private partnerships, knowledge sharing and mutual learning.

In the meantime, ten new Member States are in the process of transition. They must continue with efforts to establish an enterprise-friendly environment and build conditions for the knowledge-based economy. Institutional reforms and the allocation of sufficient resource to knowledge creation and sharing are both necessary steps in building a sustainable economic future. The intelligent use of structural funds combined with other EU and national instruments could provide solutions to these challenges.

Finally, the general public in Europe is becoming concerned about the social and economic impact of scientific and technological advances, as well as about how decisions relating to these developments are made. The lack of public support is apparent in some areas. To achieve the leadership in science and technology that is crucial for future prosperity, these concerns have to be addressed at both European and national levels.

In order to reverse the trends and achieve desired objectives, the Panel identified four key challenges that must be addressed through coordinated actions by the European Union and the Member States:

- Attract and reward the best talent
- Create a high-potential environment for business and industrial RTD
- Mobilise resources for innovation and sustainable growth
- Build trust in science and technology

3. Structure and Achievements of the Framework Programme 1999-2003

The Framework Programme for Research (FP) has undergone significant changes during the past decade and a half. FP3 (1990-1994) was developed against the background of efforts to extend the Internal Market; FP4 (1994-1998) took place during the period of the Maastricht Treaty and the White Paper on Growth Competitiveness and Employment; FP5 (1998-2002) reflected increasing interest in socio-economic values; and FP6 (2002-2006) has promoted the European Research Area.

Thematic priorities have evolved over the years and budgets have risen substantially. Early Framework Programmes placed a lot of emphasis on information and communication technologies and energy technologies. The share of both these technology areas has decreased more recently in favour of industrial and materials technologies, life sciences, environment, transport, and researcher training. Several other areas are funded at significantly lower levels. Overall, the Panel could not identify any major thematic gaps in the examined parts of the Framework Programmes.

FP5 and FP6 research activities and goals were found broadly consistent with the originally defined higher-level socioeconomic goals of the Programme. The Framework Programme has

by now established its position as a key element of the European RTD landscape contributing to the competitiveness and competence base of the Union. Organisations from all Member States participate in the Programme extensively in proportions largely in line with the States' size and RTD capabilities. This also applies to the New Member States whose organisations have achieved participation rates more or less commensurate to their population.

However, members of the Panel expressed their concern with what they viewed as extensive fragmentation of the Framework Programme and over-determination of its lower-level thematic areas. Industry reports of declining interest, general complaints about proposal costs, and heavy over-subscription of certain programmes may reflect, in part, excessive fragmentation and thematic specification. Further fragmentation could lead to marginalisation in some areas, declining industrial interest and increasing frustration in the research community. Such considerations led to a call for better focus of thematic priorities of the Framework Programme. More focus in terms of priorities at the higher level can, in fact, be combined with less specificity at the individual programme level.

FP6 has promoted risky research through the NEST programme which supports and anticipates scientific and technological needs. Although welcome, this is still a narrow approach. The Panel emphasised the importance of encouraging high-risk research in all thematic priorities of the Framework Programme, i.e., by raising the degree of risk of the average project funded by the Programme. The support of long-term RTD should be enhanced.

Allegations of severely dropping industrial participation do not appear clearly in the available aggregate numbers. The overall industrial participation in FP6 up to July 2004 was not significantly different from that in FP5, especially when Networks of Excellence are excluded. Industrial participation has been relatively higher in information society technologies (IST), nanotechnology, aeronautics and space, and sustainable development. It has been relatively lower in life sciences and food quality and safety. Looking across the two Programmes, in-

dustrial participation has increased in FP6 both as a percentage of participation and budget share in life sciences, has remained about the same in environment and energy, and has decreased somewhat in IST and in aerospace and transport.

Among FP6 instruments, the share of industrial participation is highest in Integrated Projects (IPs), followed by Specific Targeted Research Projects (STREPs) and at a substantially lower level by Coordinated Actions (CAs), Specific Support Actions (SSAs), and last and at some distance by Networks of Excellence (NoEs). The differences among instruments are even more pronounced in financial terms (industry share of FP funds absorbed).

The Panel felt that the original target of the Framework Programme to strengthen European competitiveness has over the years been complemented with a number of socio-economic objectives which have expanded the scope of the Programme and may have inadvertently decreased its industrial focus. In fact, European Commission data indicate that the examined Framework Programmes have had more participants from higher education institutions and other research institutes when taken together than from industry (Figure 1). Industrial participation should be raised above its current level. In particular, it is very important that the Framework Programme remains easily accessible to small technology-based firms and high-tech start-ups with strong growth potential.¹

[FIGURE 1 ABOUT HERE]

In its deliberations, the Panel received significant input on European Added Value from the 5-Year Evaluation Appraisal of the IST Programme, from Member State appraisals of the effect of FP5, and from surveys of Framework Programme participants. Such evidence consistently points at higher levels of additionality for FP5 relative to earlier Framework Programmes.

¹ Another paper in this collection by Ken Guy et al. presents the results of a recent broad survey that produced significant evidence for private sector participants in all FP5 thematic areas except IST.

The reported sources of European Added Value include the augmentation of national RTD funds for research infrastructures, pooling of resources to raise RTD investment on Europe-wide issues, enhanced access to foreign resources and capabilities, facilitation of international mobility of researchers, support to EU policy including regulation, health issues, etc.

Such benefits notwithstanding, the Panel emphasised the importance of an explicit, consistent definition of the added value of Framework Programmes. The concept of European Added Value has been evolving. Many of the conventional benefits identified in project-level evaluations imply such value: networking, especially international networking; facilities sharing; knowledge sharing; attaining bigger scale (critical mass) than is possible at the national level. There has, however, been limited concerted effort at systematic measurement. Research is needed to develop guidelines, concrete criteria and, perhaps, checklists to be used in assessing European Added Value. The Commission should take a leading role in developing a simple and robust definition of European Added Value taking into account the latest research on the need for government intervention and the need to develop lead markets for European solutions, which often involve measures from other policy domains such as common standards and easy access to the Single Market.

The principle of subsidiarity precludes the Framework Programme from supporting activities that would be better conducted at the national level. The continuation of the ERA, the possible establishment of a European Research Council, and the ability to facilitate technology platforms can raise the added value of future Framework Programmes and will increase the importance of a clear definition of the European Added Value even further.

In this context, the Panel stressed that expanded budget allocations to the Framework Programme will not make sense if Member States decrease their own commitments to national RTD. Anecdotal information points out such behaviour in both old and new Member States

and in specific areas such as human mobility. If true, such behaviour must stop or it will risk making the whole exercise of European RTD meaningless.

Implementation has not been entirely smooth for the two Framework Programmes under consideration. Oversubscription, increased management burden, complexity in preparation of proposals, and long and arduous negotiations have discouraged prospective applicants. One of the basic underlying problems in implementation seems to rest with the frequent changes in the Framework Programme thrust and objectives.

The Sixth Framework Programme has responded to the challenge of ERA by introducing two new instruments in the range of tools available to implement the Programme's priorities: Networks of Excellence and Integrated Projects. The effectiveness of the new instruments during the first two years of implementation has recently been reviewed by an independent panel of high-level experts, chaired by Professor Ramon Marimon, which praised the continuity preserved by the new instruments in following the long tradition of transnational collaborative research in Europe. In addition, these instruments make it possible to set more ambitious goals in objective-driven research (IPs) and in research integration (NoEs) through consortia and agglomeration of researchers that have the necessary critical mass.

However, the Marimon Panel also pointed out several areas for improvement. One such area is the costs and risks of participation in the new instruments that seem to be unreasonably high for prospective industry participants, most notably small and medium-sized enterprises (SMEs) and other small and emerging groups. SMEs have found it almost impossible to be involved in NoEs and have been disadvantaged in IPs. In contrast, SMEs have fared well in STREPS and CRAFT projects. Another area that requires improvement was said to be the goal for enhancing flexibility and simplification. Processes such as consortia-building, proposal submission, proposal evaluation and contract negotiation can be improved.

On the basis of the available evidence and consultations, the Panel found the Marimon report conclusions and recommendations quite appropriate. A greater future budgetary allocation was called for STREPs and small consortium IPs given that such instruments are better adapted to risk-taking, industry, participants from new Member States, and to smaller players in general. The efforts to attract emerging research groups and the most innovative firms in Europe must be enhanced. Administrative procedures and financial rules should be significantly simplified and further improved to allow more efficiency and flexibility in implementing participation in the new instruments.

Barriers to participation can be created by inefficient management processes, ineffective communication from the Commission, inadequate information channels, and lack of experience in application procedures. To the extent that application costs and risks of participation are unreasonably high in FP6, SMEs will suffer the most. Apart from these generic barriers, the effort to increase the impact through substantial funding of larger projects in FP6 may create biases in favour of research groups with proven track-record and well-accepted, objective-driven research. New, higher risk approaches and emerging research groups may be excluded. Organizations for the New Member States may run a higher risk of being excluded.

An area of high importance was identified in the mobility programmes. Key among them is the Marie-Curie Fellowships activity supporting the training and mobility of young researchers, the transfer of knowledge towards less favoured regions of the Community and, to some extent, between industry and academia. Individual fellowships account for the majority of Marie Curie Fellowships. SMEs account for only one quarter of the minority host fellowships. Nationals of France, Spain, Germany and Italy (in that order) topped the list of funded proposals. The UK was the most favoured Member State of applicant destination.

Marie Curie Fellowships would seem to be a fundamental programme for the achievement of the Lisbon objectives and for ERA. In order to build a knowledge-based society, Europe

needs to train more researchers from within and from outside – an estimated 500,000-700,000 researchers for this decade alone. To retain them, Europe must make research careers more attractive by giving researchers more autonomy and responsibility, providing science careers with greater visibility, making it easier to move across disciplinary lines and across geographical lines, and by paying researchers better.

On the basis of the broadly held impression that Marie Curie Fellowship activity has been an overall success, and given the very severe shortages of qualified personnel expected if Europe is to meet the Lisbon and Barcelona objectives, the Panel found it reasonable to call for increased attention to this activity in future Framework Programmes. It was deemed imperative that exchanges should be more balanced in terms of promoting mobility between the public and private sectors.

Finally, the Panel stressed that the Framework Programme must continue to address the issue of trust and legitimacy of science and technology in Europe as well as gender balance.

4. Interaction with Other Policy Areas of the Community and of Member States

Research and development promoted through the Framework Programme is not an end in itself but an important instrument for achieving a competitive European economy. Neither the Framework Programme nor its components can alone cause the major changes in the European research and innovation system that are envisaged in the ERA, Lisbon and Barcelona agendas. RTD investments and programmes are necessary but not sufficient for successful innovation. The interaction of RTD policy with other policy areas is of critical importance.

RTD policy should be complemented by and coordinated with other socio-economic policies. These should include policies for competitiveness, intellectual property protection, competi-

tion and state aids, human resource policies, especially education and gender, and ethics. More appropriately, they should also include demand-side policies, especially public procurement of RTD and innovative goods and regulation which can be used creatively to promote innovation and the emergence of lead markets.

The importance of competitiveness, innovation and entrepreneurial culture as major drivers for growth cannot be overemphasised. Although RTD is a critical input, innovation and competitiveness depend on many other factors for success such as investment opportunities, the regulatory environment, the ability of economic actors to rapidly transform technology into economic goods, and access to markets for goods and services.

Creating a business environment favourable to RTD, innovation, and entrepreneurship is of primary importance. Europe must be able to attract the most talented individuals from both within and from outside Europe. It must also become the best location for RTD for organisations from all over the world. This requires the willingness of the public and private sectors to work together, the former by providing an EU-wide framework favourable to business and by investing to remedy market failures, and the latter by investing the lion's share to achieve the Barcelona RTD targets. The integrated approach to competitiveness advocated in the research investment Action Plan proposed by the Commission promotes a whole set of legislative, coordination and stimulation measures across several policy fields such as RTD, innovation, intellectual property protection, human resources, fiscal measures, product-market regulation, competition policy, and financial markets. A systemic view to the various policy dimensions involved here is absolutely crucial.

Importantly, these are not issues only of Community RTD expenditures or of the Community services alone. It is an issue that relates to the overall innovation environment, the related framework conditions, and corresponding policies. It is also an issue for individual Member States who have very important roles as implementers of structural reforms and guardians of

competitiveness. The coherent development of national and European policies through an open coordination process is similarly important. The stimulation of RTD, innovation and entrepreneurship depends to a large extent on the commitment of the Member States to take the necessary decisions at the national level.

Private sector RTD investment – at the core of the Lisbon strategy – depends also on many factors that lie outside the traditional realm of science, technology and innovation policy. They critically depend on key framework conditions including macroeconomic conditions, fiscal conditions, financial markets, and labour markets that induce and empower companies to invest. Private RTD investment is also influenced in important ways by other policy domains like those affecting competition, standards and regulations, entrepreneurship, intellectual property protection, human resources, and public research.

Two of these policy domains directly relate to the organisation and success rate of the Framework Programme for Research: intellectual property protection and competition policy and State Aids.

The intellectual property (IPR) system in Europe currently faces very significant challenges. One of these is the lack of a European patent, a subject of discussion for no less than thirty years. The lack of a Community Patent disadvantages European organisations and individuals by raising the cost of protecting their inventions in distinct national markets with disparate IPR protection regimes. The overall cost for application, maintenance, and enforcement of a patent with European coverage remains significantly higher than the cost in competitor countries such as the United States and Japan. Europe still lacks an IPR regime that is simple, inexpensive, and efficient. The Panel strongly advocated the swift implementation of the European patent with the requirement of one language only. Another core issue is the increasing involvement of higher education institutions and other public research institutes in the commercialisation of innovation-related knowledge. Key here is the establishment of IPR rules to

provide the appropriate balance and incentives to university and other public research institute personnel, especially in relation to collaboration with industry and to participation in public research programmes.

Competition policy promotes competitive markets. A new EU competition regulatory framework entered into force in May 2004 revamping antitrust and merger control regulations and intending to reduce regulatory uncertainty by replacing national standards by a single European rule. Competition policy also addresses State Aid regulation (public subsidies), currently under review. While Community RTD funding alone does not constitute State Aid in the meaning of Article 87(1) of the EC Treaty, the Community framework for State Aid becomes applicable in cases of cumulation between Community and national funding. In such cases, the cumulative public support and its impact on competition are considered.

The present Community framework for State Aid rules, last modified in 1996, will expire at the end of 2005. The environmental aid guidelines expire at the end of 2007. Combined to the beginning of the new programming period for the Community Structural Funds in 2007, these provide an opportunity for a comprehensive review of the horizontal State Aid rules to account for the Lisbon objectives and the economic and social cohesion policy of the Union.

Meanwhile, the World Trade Organization rules for RTD subsidies have expired. In order to increase its international competitiveness, the Community must apply the appropriate economic rationale. The current system where the aid level is determined by the phases of research is outdated and not in compliance with the modern conceptualization of innovation. The interactive nature of the innovation process and the importance of networking as a primary working mode for the various stakeholders should be adopted. Justification of RTD funding is well established internationally and it is therefore important that EU State Aid provisions maintain a level playing field in comparison with Europe's main competitors. It has no reason to use stricter rules than they do.

5. Looking Into the Past, Seeing Into the Future

The Panel determined that the Framework Programmes for Research have, on the whole, played an important role in developing the European knowledge base. The Programmes have corrected some of the deficiencies in the European RTD landscape and have contributed to bridging the gap between RTD and innovation.

Carefully planned and targeted, the Framework Programme could serve as a catalyst for the European science, technology and innovation system. To succeed in this role, the tendency to expand the objectives (excellence, cohesion), thematic scope, and modalities/instruments of the Framework Programme should be resisted. Being different than the role of the national RTD activities, the Framework Programme must address the big European challenges with clear and transparent European added value. It should leave the tailoring for local effectiveness and take-up to programmes at the national or regional levels that must be further mobilized through the ERA process.

There is no doubt that work is needed on the demand side and on the supply side, at the European level and at the national level, for RTD policy and for related broader socio-economic policies. Europe must become a lead market for innovative new products. It must also be able to respond swiftly when substantial new economic opportunities emerge. The Framework Programmes for Research could identify such opportunities, facilitate the development of lead markets, and provide the catalyst for European countries working together to lead major global developments. One possible way to achieve this that the Panel discussed is through the establishment of a limited number of ‘technology platforms’ in key technology areas.

Industry has already been active in developing large collaborative research programmes for technology platforms. Ideally, they should be industry-driven and based on public/private partnerships for both financing and execution. They should involve academic institutions, large and small companies and, when needed, participants from outside Europe. They should be designed to restore European leadership in key technologies and thereby increase private investment in RTD in Europe. In order to be able to have the intended impact, technology platforms must be adequately funded and managed by pooling resources from the Framework Programme, national sources, and industry. Technology platforms are something to consider in areas where sufficient industrial commitment in terms of financing, intellectual resources and leadership is confirmed and significant economic potential on a global scale is identified. Adequate care should be devoted, however, in making certain that this process is not high-jacked by specific interests and short-term profit objectives.

Another issue of strong current concern that the Panel considered in its deliberations is basic research. This, of course, is an area with traditional support from national governments. The immense contribution of basic research to innovation and, more generally, to socio-economic development through both research results and training of highly-skilled researchers and scholars has been firmly established in the social sciences literature. Basic research, and the organisations responsible for it, are now the subject of intense debate in Europe: the twin objectives for the ERA and for a knowledge-based economy have brought to the forefront the notion of a European basic research fund and the possibility of setting up a new organisational structure to administer it.

While international research is already being carried out in Europe through various channels including the networks and projects of the European Science Foundation, EUREKA, large basic research laboratories (CERN, ESO, EMBO, EMBL), and thematic areas of the Framework Programme for Research, such support is focused on a limited number of activities and its magnitude pales compared to the support for scientific research and graduate education

provided at the national level. The compartmentalisation of national programmes and support systems among Member States may introduce three adverse effects at European level: insufficient competition among scientists and research teams; lack of sufficient cooperation and coordination activities; and, in some cases, lack of critical mass.

For these reasons, the Panel supported the establishment of a European Research Council. The Council needs to have sufficient resources to become a credible player in the European RTD landscape. The Council should promote excellence in science, be cost efficient and encourage the development of world-class research environments. In order to be able to make a difference, sufficient resources should also be allocated to scientific fields which have a long-term impact on competitiveness and innovation.

Finally, the Commission was urged by the Panel to address more clearly the contribution of the Framework Programmes to the EU policy formulation process. EU research should play a significant role by providing new insights into the European innovation environment and the creation of lead markets for new innovations. Not least, Member States can greatly assist in progressing towards the ERA. The overall effort must be calibrated against the results of regular, well-structured evaluation exercises that should address, in addition to the direct impacts of the Framework programmes, the higher level socio-economic effects and implications for the structural reform of the European research landscape and economic competitiveness. Such evaluation should seek answers to questions that cut across Framework programme activities and increase understanding of portfolio impacts. Ex ante appraisal of the future Framework Programme objectives should be connected to ex post evaluation on a regular and systematic basis applying consistent criteria that give sufficient attention to both long-term and short-term issues.