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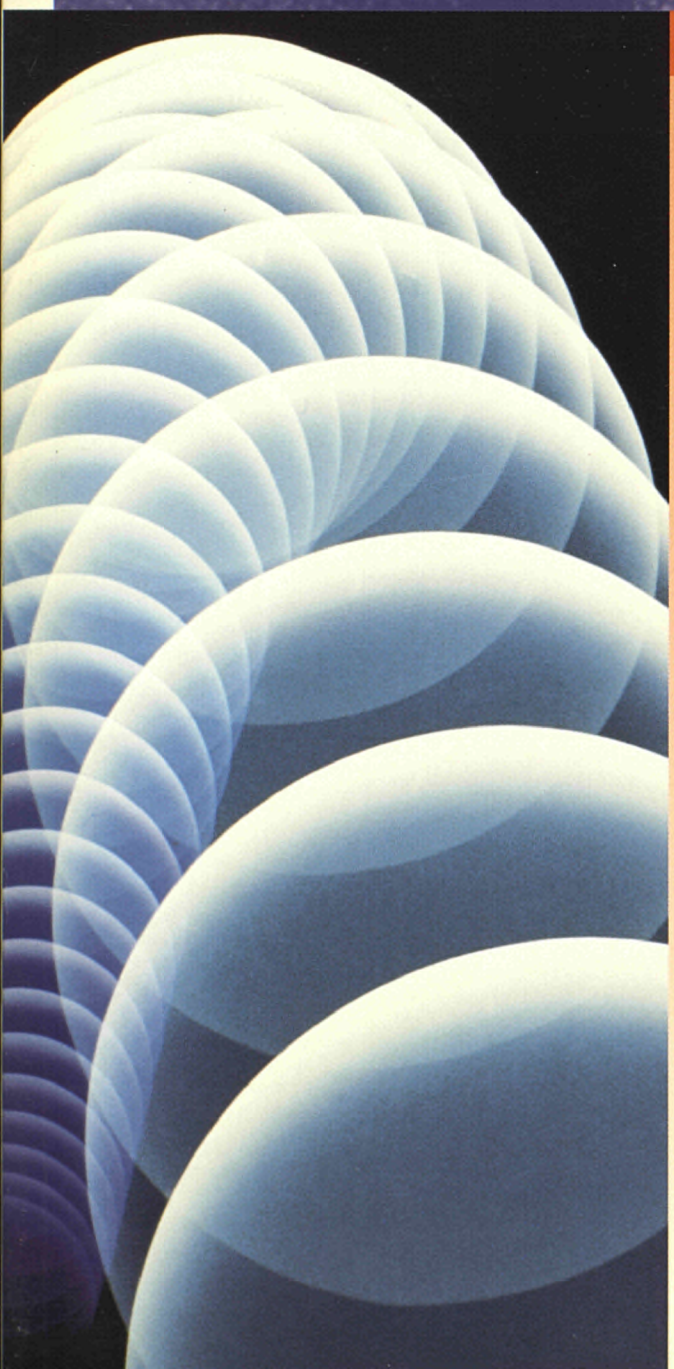

General information

Five-year assessment of the European Community RTD framework programmes

Report of the independent expert panel chaired by Viscount E. Davignon and the Commissions's comments on the panel's recommendations

EUROPEAN COMMISSION

FIVE-YEAR ASSESSMENT OF THE EUROPEAN COMMUNITY RTD FRAMEWORK PROGRAMMES

REPORT OF THE INDEPENDENT EXPERT PANEL
CHAIRED BY VISCOUNT E. DAVIGNON
AND
THE COMMISSION'S COMMENTS
ON THE PANEL'S RECOMMENDATIONS

DIRECTORATE-GENERAL
SCIENCE, RESEARCH AND DEVELOPMENT

1997

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PREFACE

In the current climate of increasingly tough worldwide competition, scientific excellence and technical innovation are, more than ever before, preconditions for economic competitiveness and hence for job creation and economic and social progress. This is the operational context for Community research policy, which, with four framework programmes to its credit, must now be regarded as a long-term endeavour.

When the time came to prepare the next framework programme, which will run from 1998 to 2002, it was vital to assess the advantages and disadvantages of the various instruments used under this policy. At the same time as I was leading the Commission in its own deliberations on this, an evaluation was being carried out by a group of high-level independent experts, presided over by Viscount Etienne Davignon, whose role in the development of Community research policy needs no introduction. I should like to express my heartfelt thanks to him and to the other members of this group for their valuable work and lucid analysis.

Their evaluation lends credence to the idea that a change is necessary, taking as a starting-point certain principles which clearly must guide Community action. Firstly, there is the Union's scientific and technological excellence, which must be strengthened; secondly, there is the pertinence of this action to the economic and social objectives involved in the building of Europe, an element which is given particular emphasis in the evaluation group's report; and finally, there is the contribution of European 'added value'.

We cannot deny that the current framework programme reflects these principles somewhat imperfectly. There are several reasons for this, not least of which is the decision-making process with which it is trammelled.

I should like to quote Viscount Davignon and echo his comment that 'none of the Member States would agree to carry out their own research policy in the conditions which govern the Union's research policy'. These conditions include unanimity on the part of the Member States and co-decision with the European Parliament, too many monitoring and

approval procedures, which make it impossible to react swiftly to unforeseen needs (as seen recently in the case of BSE), and too many programmes and committees.

It was obvious, therefore, that the fifth framework programme could not be conceived as a simple continuation of its predecessors. In an ever more rapidly changing world, merely doing what we have done in the past is tantamount to taking a step backwards. A new approach was needed. This is the tenor of the proposals which the Commission has put forward following extensive consultation of all the players concerned and broadly taking into account the comments of the evaluation group.

In the first place — and contrary to what has happened hitherto — objectives have been set at all levels, whether it be the framework programme as a whole, the individual programmes which comprise it, or the activities included in these programmes. At the same time, a number of objective criteria have been set to define the content of the framework programme. These criteria have been grouped into three 'families': the first is concerned with the social aspect, with primary emphasis being given to the impact on jobs, the second concerns economic development, the objective being to strengthen our competitiveness; and finally there is 'European added value'.

The second feature of the new approach is the attempt to be concentrated and selective, which takes place at two levels: firstly, and this is setting real priorities, the number of programmes is limited; secondly, we have proposed — as a complement to activities to develop generic technologies — a restricted number of 'key actions', which, as part of a global approach, will mobilize a vast range of disciplines and technologies in the service of economic and social objectives.

Finally, we have suggested that Community research programmes should be much more flexible in order to be able to respond to new requirements and situations, and to ease what is commonly perceived as the burden of over-bureaucratic management procedures.

With these changes, the Union should have at its disposal a radically transformed research policy, governed not only by the thrust of science and technology, which was the case for too long, but also — and above all — by the need to respond to the problems confronting our societies and economies, and thus to the concerns of the people of Europe.

Édith Cresson

Member of the Commission responsible
for research, education and training

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PART A

REPORT OF THE INDEPENDENT EXPERT PANEL

THE FRAMEWORK PROGRAMMES' FIVE-YEAR ASSESSMENT PANEL

We, the undersigned, the Framework Programmes' Five-Year Assessment Panel, are pleased to present our report to the European Commission.

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Former European Commission Vice-President
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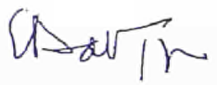

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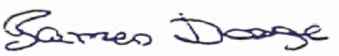

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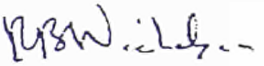

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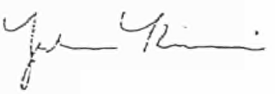

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Former Minister for Transport and Communications

Dr Alan Calder (United Kingdom), *Rapporteur of the Panel*
Segal Quince Wicksteed Ltd

TIME FOR A NEW LEAP FORWARD

In the Panel's view, the framework programme is not fulfilling its promise. It lacks focus and is underachieving. This is not the fault of individuals but of a structure which inhibits the formulation of real strategy and makes effective implementation difficult.

As it is currently conceived and managed, the programme is not flexible enough to respond to new challenges and opportunities.

Nor is it clearly related to the goals and objectives of the European Union. For too long it has tended to be an aggregate of national and sectoral desires and ambitions. It must be more than that in the future.

Essentially, the Union needs a strategy for determining programmes whose priorities are those of the Union. It also needs the appropriate political and legal framework for governing the programmes, improved managerial procedures for implementing them and, when necessary, for adjusting their priorities.

We agree with the Commission that it is time for a major change, for a leap forward as qualitative and fundamental as the creation of the framework programme itself. Our recommendations are designed to achieve that objective.

EXECUTIVE SUMMARY AND RECOMMENDATIONS

1. The Panel and its work

We are an independent panel of 11 European citizens convinced of the contribution that science and technology can make to Europe in the next millennium. By virtue of being free of national or sectoral bias we are well qualified to offer the objective advice contained in this report. The fifth framework programme is imminent and rather than offering a detailed evaluation of the past, we have geared our advice very much to the future. It is our hope that this report will be found useful in setting up this programme.

1.1. A thorough assessment

Our analysis has been both strategic and top-down. Within the limits of what we could examine and absorb in the time available, we have greatly benefited from:

- access to more than 100 submissions to the Commission on the fifth framework programme;
- consideration of the five-year assessment reports on all 18 specific programmes in the fourth framework programme and of the JRC;
- discussions with the directors of each specific programme (DGs III, VI, VII, XII, XIII, XIV, XVII, JRC) and with the chairmen of the five-year assessment panels, the Director-General of the Joint Research Centre (JRC) and the Director-General of DG XII, his deputy and other key staff.

Inevitably, there were limits to the expertise and knowledge that the Panel brought to its assessment of the large volume of material made available. But it did not come across any areas of major concern regarding the quality of the research being undertaken in the programmes.

We have confined our recommendations to a small number of general reforms with the potential to achieve that leap forward in qualitative performance required for the fifth framework programme.

We believe that our proposals will greatly improve the efficiency, quality, and relevance of the framework programme, while also enhancing the reputation of the European Union's scientific community in the eyes of its citizens and elected representatives.

2. The objective for the fifth framework programme

A strategy based on social and economic relevance and European added value

It is time for a change because times have changed. There is much more caution

about private and public investment in research in Europe than there was when the framework programme was launched in 1984. Then, there was strong political and public confidence in the contribution which science and engineering could make to the economic and social future of Europe. Major European companies saw a business advantage in increasing their investment in research and development. Now, market requirements prompt industry to focus on short-term results, despite the heavy investment in science and technology by competitor nations and businesses, especially in the Far East and the United States of America.

Nevertheless, the science and technology community in Europe is a vibrant, dynamic resource of the highest international quality. Provided that it can sustain the highest levels of scientific excellence, it is capable of making a decisive contribution to the task of maintaining and enhancing Europe's social and economic position in the face of increasing global competition.

2.1. A focusing strategy

The framework programme accounts for only 3.5% of all research and development expenditure in the EU. It is an instrument of the Union as a whole, to be used to meet specific challenges and opportunities and its impact will be minimal if it is no more than an extension of national policies. Effectiveness is greatly determined by the criteria employed in the selection of programmes and projects.

The Panel believes the strategy to focus the next framework programme must be firmly based on the twin pillars of scientific excellence and social and economic relevance.

A focused strategy is unlikely to emerge if the Commission follows the same consultative approach in preparing the fifth programme as it has done for the two previous ones. Consultation is clearly essential, but the 100 or more submissions that have been received all suffer from a common defect — their points of view have been decisively coloured by national or sectoral perspectives.

Simply adding them together will not produce a strategy for the Union. The framework programme is the responsibility of the Union as a whole, to be used to meet its specific challenges and opportunities.

2.2. Establishing relevance

Relevance can be derived from forward-looking analyses of technologies and markets, monitoring and anticipating developments. These are essential inputs and some part of the Commission needs to be responsible for ensuring that even the weak signals of significant social and scientific change are analysed as future opportunities or threats. It has been suggested to the Panel that the potential for developing the role of the JRC's Institute for Prospective Technological Studies is worth examining in this connection.

Additional support for strategy development should continue to come from the 'Targeted socio-economic research' programme and the small policy/strategy sections within the various Directorates-General. The effective use of analysis, monitoring and early warning can best be ensured if they are made part of the

Council of Ministers' decision-making process by, for example, submission of an annual report to the Council.

2.3. Adding European value

The Panel believes that, together with relevance, European added value should be the touchstone for selecting programmes and projects in future framework programmes. It is this criterion that separates work that should clearly be done at the European level from activity that should be sponsored solely within Member States.

Evidence of European added value is demonstrated by:

- the existence of important large-scale facilities which no individual Member State would develop and sustain;
- the promotion of internationally competitive R&D communities in new interdisciplinary areas such as information technology and biotechnology;
- the creation of strong European industrial platforms based on common technical standards able to compete or cooperate at a global level, for example mobile telecommunications;
- the development of pan-European norms and standards for commercial applications.

The primary instrument for adding European value is our invaluable scientific community, a precious legacy of previous framework programmes. It is a networked pool of talent, whose level of international competitiveness is beyond the capacity of an individual Member State to replicate. Nonetheless, it can and should be further developed and strengthened by:

- ensuring that European science supports and develops its existing strengths rather than focusing, as it has in the past, on compensating for weaknesses or 'catching up';
- encouraging the scientific community to work closely with users to realize the fruits of scientific research;
- recognizing that European critical mass can often be achieved in areas where no single Member State can mount a major effort.

If an excellent scientific community is a crucial means of delivering European added value, ensuring that its resources are concentrated in the areas of the Union's policy responsibilities is another. These now cover a very wide range, including the environment, transport, agriculture and food, communications infrastructures, as well as Euratom.

Good quality research is an essential precondition for good policy-making, not only in the setting of technical standards and regulations, but also in wide areas of economic and social life. It provides vital technical underpinning for many of the policy proposals the Commission sends to the Council. In a significant part of its work, the Joint Research Centre, the Union's own research capability, is meeting the criteria of excellence and European added value.

Since the Structural Funds could be a source of finance for research in some Member States, the same criteria for establishing European added value should be applied in making allocations. In

addition, the Commission should encourage Member States to use the Structural Funds to improve the quality of their research and to reinforce the benefits of the framework programme.

3. Political and administrative governance of the new framework programme

The Panel considers that changes are needed in the legal setting of the framework programme. At the moment, it is subject to detailed laws and controls imposed by the Council of Ministers and the Parliament which leads to inflexibility and lack of focus. Adjustments to meet new needs, or to reflect new scientific advances, require a tortuous and time-consuming legal process.

A new legal framework is needed with the following characteristics:

3.1. Council decisions by qualified majority

The present decision-making process is based on unanimous voting procedures in the Council, and co-decision by the Council and the Parliament. This tends to produce a programme built on national and sectoral interests, a view confirmed in discussions with many assessment panels.

The Panel believes that a strategic programme for the European Union is much more likely to emerge when Council decisions are made by qualified majority voting. It strongly recommends the Intergovernmental Conference to consider adopting qualified majority voting for framework programme decisions.

This would facilitate a process in which the Council and the Parliament would give the necessary political authorization for a framework programme, including a limited number of general programmes with their financial commitments.

3.2. Flexible procedures

Flexibility must be an essential characteristic of the next framework programme. It is currently lacking because each specific programme is governed by a legal decision fixing its topics and budgets for the full five-year term. With the approval process taking up to two years, the total effective span of the framework programme can be as much as seven years.

Given the accelerating pace of change and scientific advance, this is much too long for a programme to be without the possibility of change or adjustment except by means of a time-consuming legal process. It must be made easier to adapt the programme to new needs and scientific developments.

The solution lies in the Commission committing only a part of the programme budget during its first three years. This will allow the Council the choice every year of choosing either to fund new programmes or of leaving the budget as previously allocated.

3.3. Improving management accountability and quality

The task of implementing the programmes must be clearly delegated to the Commission, whose responsibilities would be to identify and design the list of specific projects which meet the goals set in the framework programme decision. The Commission must be clearly accountable for its detailed handling of implementation in a way which corresponds to best management practice in Member States and enterprises.

The management challenge facing the Commission is to eliminate the levels of bureaucracy and delays which are currently the source of much frustration and produce negative consequences for the framework programme as a whole. It must take steps to ensure that responsibilities are delegated internally in such a way as to raise efficiency and effectiveness in line with best practices in Member States and private enterprises.

3.4. Monitoring the Commission

If the Commission is to have more delegated authority, then the Panel believes that it must be effectively monitored by means of a new and stronger link between the Commission, the Council and the Parliament. We recommend the creation of a new Union Committee as a permanent and integral part of a more devolved process, made up of high-level independent experts appointed by, and responsible to, the Council. The new Union Committee should replace the existing Programme Committee structure.

4. New approaches to implementing the framework programme

The fifth framework programme must remain pre-competitive, but its implementation and organization need to be changed. The Panel wishes to re-emphasize that an essential precondition for pre-competitive research in Europe is that those submitting proposals must have total confidence that their scientific and technological content will be protected. Therefore, experts employed as reviewers of proposals must be bound by a confidentiality agreement.

The Panel recommends the following:

4.1. More active promotion of technology diffusion and commercial exploitation

One of the clearest manifestations of Europe's less-developed entrepreneurial culture compared with the USA lies in technology diffusion and transfer. Attempting to remedy this defect is the most important aspect of the Commission's implementation of the fifth framework programme. The Panel recommends that:

- programme directors and managers must be made clearly responsible for diffusion and exploitation. They must ensure that the user community and non-participants in the programme, particularly SMEs, are alerted to the possibilities of exploiting framework programme research. They should also improve links with the venture capital community and with Easdaq;

- Eureka is concerned with establishing products in the market place and the Commission should improve its direct links with appropriate programmes and projects.

4.2. Give more help to SMEs

A simplified and extended CRAFT scheme could help SMEs with legal (intellectual property) and financial issues. A decentralized form of management should be considered.

4.3. Apply a systems approach to implementation

This is needed because the Union's technological challenges are increasingly complex, multidisciplinary and multisectoral, spanning, *inter alia,* safety, the environment, energy, transport and sustainability issues.

4.4. Create 'virtual' institutes

Thought should be given to leveraging the resources of quality European research institutes by means of modern communications technology. Powerful 'virtual' institutes in Europe would remove the Commission's need to invest in 'hard centres' for its own research and could include elements from the JRC.

4.5. Establish the Union as a partner in Member States' projects

The Union should be encouraged to take part in large joint projects with groups of Member States under Articles 130k, l and n of the EC Treaty.

5. Balancing the programme

5.1. Fundamental research versus applied research

Each thematic programme should be given full responsibility for achieving the correct balance between fundamental and applied research. While many projects do not require fundamental research, it can be crucial in new emerging areas such as biotechnology and microelectronics. A linear approach spanning all programmes is too inflexible and simplistic when requirements change. For example:

- BSE was once a diagnostic issue, now it demands fundamental research on the biology of the disease;
- there is a strong trend away from fundamental research towards user needs in the ACTS, IT and Telematics programmes, and a strong convergence between the three.

The balance between fundamental and applied research will tend to depend on technological maturity. The need will be greatest in new, emerging so-called science-based technologies, such as biotechnology and microelectronics.

5.2. Merge the IT programmes

Given the breadth of agreement on the convergence between the IT, ACTS and Telematics programmes, the Panel believes they should be merged in the next framework programme.

5.3. Thematic and activity-based programmes

In trying to encourage innovation, a correct balance must be struck between these two types of programmes. Since the Panel has concluded that responsibility for exploitation should remain with the thematic programmes, the Innovation programme should concentrate more on the demand side, disseminating technical information very close to the market and dealing with innovation management and organizational issues.

5.4. External balance — Enlargement, developing countries and international cooperation

Preparation for enlargement should be given a special place in the framework programme, which is likely to overlap with the start of negotiations with the candidate countries.

Technical projects for developing countries should contain a clear European interest, although some will be undertaken for political reasons, such as health-related research into tropical diseases.

International cooperation activity can be assigned to thematic programmes, but with much stronger coordination with other Union programmes such as PHARE, TACIS and MEDA. A small team could be set up and charged with the responsibility of developing a global scientific and technology policy for those regions not covered by existing Union programmes.

6. Conclusion

The fifth framework programme needs to make a qualitative leap forward; it should not be a straightforward prolongation of the fourth framework programme.

It needs to be based on the twin pillars of scientific excellence and social and economic relevance, and it can only be made relevant if it is the result of a strategic approach. The Panel's recommendations for changes to the legal framework and for a more effective implementation process are the basis for such a strategy.

However, scientific excellence and relevance have to be accompanied by European added value, which the Panel firmly believes must be the essential criterion for selecting programmes and projects in future framework programmes.

1. INTRODUCTION

The European Union is approaching a watershed in relation to the framework programme[1] created by changing perceptions about the role of research in society. Research is no longer considered to be an end in itself and increasingly has to be seen to be delivering benefits that are relevant to societies' industrial competitiveness and broader needs.

As a result, a more selective approach is being taken towards investment in research in the public and civilian sector in Europe. This contrasts with the much more positive climate that existed in the early 1980s when the framework programme was initiated. At that time there was much higher public and political confidence in the contribution that science and technology could make to the economic and social future of Europe.

In Europe today many industrial RTD organizations have been both downsized and moved nearer to the market in product-based divisions. This has led to a reduction in RTD expenditure in many sectors, with the notable exception of pharmaceuticals.

University budgets throughout Europe are feeling the impact of pressures on public expenditure, and governments are clearly signalling that they may withdraw support from university research which is not internationally competitive.

On the competitiveness front, a number of different indicators point to worrying differences in the level and application of RTD between the EU and its main competitors — the USA and Japan. Total European research investment in 1995 amounted to 1.9% of GDP with comparable figures of 2.45% for the USA and 2.95% for Japan, which is still increasing its rate of RTD investment faster than that of the USA or Europe. Further pointers to more innovative cultures in the USA and Japan are their 7.4 and 8.0 scientists and engineers per 1 000 inhabitants, respectively, compared with 4.7 in Europe.

As Europe approaches the millennium, its main concerns are to maintain its social and economic advance in the face of increasing global competition. In detail, the issues to be faced are as follows:

- **unemployment** — Europe now has 18 million unemployed;
- **competitiveness** — Europe has lost industrial competitiveness in a number of high-tech product areas to the USA and Japan;
- the **information society** — this is now within reach but requires action to be fully established;

[1] Framework programme refers to two separate Decisions:

(a) Decision No 1110/94/EC of the European Parliament and of the Council of 26 April 1994 concerning the fourth framework programme of the European Community activities in the field of research and technological development and demonstration (1994 to 1998); and

(b) Council Decision No 94/268/Euratom of 26 April 1994 concerning a framework programme of Community activities in the field of research and training for the European Atomic Energy Community (1994 to 1998).

- there is a need for **sustainable development** to improve living standards and reduce environmental damage;
- **enlargement** — preparation must be made for the accession of new Member States from Central and Eastern Europe and the Mediterranean;
- support for a **wider range of Community policies** in the areas of agriculture and fisheries, transport, cohesion, health and energy, and the involvement of SMEs in research.

Despite the pressures, the science and technology community in Europe remains a vibrant, dynamic resource of the highest international quality. It contains many areas of scientific and engineering excellence and is able to make an immense contribution to these issues. However, further efforts are required because this potential has not yet been fully realized in the achievement of economic success.

In order that the appropriate resources can be allocated, it is the task of the science and technology community to honestly assess the contribution it can make to each relevant issue and advise the political process accordingly. In some cases, political and scientific priorities may differ, and when they do the former must take precedence when it comes to allocation of public resources. To be successful, the framework programme needs to combine the traditions of scientific excellence with social and economic relevance.

Given that this assessment has been made just before the formulation of the fifth framework programme, it is highly appropriate that **the Council of Ministers and the European Parliament have decided that an independent expert panel be asked to evaluate the last five years of framework programme activities.**[1] In the light of the timing, the Panel took the view that its primary focus should be on looking forward, rather than dwelling on the past, distilling the lessons learned from previous framework programmes into a sound body of advice for the future.

The move from the fourth to the fifth framework programme now provides a unique opportunity to rebase the European Union's research activity on the important issues and priorities that concern the Union as it approaches the millennium. The criterion of scientific excellence must be maintained and enhanced. In addition, more emphasis must be paid to the criterion of social and economic relevance. These are the twin pillars upon which the fifth framework programme must be built.

2. THE PANEL'S APPROACH

Members of the Panel met nine times between July 1996 and February 1997 and communicated extensively among themselves and with their independent

[1] Article 4(2) of Decision No 1110/94/EC and that of Decision No 94/268/Euratom on the framework programmes stipulate that 'the Commission shall have an external assessment conducted by independent experts into the management and progress with Community activities carried out during the five years preceding this assessment. It shall communicate this assessment and conclusions, accompanied by its comments, to the European Parliament, the Council and the Economic and Social Committee prior to submitting its proposal for the next framework programme'.

Rapporteur. From the outset the Panel decided to take a strategic and top-down view looking to the future and focusing on those issues that will stimulate the **qualitative leap forward** that it believes is required.

The Panel has benefited from access to the more than 100 submissions to the Commission made by national governments, European bodies and institutions during the consultative process. In addition, the Panel has had the benefit of the reports from the parallel five-year assessments of all 18 current specific programmes, as well as of the Joint Research Centre (JRC).

Subgroups from the Panel have also interviewed specific programme directors from DGs III, VI, VII, XII, XIII, XIV and XVII and the Director-General of the JRC. In addition, the Rapporteur interviewed either the chairman or rapporteur of each of the specific programme assessment panels and the JRC. Finally, discussions have been held with the Director-General of DG XII, his deputy and other key staff. Many helpful documents have been supplied by the Commission services, notably the DG XII Programme Evaluation Unit which has ensured the overall coordination of the assessment exercise.

The Panel wishes to record its appreciation of the open and frank nature of all the discussions which were important in highlighting many of the key issues.

The methodological approach of the Panel was to evaluate the legal and economic context of the framework programme and the European position at the world level, assess relevance, efficiency and effectiveness as well as strategy formulation and instruments. Despite the wide knowledge and experience of the Panel, its members could not look into all areas in detail.

In the light of all the above, the Panel has concluded that it can be most effective in focusing its independent advice on a small number of general recommendations, which it believes have the potential to create the qualitative leap forward that is required in the formulation of the fifth framework programme.

The Panel wishes to stress the importance of the fact that **the framework programme is a European Union programme designed from a European perspective.** The next programme will fail if it repeats the tendency of previous framework programmes to be an aggregate of national and sectoral projects.

3. ASSESSMENT OF THE FRAMEWORK PROGRAMME DURING THE LAST FIVE YEARS

In parallel with this assessment, separate five-year assessments have been carried out by independent expert panels on all 18 specific programmes, the seven JRC institutes and the JRC as a whole. The Panel recognizes the scale and uniqueness of this exercise involving some 170 European experts. While these assessments contained a wealth of valuable input to the overall exercise, the Panel felt that it could not carry out a rigorous analysis of all 26 evaluations. Nevertheless, a fairly detailed summary of all panels' views of the relevance, efficiency and effectiveness of the specific

programmes and the JRC was prepared by the Rapporteur and is presented in the Annex.

The overriding common theme from these assessments is the **unacceptability of the levels of bureaucracy and delay** that stem directly from the legal structure of the framework programme. The need for change in this aspect is covered in detail later in this report. In addition, the Panel takes the view that some of the specific programme reports could have had a wider scope if more Panel members had been taken from outside the same science and technology community. However, it is important to note that **no areas of major concern were noted regarding the quality of the research being undertaken in the programmes.** On this basis, the Panel does not consider it necessary to make any specific comments on quality.

4. KEY ISSUES FOR CHANGE

The Panel's view is that the framework programme **has not so far fulfilled its promise.** The Panel believes that this is principally because of a legal structure which makes strategy formulation and implementation difficult and leads to too much bureaucracy and inflexibility. In addition, the Panel feels that further efforts should be made to exploit the fruits of framework programme research with better linkages to activity in the market place.

Finally, the framework programme has to achieve a correct balance between basic and applied research and also between thematic and activity-based programmes.

This analysis has led the Panel to highlight a short list of issues requiring urgent attention in order to improve the structure of the fifth framework programme.

4.1. Programme strategy

The Panel's view is that a real improvement is needed in the way in which strategy is developed for the framework programme. The programme's approach to consultation with the Member States tends to lead to a negotiation between national and sectoral interests. Thus the programme turns out to be shopping lists of national priorities, often with low coherence and little European added value.

While recognizing a continuing need to consult with Member States, the Commission is urged **to employ a more strategic approach** in proposing the content of the fifth framework programme.

4.1.1. Relevance

The Panel believes that strategy should be firmly based on the **criteria of relevance and European added value.** Relevance should be based on a forward analysis of technologies and markets to see which new technologies are likely to be important for the future and which markets are likely to grow in response to future market drivers. This approach is the heart of technology foresight and many countries, including Member States, are undertaking market and technology foresight exercises to assess which technologies and markets are going to be the most important for future prosperity. The

results from these exercises are now being used in some countries to set priorities for RTD support in universities.

The Commission should make more extensive use of techno-economic and market scenarios and technology watch. In order to assist it in recommending new or adapted programmes, the Commission should also put in place measures to detect the weak but significant signals which point to key changes in the scientific or social environment that represent future opportunities or challenges.

Looking at the resources available to the Commission, the 'Targeted socio-economic research' programme and the small policy/strategy sections within the various Directorates-General can continue to work on the substantiation of strategic options. The IPTS (JRC Institute for Prospective Technological Studies in Seville) is also a highly relevant resource and the Panel recommends that its role be examined to ensure that its work is both directed at this issue and included in strategy formulation. One priority is to create a centre of overall responsibility within the Commission for gathering all the different elements of the strategy. This must be clearly linked to the Council's decision-making process. Such a role might be fulfilled by IPTS. (A fuller discussion of the JRC is given in Section 4.3.7.)

The Panel believes that these suggestions will create a **more strategic** basis for the formulation of framework programmes and will result in a **better targeted and focused outcome.**

4.1.2. European added value

The Panel firmly believes that, alongside relevance, the other main selection criterion for programmes should be **European added value.** This criterion separates work which clearly should be done at the European level from activity that should be sponsored solely within Member States. The Panel has formed the view that European added value has not been given sufficient priority in previous programmes. Its importance derives from the fact that the framework programme represents only 3.5% of all research and development expenditure in the public and civilian sectors of the European Union. This allocation is so modest that it can have only minimal impact without significant European added value.

If it is to be the overriding selection criterion, then clearly European added value must be readily identified. Its qualities derive from:

Treaty and policy obligations

European added value here relates to **Treaty obligations** entered into by Member States for specific areas of research, for example Euratom. In addition, the Union has an obligation to support research in areas such as environment, transport, agriculture and communications infrastructure where there is a clear need to have Europe-wide policy. The Commission also needs to be able to carry out research to substantiate its proposals.

The European scientific community

A European scientific community now exists in many areas and past framework programmes have made a positive contribution to building it. It is a valuable asset which must be further developed in the

next framework programme. The scientific community's added value lies in it being a networked pool of talent that can compete internationally at a level beyond the capability of an individual Member State. Hence a **European critical mass** can be established in areas where no one Member State can separately mount a major effort.

This European network should be further extended to large-scale facilities. They constitute an important research instrument to maintain the competitiveness and cohesion of European research when no individual Member State has the capacity to develop and fund them individually. European added value is also evident in promoting new interdisciplinary activity in such internationally competitive fields as information technology or biotechnology, with the aim of accelerating the growth of a viable RTD community.

European standards and platforms

Looking towards the market place, European added value is clear in RTD, which creates **pan-European commercially utilizable standards** which can transform a technical into a commercial success. Building on European standards is also evident in RTD, which creates strong European industrial platforms for cooperation or competition on equal terms with other global powers, for example, on mobile telecommunications.

Although these criteria are aimed at the framework programme, the test of European added value could also be applied to the science and technology activities supported by other European Union initiatives such as the Structural Funds.

These initiatives commit considerable additional RTD expenditure alongside the framework programme and essentially aim at improving the level of research in less-well-developed regions. The Panel sees strong synergy between the use of the Structural Funds for RTD and the framework programme, and urges the Commission to encourage Member States to use the Structural Funds to reinforce the benefits of the framework programme.

4.2. The legal and management environment

4.2.1. History of the legal problem

The present complicated legal environment surrounding the framework programme is considered by the Panel to be the major area where change is required. European Union research and technological development, a relatively recent introduction to the life of the Community, is subject to detailed laws and controls imposed by both the Council of Ministers and the European Parliament. These make the framework programmes subject to a set of legal decisions (25 in total for the fourth framework programme and the Euratom framework programme) which fix topic areas and budgets at the beginning of the programme for its five-year duration. This practice has its origins in the wishes of Member States to control the programme content in their national and sectoral interests. The result is a programme that is both **inflexible and contains too many multinational 'shopping lists'** and consequently lacks focus.

A further constraint arises from the specific procedures of the Euratom Treaty.

It follows that any subsequent changes to meet new needs or to reflect new scientific advances require a tortuous and time-consuming legal process. For example, the need to mount a greater European response to the new threat to human health posed by BSE could not be adequately satisfied within existing programmes and required additional budget finance under procedures involving the European Parliament. On transport, the legal process is so constraining that the specific programme management, while wishing to focus more on intermodality, concluded they were powerless to make the necessary changes.

These problems have diminished the reputation of the Union and the Commission and created frustration among participants. This has led to some companies and organizations refusing to participate and, for resource-limited SMEs, made the prospect of participation even more daunting.

4.2.2. A new legal framework

A **new legal basis** is urgently required for the fifth framework programme to improve its strategic content, flexibility and efficiency.

The key is to define clear roles for the Council and the Parliament in setting strategic policy and direction, and for the Commission in implementation.

Policy

The current legal basis requires unanimous adoption of the European Union framework programme by the Council and co-decision by the Council and the Parliament. The Panel's view is that the requirement for unanimity on the framework programme decision perpetuates fragmented approaches leading to sub-optimal programmes sometimes based on national shopping lists. This view was confirmed in many of the discussions which the Panel had with the assessment panels of the specific programmes. This problem would be exacerbated, moreover, with the enlargement of the European Union.

The Panel therefore believes that a strategic European Union framework programme will be much more likely to emerge when decisions are made by qualified majority voting. It recommends that the Intergovernmental Conference considers adopting qualified majority voting for the framework programme decision. This is seen to be the key to securing political authorization from the Council and the Parliament in the form of a smaller number of more focused and strategically sound specific programmes together with the relevant budgets.

Implementation

The Panel recommends that the task of implementing the programmes is **clearly delegated to the Commission.** Its task will be to design and deliver the list of specific programmes which meet the goals identified in the framework programme decision. The Commission will then be clearly accountable for implementing the specific programmes. This will conform with best practice in Member States where governments approve RTD programmes at a broad conceptual and budgetary level, leaving

government officials clearly in charge of implementation. Similarly, directors of multinational corporations approve budgets covering broad business areas and technologies, leaving research and project managers to translate commercial objectives into relevant RTD programmes for new and improved products, processes and services.

A new Union Committee

If more authority is delegated to the Commission, the Panel recognizes the need to monitor its implementation activities. At the same time, the clear separation of roles between the Council and the Parliament, on the one hand, and the Commission, on the other, creates the need for strong formal links between the two.

Accordingly, the Panel recommends the formation of a new **Union Committee** appointed by, and responding directly to, the Council. It would consist of high-level independent experts and should act as a Committee of the Union. The Panel believes that this new Union Committee should replace the existing Programme Committee structure.

This Committee would take responsibility for monitoring the Commission's implementation activity and should also be the sponsor for the more detailed monitoring and evaluation of programmes recommended in Section 4.2.4. At the same time, this new Committee could play a key role in advising the Council and the Parliament on options for new framework programmes and on the interim decisions which could arise from the new budgeting mechanisms suggested in the following paragraph.

Flexibility

As indicated above, the current framework programme lacks flexibility, essentially because the whole budget is allocated to specific programmes at the beginning of the five-year period. To create the flexibility needed to respond to new developments or threats, the Panel recommends that not all of the framework programme's allocated budget is committed at the beginning of the five-year period. The Commission should **only commit a relevant part** to cover the first three years. It is likely that the uncommitted part of the budget will vary between different areas depending on the perceived rate of evolution of the science and technology.

However, in a case where, for example, no more than 80% of the total budget is to be committed over the first three years, the Panel envisages the following. In year one of the programme, 100% of the allocation for that year will be committed, up to 80% of the allocation for year two and up to 60% of the allocation for year three.

Under this new procedure, the Council would be advised by the new Union Committee, which every year would be reviewing the potential or need for new initiatives or specific programmes that could be supported by uncommitted parts of the budget. If the Council does not opt for new proposals, the budget would then be allocated to the existing programmes along the scheme above.

The package of legal changes outlined above is an absolute prerequisite for a significant increase in flexibility within the framework programme. The changes will, we believe, have a greatly beneficial effect on the efficiency, quality and

relevance of the framework programme and enhance the reputation of the European Union's scientific community in the eyes of the Union's citizens and elected representatives.

The Panel believes that this greater flexibility will make it much easier for the framework programme to respond to new opportunities or challenges. This is a particularly important justification for flexibility, given the extremely rapid pace of evolution of some technology areas, for example in microelectronics and biotechnology.

4.2.3. Commission programme procedures

While a lighter legal base and more delegation to the Commission will provide a backdrop for a more flexible framework programme, many of the detailed procedures employed by the Commission have been criticized by the assessment panels of the specific programmes. These criticisms are endorsed by our Panel and changes are recommended and outlined below:

- *Delegation* — with more delegation to the Commission it is clear that authority to act within the Commission itself is a critical issue for improving efficiency and effectiveness. There needs to be transparency of authority and, in particular, sufficient robustness at programme director level consistent with best practice in Member States.

- *Overall timescale* — this issue provoked by far the majority of recommendations for change from the specific programme assessments. Almost all assessment panels registered strong discontent with the length of elapsed time between closing of calls for submission and first payment. Generally speaking, this is normally more than a year and there are clear calls for a reduction to six months at most. Looking at the steps in the process, the least satisfactory appears to be the stage concerned with agreeing and signing contracts. Clearer and less-complex contractual agreements are called for, along with a change in culture within the Commission's legal and financial services.

- *Transparency and feedback* — an improvement in the transparency of selection procedures is deemed to be necessary, especially when deciding between highly rated projects. More regular and clear feedback is required during this process, especially when delays occur and when turning down highly rated projects. Debriefings with those whose proposals are rejected should also be considered. Published service standards based on declared quality procedures would be helpful in this area.

- *Commission staffing* — there is clear evidence from a number of specific programme assessment panels and interviews that the Commission is understaffed in some areas. While this appears to be a deliberate tight management policy, it is contributing to delays and loss of efficiency in some areas together with poor morale amongst overworked staff. The problem is regarded as sufficiently general and serious to ask the Commission to review staffing and ensure that workloads are adequately balanced. Delegating specific tasks outside the organization might provide a solution in some situations.

4.2.4. Monitoring and evaluation of programmes

The delegation of more authority to the Commission in running the framework programme and the implied greater flexibility of approach highlight a greater need for effective monitoring and evaluation of Community RTD programmes. In this matter, the Panel supports the broad proposals made by the Commission[1] and endorsed by CREST,[2] and already being implemented by the Commission.

These call for an annual monitoring of programmes by a small group of independent experts consisting of a representative from industry, an academic and an expert in programme evaluation. At an interval of every fourth year, the evaluation of programmes should cover each five-year period and be carried out by a panel of five or six independent experts. For continuity, a few members of monitoring panels could join the evaluation panels, but a majority of the evaluation panel members must be different from those participating in the monitoring process.

The Panel is of the opinion that the scope of the evaluation exercises should be increased by considering the broader context of programmes, international developments, as well as a detailed and serious set of input and output indicators addressing questions such as 'what happened?' and 'did the EU promotion make any difference?'. This is a continuous task of the Commission or of external evaluation studies, which has to be performed as a preparatory input for the panels. The task of the panels is not to guide this fact-finding process, but to survey and interpret these facts and results and to draw conclusions.

These procedures will provide an independent view on key issues relating to programmes' development and will constitute an important check on the integrity of the new approach to managing the fifth framework programme.

4.2.5. Intellectual property and patents

An associated area with important legal implications concerns the establishment of intellectual property and patents. At the moment, the cost of patenting in the European Union is about 10 times that of the USA and is seen as a highly negative factor for competitiveness based on exploitation of technology. The very high charges are particularly discouraging for high-tech SMEs which are increasingly seen to hold the key to employment and growth. Apparently, much of the difference between the US and European costs relates to translation. Moves are being made to limit this by narrowing the range of languages required. The Panel strongly supports further efforts to simplify and to reduce the cost of the European patent system.

Moreover, if European pre-competitive research is to realized, it will be essential that those submitting proposals must have total confidence that their scientific and technological content will be protect-

[1] COM(96) 220 final — communication from the Commission to the Council and the European Parliament, 'Independent external monitoring and evaluation of Community activities in the area of research and technology development'.

[2] CREST/1208/95 — CREST advice to the Council and the Commission on the monitoring and evaluation procedures for Community research programmes.

ed. Confidentiality must, therefore, be assured.

4.3. Approach to the implementation of the new framework programme

Comparative studies suggest that while research activity in Europe compares well with that in the USA and Japan the innovation culture in Europe is weaker, and the development and exploitation of research through to commercial success is pursued with less vigour. In addition, venture capital is less available in Europe, and there is a lower rate of formation of high-tech SMEs.

The current framework programme is clearly pre-competitive and has three main instruments: the 50/50 funded shared-cost action, which is the main vehicle, concerted actions and the direct work of the JRC.

In essence, these policy instruments have been unchanged for 12 years, while no Member State has left RTD policies untouched over this period. In general, most national governments have pulled back from the 50% shared-cost form of funding in favour of an increased emphasis on broader innovation policies. These focus strongly upon providing firms with the capabilities to make use of scientific and technological knowledge. At a minimum, the framework programme should have a much more integrated approach to support for RTD and support for innovation. The present separation of responsibilities between at least three Directorates-General institutionalizes and implies acceptance of the linear model of innovation, rather than fostering interaction between knowledge creation and application.

The Panel's view is that while remaining pre-competitive the framework programme **requires an enhanced range of modalities** to ensure that it can play a full part in promoting a more innovative culture leading to economic success. In that context the Panel sees a strong role for the Commission's programme directors and managers. They should have a much clearer responsibility for managing projects all the way towards a successful commercial outcome. The Panel recommends that the Commission adopts the following approach to developing a more innovative culture.

4.3.1. Technology diffusion

The Panel considers this to be an important aspect to be tackled by the Commission. A manifestation of Europe's less-developed entrepreneurial culture compared with the USA lies in technology diffusion and transfer. In the USA, the market is more efficient at transferring technology from its creation in universities and institutes to industrial firms, especially SMEs. As a contribution to improvement in this area, the Panel strongly recommends that the Commission's programme directors and managers within the specific programmes have **clear responsibility for ensuring the diffusion** of the technology developed within their programmes into the market place for commercial exploitation. While the most successful outcome is one in which project participants commercialize their own findings, other avenues of exploitation need to be vigorously pursued with non-participants when this

does not occur. In such circumstances, programme directors and managers need to have contact with the venture capital community.

4.3.2. SMEs

The support and development of SMEs, particularly in the high-tech sector, is critical to the employment growth objectives of the Union. Many SMEs are already involved in the framework programme and the improvements to implementation procedures recommended here should encourage further participation. It is clear, however, that their participation would be better facilitated if they had more help with all the financial and legal issues related to exploiting research, particularly in the area of intellectual property issues.

The Commission is urged to examine whether the existing CRAFT scheme could be further developed as a vehicle for this. It would also be appropriate to examine whether the provision of such services could be delegated to Member States and organizations nearer to the local market.

4.3.3. Eureka

Better links should be encouraged with Eureka. This organization was launched in 1985 by 17 West European countries. The main objectives of Eureka are to raise productivity and competitiveness of European industries and economies in the civilian world market. Eureka is aimed clearly at putting products directly into the market place and hence operates beyond the pre-competitive line that must be respected by the framework programme. However, framework programme and Eureka projects could readily dovetail in an enhanced innovation chain propelling framework programme RTD into the market place.

The Commission is urged to build the necessary **links with Eureka** to achieve this purpose.

4.3.4. Advanced European virtual institutes

The success of the European yeast genome sequencing network highlights the potential of **linking European centres together** in thematic areas to mount projects with international critical mass.

The Panel feels that this concept could be developed further using modern communications technology to create European virtual institutes in appropriate thematic areas. These would allow greater European focus on emerging areas of technology and the more rapid establishment of a competitive European position. Such an approach could obviate the need for the Commission to invest in further 'hard centres' for its own research.

The basic idea is to create a modern institutional arrangement for international research which offers:

- flexibility through limited duration (5 to 10 years);
- a stable medium-term operating environment to allow continuity over a certain period;
- close cooperation between excellent research groups in Europe (and abroad).

Such a new instrument would support a modern and advanced research organization, which is institutionally located between the established research infrastructure (such as the JRC) and the (time-limited) project-specific cooperations.

The Commission is urged to seek **appropriate opportunities** to implement this concept.

4.3.5. A systems approach

Increasingly, the technological challenges that face the Union have a complexity that is difficult to contain within a traditional thematic framework programme. More and more of the challenges are multidisciplinary requiring combinations of scientific and technological disciplines. In addition, a multisectoral approach is required, since many opportunities are at the interfaces between sectors, or clearly involve more than one sector. This is true, for example, of major projects that relate to safety, the environment, energy, sustainability, and transport.

The challenge here lies in effective co-ordination of the various elements and in the Panel's view a new systems approach is required.

It is recommended that the Commission **puts in place a systems approach based on a set of coordinating mechanisms** to deal with major projects.

4.3.6. Use of Articles 130k, l and n

The Maastricht Treaty on European Union introduced Articles 130k, l and n to further boost the possibilities for RTD co-operation in addition to the framework programme. These Articles open the way for the Union to participate in major projects financed by groups of Member States, including participation in the structures created for the execution of the relevant programmes.

The Panel recommends that the Commission promotes the **use of this vehicle for large development projects** funded essentially by interested groups of Member States.

4.3.7. The Joint Research Centre (JRC)

The JRC is the European Unions' own internal research capability concentrated in seven separate research institutes located in various Member States. As such, it is an **important instrument of the Union** which increasingly needs many different research activities in support of policy.

The Panel's view is that much of the work of the JRC meets the criteria of excellence and European added value, especially the Institute for Transuranium Elements at Karlsruhe. The Panel also supports the view expressed by the JRC Assessment Panel, that the JRC should further focus its research efforts, concentrating only on those areas where it can achieve **true scientific excellence.**

The Panel welcomes the progress made in putting the JRC on a more commercial footing, noting that an important part of its income derives from research contracted by third parties.

Recruitment appears to have been a problem at the JRC for some time. The Panel therefore welcomes the new

research personnel policy, and encourages moves to increase the flexibility of JRC personnel.

The Panel would also like to see further moves to increase the autonomy of the JRC.

4.4. Programme balance

In a number of important areas both inside the framework programme and concerning its external relations, the Panel's view is that a correct balance must be struck between key factors.

4.4.1. Fundamental research and applied research

One of the most important aspects within the framework programme is the balance between fundamental research and applied research and development. This issue becomes even more important as many areas of the framework programme move their centres of gravity nearer to user needs and applications.

In the past, an oversimplified approach was used. This followed linear assumptions about the RTD process and tended to apply the same rules to different thematic areas. In addition, the lack of flexibility of the programme made the evolution from fundamental to applied research more difficult.

It is clear that there cannot be a uniform approach to this issue. The Panel firmly believes that it is the responsibility of each thematic programme to achieve the **correct balance between fundamental and applied research.**

The correct balance will inevitably depend on the state of technological maturity of the field. The research need will be greatest in new emerging areas, the so-called science-based technologies such as biotechnology and microelectronics, where there is clear European added value in rapidly building a critical mass of competitive research in the Union.

It is reasonable to expect, therefore, that the balance between fundamental and applied research will vary widely between thematic programmes.

The correct balance within a thematic area will not, however, be static. BSE, for example, first appeared as an animal disease and early research was mainly confined to its epidemiology. However, the emerging threat to human health has recently precipitated much more fundamental research on the biology of the disease.

In the ACTS, IT and Telematics programmes, the balance between fundamental and applied research has been shifting steadily through the successive framework programmes towards the applied end and user needs. At the same time, it is widely perceived that these technologies are converging in advanced applications meeting complex user needs.

The Panel therefore recommends that the **ACTS, IT and Telematics programmes are merged** under the fifth framework programme.

In a similar way, convergence is seen **in the biotechnology elements within the Agriculture, Biomedical and Biotechnology programmes,** and the Panel recommends that these aspects also be merged in the fifth framework programme.

Finally, and subject to meeting European added-value criteria, the Panel wishes to stress **its support for a continuing level of fundamental research linking universities and industry in fruitful partnerships.** It is essential that this is retained as a platform for new concepts that can replenish the science and technology reservoir.

4.4.2. Thematic and activity-based programmes

The Panel believes in the principle that wherever possible research projects and programmes should be **managed from within the thematic areas.** In addition, responsibility for dissemination and exploitation of project and programme results should also be the clear responsibility of the thematic programme.

In the case of the **Innovation programme,** this means **a refocusing and freedom to concentrate** more on the demand side, coordinating programme-wide issues that cover the interests of all specific programmes, for example issues of innovation management and organization.

In the training field, the **'Training and mobility of researchers' (TMR) programme** is seen by the Panel as needing to be **better linked to the thematic programmes.** The Panel's view is that the programme has a potentially high European added value and is held in high regard by the European academic community as being a useful scheme, even if it often supports unfashionable areas that are otherwise difficult to fund.

In the past, a weakness of the programme was its inability to attract the highest quality young researchers in Europe, partly because of image but also because of bureaucratic slowness in the appointment process. The Panel understands that measures have been taken to improve this situation and hopes that the programme will be able to attract the best candidates.

The Panel supports a TMR programme with a greatly improved image so that the best young minds will be proud to occupy European fellowships.

4.4.3. External balance

Regarding the external balance of the framework programme, the key issues are seen to be enlargement and international cooperation.

On **enlargement,** the Union has already made a significant effort to cooperate with the RTD communities in Eastern Europe, where most of the potential new Member States are located. The Panel very much sees this as a platform to build on and recommends that the Commission takes **further initiatives** to stabilize and develop the RTD communities of aspiring Member States. This should be an element within the fifth framework programme handled wherever possible within the appropriate thematic programme.

In the **international cooperation** field, the Panel's view is that much of the research activity should be **reassigned** to the appropriate thematic programme. A need is also seen to **improve greatly coordination** between INCO and other Union programmes that operate externally, such as PHARE, TACIS and MEDA. Finally, a small team in charge of develop-

ing a **global science and technology policy** towards regions outside the Union not covered by these programmes could be put in place.

Regarding **developing countries,** some notable success has been achieved, particularly with biomedical programmes on tropical diseases. Such programmes, however, are mainly to the benefit of the developing country and have little European added value. As such, they form part of the wider political relationship between the Union and developing countries. While the Panel views this as a legitimate area for RTD cooperation, it would also encourage the framework programme to establish **more technically driven cooperative projects** which meet European added-value criteria.

ANNEX

RELEVANCE, EFFICIENCY AND EFFECTIVENESS OF THE FRAMEWORK PROGRAMMES DURING THE LAST FIVE YEARS

1. Introduction

The 18 specific framework programmes, the seven JRC institutes, and the JRC as a whole, have all been the subject of five-year assessments in parallel with the overall framework programme assessment.

A significant part of the overall picture is the assessment of relevance, efficiency and effectiveness of the specific programmes. Having decided to take a top-down strategic view, the Framework Programme Assessment Panel will not comment in detail on the results of all the specific assessments. The summary below represents the views of the specific programme assessment panels themselves. However, the Framework Programme Assessment Panel does wish to note that no areas of major concern were noted regarding the quality of the research being undertaken in the specific programmes.

2. Framework programme — Modes of operation and delivery mechanism

The objectives of Community research and technological development (RTD) policy as defined in the EC Treaty (Article 130f) are aimed at strengthening the science and technology base of European industry and bolstering its international competitiveness. Following the Treaty on European Union, there is also an obligation to promote all research actions considered necessary under the terms of other Community policies.

Article 130g of the Treaty lays out the following list of activities as relevant to the above:

- implementation of research, technological development and demonstration programmes by promoting cooperation with and between undertakings, research centres and universities;
- promotion of cooperation in the field of Community research, technological development and demonstration with third countries and international organizations;
- dissemination and optimization of the results of activities in Community research, technological development and demonstration;
- stimulation of the training and mobility of researchers in the Community.

Community RTD policy is mainly implemented through three types of action: shared-cost contractual research, concerted actions, and the Community's own research programme within the Joint Research Centre (JRC). The Community framework programme (FP) dates from 1984 with the introduction of FP1 (1984-87). FP2 (1987-91) was followed by FP3 (1990-94) and the current FP4 (1994-98). Current annual expenditure is about ECU 3.5 billion, representing about 3.8% of the Community budget.

The detailed objectives of FP3 and FP4 are described in Table 1. Building on EU concerns for industrial competitiveness, standards and the propagation of a European dimension, FP4 added coordination of research policies between Member States and the Community, dissemination of research results to SMEs and technological support for the whole of EU policy.

FP4, together with the Euratom FP, consists of 15 specific programmes covering different technological areas, referred to

collectively as Activity 1. Three horizontal activities (also called specific programmes) cover all sectors and deal with 'Cooperation with third countries' (Activity 2), 'Dissemination and optimization of results' (Activity 3), and 'Stimulation of the training and mobility of researchers' (Activity 4). In addition, the work of the Joint Research Centre's seven research institutes falls within the framework programme. The 18 specific programmes are listed in Table 2.

Each specific programme has a responsible director within the Commission and is assisted by a Programme Committee, representing Member States. Following calls for proposals, scientific peer review committees evaluate applications and make recommendations for funding to the Commission.

Independent evaluation of programmes is an important policy platform for the Commission and frequent reviews are held. In particular, a series of five-year assessments of all specific programmes has just been completed and the summary evaluation described in this report is based on that output and represents the views of the specific programme assessment panels.

The total financial commitment to the various programmes is shown in Table 3.

3. Summary of the five-year assessment

For assessment purposes, the 18 specific programmes are divided naturally into three groups as follows:

Industrial programmes (A)	Life sciences and the ecosystem (B)	Other programmes (C)
• Telematics applications	• Biomedicine and health	• Targeted socio-economic research (TSER)
• Advanced communication technologies and services (ACTS)	• Biotechnology	• Cooperation with third countries and international organizations (INCO)
• Information technologies (IT)	• Agriculture and fisheries	• Dissemination and optimization of results (Innovation)
• Industrial and materials technologies (IMT)	• Marine science and technologies	• Training and mobility of researchers (TMR)
• Standards, measurement and testing (SMT)	• Environment and climate	
• Non-nuclear energy		
• Transport		
• Nuclear fission safety		
• Fusion		

3.1. Relevance of specific programmes

The panels generally conclude that the selection criteria of research projects as outlined in the specific programme objectives had been adhered to. It is also clear that specific programmes are considered to be relevant to European industry and to the Community's general socio-economic policy orientations. Indeed, some programmes were noted as 'even more relevant', especially in bringing to FP4 a sharper focus and more accent on user applications and deliverables rather than basic research.

Relevance was identified in terms of the creation of new or improved scientific and engineering models and methods, processes and technology validation that benefit industry directly. In addition, programmes provided significant input to the drawing of guidelines for the establishment of European or even global norms and standards, which are especially important in the creation of technology systems that confer competitive advantage on Europe.

Industrial programmes (Group A)

For the major industrial programmes, i.e. Telematics, ACTS, IT and to some extent IMT, a significant shift occurred between FP3 and FP4. These programmes had previously had a technology push focus aimed at closing the technology gap between Europe and the USA and Japan. For FP4, the focus moved sharply to user needs and applications, more in the innovation area and recognizing the broad needs of all industries. This focus on applications recognizes that much of the added value arises at that point in the innovation chain and that this has added relevance for European competitiveness.

Looking forward, the ACTS programme is calling for standardization on a European information infrastructure combining telecommunications, data networking and broadcasting capability, with a focus shift from technical standards to volume deployment especially around home multimedia.

In the IT field, while continuing with the emphasis on user involvement, closer attention should be paid to electronic systems builders and IT user companies. Structurally the programme should adopt a base of macro-domains in microelectronics, software technologies and applications. Microelectronics is especially crucial as an infrastructure issue. To facilitate its spread, links between RTD and structural funding should be substantially extended. The Telematics programme evaluation draws attention to the emerging multimedia industries as offering major business opportunities over the next two decades, and calls for a continuing focus on standards, particularly open standards, infrastructure and platforms (e.g. SAP).

All three programmes (i.e. Telematics, ACTS and IT) are calling for closer integration and, indeed, a common integrated ICT programme.

The IMT evaluation focuses on the increasing relevance of technological competitiveness as most manufacturing industries are engaged in fierce global competition. This is aided by the shortening of product design and development timescales, and the continuing trend to concentrate on core activities.

On **'Standards, measurement and testing'**, metrology objectives remain valid and should continue into FP5, providing a base for European standards. However, competitive product standards should be the responsibility of relevant specific programmes.

'Non-nuclear energy' objectives are still valid in the light of increased environmental concerns around fossil fuel burning, the potential expansion of the Union to countries of Eastern Europe and the likely sharp increase in energy demand from an expanding world population.

'Transport' research continues to be important, given the fragmentation of standards among Member States, serious traffic congestion and the objectives of sustainable mobility and European competitiveness. Activity has served to institutionalize the cooperation between Member States by bringing together key industries and operators in the rail, air and waterborne areas.

As regards the **'Fission safety'** programme, the growing and ageing European population of nuclear reactors and the situation of the pre-accession countries of Eastern Europe point to the continuing relevance of this programme. The *raison d'être* of the fifth framework programme in this field should be to maintain European Union expertise. It will need to emphasize research on new concepts, advanced reactors, and safe management of nuclear waste, as well as knowledge of the effects of radiation on man and the environment.

For **'Fusion'**, the Assessment Panel was particularly impressed by the progress made by the programme over the last five years. The programme is highly relevant for long-term energy supply, creating options for the middle part of the next century. Global cooperation is being sought against a background of tightening public spending in Europe. A key strategic decision is required to clarify the future for Europe's large community of fusion researchers.

Life sciences and the ecosystem (Group B)

'Biomedicine and health' had the objective of contributing to the improvement of medical and health research and development in Europe by facilitating the establishment of new collaborations and/or consolidating and strengthening existing collaborations. This objective continues to be relevant with an ageing West European population and provides a European dimension for responding to new threats, for example the human form of BSE. The programme is strongly research-oriented and has produced an impressive list of publications and patents.

For **'Biotechnology'**, a strong shift from curiosity-driven research to industrial collaboration is evident in the move from Biotech I to Biotech II and is increasing the relevance of the programme. Programme changes were made for various calls, demonstrating flexibility at Programme Committee level and a capability to respond to new developments, especially in molecular genetics. Europe's lagging position opposite the USA is a spur for enhanced activity in this field, both at a research level and at the exploitation stage, where routes to market are less evident than in the USA.

The development of financial platforms alongside the industrial area is

recommended to plug the venture capital gap. While high European added value is evident, too many projects are approved allowing different laboratories to proceed with independent research.

For **'Agriculture, forestry and fisheries'**, the Specific Programme Assessment Panel was concerned that it had become too short term in focus because of its close links to the common agricultural policy (CAP) and the common fisheries policy (CFP). To be able to lead policy evolution, the research agenda must include longer-term issues. Two broad objectives are clear. The first is concerned with productivity and international competitiveness, but, increasingly, issues related to the sustainability of all rural systems are coming to the fore. The Specific Programme Assessment Panel feels that research on sustainability should be more strongly encouraged, taking care to develop new methodologies which do not compromise scientific rigour and paying particular attention to the needs of the environment.

Taking the 'Biomedicine and health', 'Biotechnology', and 'Agriculture, forestry and fisheries' programmes together, several of the panels recognized a strong biotechnology thread running through all three. This is not currently recognized in any coordination mechanism. It is suggested that for FP5 the biotechnology elements of all three programmes are combined.

For **'Marine science and technology'**, the objectives are seen to be more relevant than ever in view of increased competition in the sector from the USA and Asian countries. In addition, utilization of marine resources is now a matter of much greater public concern. Most recent programmes emphasize getting end-users in industry more involved along with government research institutes and policy-makers.

For **'Environment and climate'**, the programme goals of strengthening the European science base, conducting policy-relevant research, and supporting research capable of improving the competitiveness of European industry remain valid. The major themes addressed in the programme are considered to be relevant to the international scientific agenda and developments.

The programme content was seen to go too far in reflecting local issues of national concern and hence care has to be taken not to dilute European added value. The clarity of objectives improved between FP3 and FP4, where a clear distinction was made between science base, policy and industrial objectives. This distinction, however, is not obvious across the work plan and there are few instances of verifiable objectives.

Other programmes (Group C)

The **'Targeted socio-economic research'** programme was launched in 1994 under FP4 as a new programme in Community research. The programme consists of three parts:

Area 1: Evaluation of science and technology policy options in Europe.

Area 2: Research on education and training.

Area 3: Research into social exclusion and social integration in Europe.

The three areas chosen represent a narrow selection from the wide range of possible topics for this new programme. Area 1 is a continuation of the previous

Monitor programme aimed at giving policy advice on day-to-day issues — it remains as relevant as ever. A key issue concerns the need to underpin technology policy using more advanced systematic approaches than the old linear model of innovation. This area has produced many good, high-quality projects from excellent groups of workers.

On education and training, an impressive progress seminar was recently held covering a range of issues to do with developing the knowledge base.

Area 3 is important as a basis for social cohesion, but much more research is required. The issues of integration, enlargement, joining EMU, etc., all have major social implications. At first glance, the project portfolio gives an impression of fragmentation, but on closer inspection projects are clustering and overlapping in an interesting way. Of special importance is the need to create links between the projects and policy-makers.

'Cooperation with third countries and international organizations' (INCO) collaborative activity is divided between sectors with widely differing characteristics. The Specific Programme Assessment Panel found that the efforts undertaken were generally relevant to the objectives laid down and that high relevance continues given the prospective enlargement of the Union and the rising need to collaborate globally.

The INCO/COST collaboration has yielded impressive results especially in vaccine research which has facilitated long-term cooperation between the scientific research sector and industry. Collaboration with Eureka has been less successful owing to the difficulty in finding suitable projects.

The Copernicus and INTAS programmes were essential but temporary responses to urgent needs arising in Central Europe (CCE) and the newly independent States (NIS). The impact of these programmes has been suboptimal because of the lack of local infrastructure, and high priority should be given to PHARE and TACIS to support structural reforms in RTD and in industrial application.

Wherever possible, it is recommended by the Specific Programme Assessment Panel that full participation in Activity 1 programmes by CCE/NIS should replace Copernicus. The Panel considers that collaboration with non-European industrial countries and emerging economies is rapidly growing in importance and that all Community programmes should be opened up to participation on a case-by-case basis under reciprocity and suitable IPR agreements.

The original aims of the Japanese S&T fellowship programme have now been achieved and it should be scaled down/phased out over two to four years.

The basic objectives of INCO-developing countries remain highly relevant across the major areas of health, agriculture, the environment and technology. In the case of technology, cooperation should be funded at a higher level so that the benefits of IT and communications technology can be more widely accessible in the developing countries.

The **Innovation programme** is seen by its Assessment Panel as more relevant than ever to the Community's concerns about competitiveness and economic and social cohesion. Innovation is a major source of new, high-quality jobs and leads to creation of wealth. This means management skills, circulation of

knowledge across borders and sectors, flexible product markets and market-oriented RTD. In addition, standards and regulations that promote innovation are required, as well as beneficial tax policies and capital markets. A European patent policy that cost-effectively defends property rights worldwide is also required. At the same time, research institutions and industry should work much more closely together to meet customers' needs.

Broadly speaking, the programme was seen to be cost-effective, although there are some priorities to reassess and other shortcomings to be corrected, but these problems are not seen as paramount. The Specific Programme Assessment Panel argues that such is the importance of innovation that the activity should be expanded and based on new organizational arrangements within the Commission in support of a European innovation policy. In effect, a 'think-tank' is proposed to lead thinking in the field.

The alternative of boosting innovation within the specific programmes (currently 1% of budget) does not appear to have been considered.

The basic premise of **'Training and mobility of researchers'** (TMR) remains correct and still relevant. Europe will be better placed to face future challenges if its scientific and technology community is ready to cooperate across discipline, across culture and across regional and national boundaries. A training and mobility programme has a substantial contribution to make in developing this cooperation.

Further, these training and mobility activities must take account of the challenges and play a part in the development and stabilization of Central and Eastern Europe. Equally, the activities must have the capability of transcending purely EU concerns to ensure research encompasses the global dimension of industrial competitiveness and sustainable development.

Regarding priorities — the Marie Curie Fellowships should become the flagship of the programme and limited to high-quality candidates such as Rhodes scholars. Follow-up on contribution to European research is key. On research networks (Ph.D. training) — it is seen as key to extend these to Eastern Europe and to get more variety and a better cost/benefit ratio.

On large-scale facilities (LSFs), some interesting clusters have appeared and efforts should be made to increase this activity via more active coordination. However, this activity should not become a platform for looking at the creation of new LSFs. There is some feeling that a better position could be found in FP5 giving more freedom to develop this area.

3.2. Efficiency of specific programmes

Generally speaking, the views of the specific programme assessment panels are that programmes are being efficiently run, but most believe that there is room for improvement in making the project selection and funding procedure more streamlined and swift. This was the most commonly highlighted area among the panels and the area of most serious criticism to which the Commission absolutely must pay attention. The telematics and biotechnology panels were particularly critical of procedures.

All panels cite the long period, often longer than a year between closing calls and contract signing, as being completely

unacceptable, especially in fast-moving areas like IT and biotechnology where the picture can change dramatically within a year or, for example, in Eastern Europe, where scientists may depend on EU money for survival. Legal and financial aspects are believed to be particularly responsible for delays. It is considered that this problem, already well highlighted, must be solved for FP5.

Panels are calling for a process that reduces the overall time delay to five to six months. Increased delegation of authority is seen as essential to make progress, particularly to enable the rapid approval of smaller projects with financial control decentralized in line with modern business practice. Other suggestions call for 'total re-engineering' (IMT) and the implementation of the US ARPA model (Telematics). The use of letters of intent to allow work to start early is recommended (IMT).

A further aspect concerns oversubscription which exacerbates the timescale problem by creating unmanageable peaks. Some programmes have implemented a two-stage process with much clearer guidelines for applicants. This aspect of best practice is also recommended by several panels.

The IT Specific Programme Assessment Panel has recommended a bankruptcy contingency fund to protect those situations where the project coordinator goes bankrupt. The Biotechnology Panel called for much better feedback to all applicants and more consultation with industrial research managers, users and SMEs (instead of IRDAC!).

Regarding management efficiency, almost all the specific programme assessment panels have concluded that, within the financial and personnel constraints, the programmes were efficiently managed by the Commission staff. Indeed, in a number of cases, notably IMT, 'Transport', 'Biomedicine and health', panels offered the view that Commission staff were unacceptably overstretched in units running at staffing levels of around two thirds of the agreed complement. This seems serious enough to ask the Commission to review workloads generally and ensure that units run at the staff levels agreed to ensure efficiency.

Operational efficiency is obviously influenced by flexibility to deal with emerging rising priorities in a timely way. A traditional fixed budget and topic framework programme tends to lack the flexibility necessary to respond to developments in, for example, IT and biotechnology.

Some programmes, for example IT, have responded vigorously to this challenge by creating a rolling programme broken up by frequent calls. Supporting this, the ACTS Panel is calling for FP5 to be a 'headings only' programme to facilitate adjustment, re-targeting and reallocation. Other programmes, for example Transport, are calling for greater flexibility but have made little internal response seeing the issue at framework programme level.

Efficiency is also seen to be compromised by programmes that are overinfluenced by national shopping lists at the expense of large, broader European programmes. This criticism has been made by the assessment panels for IMT and Transport.

The 'Targeted socio-economic research' programme only began under FP4 and has seen its early efficiency compromised by frequent changes in director (four in two years) and other key staff.

The INCO programme cites poor communication, infrastructure and lack of local banking facilities for the generally moderate efficiency of many of its overseas projects.

Several programmes call for greater use of electronic communication and video conferencing to be formally led by the Commission.

3.3. Effectiveness of specific programmes

All panels assert that the initial objectives of the specific programmes related to Council decisions have mainly been achieved. Most research is deemed to be of high quality and the main research objectives achieved.

However, while most of the research was successful, it often lacked clear goals in terms of deliverables and hence impact, particularly economic impact. It has to be added that under FP4 a much greater attempt has been made to define clear measurable goals that reflect positive economic impact — the major shift to user focus in most of the industrial programmes will ensure a clearer impact in future assessments.

Most commonly, effectiveness is related by specific programme assessment panels to satisfactory project outputs, such as publications in authorized journals, other publications, workshops, conferences, test methods, new processes and prototypes. Patenting rates often look low in specific programmes — again related to the strong research perspective of the earlier framework programmes. Higher patenting rates are expected from FP4.

Some quantitative data on effectiveness are presented. The IMT Panel notes that quantitative studies of exploitation potential made over 1991-95 identified an average economic return of between ECU 4 and 6 for each ecu invested in pre-competitive research in the BRITE/EURAM programme. In the 'Non-nuclear energy' programme, Community research is judged to have made some contribution to the slight fall in the amount of energy required to generate a unit of GDP between 1973 and 1994. For Thermie, 28% of projects gave an acceptable payback in relation to the current price of fossil fuel. In the INCO/COST programme, impressive results have been obtained in vaccine development, while in the biotechnology area major achievements are recognized in genome research and technology for lipase and lactic acid production.

Dissemination is seen as a relatively weak area in many programmes, especially MAST, 'Agriculture, forestry and fisheries', 'Biotechnology', 'Telematics' and IMT. In the last case, special information/advisory units are recommended to enhance dissemination in key areas, for example aeronautics.

Indeed, in some areas, for example biotechnology, there is a conflict between exploitation and dissemination, especially if participant companies are not sure whether they wish to commercially exploit technology developed within the framework programme.

In contrast, dissemination is seen to be particularly good in the 'Standards, measurement and testing' programme, albeit in a slightly different sort of community.

Many panels are calling for a much clearer dissemination and exploitation

plan to be a firmer part of the original project evaluation.

All panels believe that an important contribution is being made to building a genuine RTD community which will have benefits for European competitiveness and, of course, contribute to Community cohesion. Building on that, the ACTS Panel sees much greater interconnectivity and interpretability within the Community. On a related theme, the IMT Panel notes that many collaborative relationships continue after completion of projects.

Significant contributions to the development of European standards are noted for ACTS, IT and SMT.

Major contributions to EU policy-making are highlighted for IMT, SMT, 'Transport', 'Biotechnology' and 'Targeted socio-economic research'. For MAST, the major impact was on national policies in Member States. The Environment and Climate Panel noted a poor relationship with policy-makers that needs to be improved.

A number of panels drew attention to the poor exploitation record of Europe as evidenced by low rates of high-tech SME start-up and growth. Better links are proposed with the venture capital community including the idea of establishing clear financial platforms alongside industrial ones.

Finally, many panels referred to poor co-ordination and collaboration between different Directorates-General. While this is not always the case, for example on agriculture, there does appear to be a general problem that needs to be tackled at Commission level.

3.4. The Joint Research Centre

Evaluation of the JRC is based on interviews with Professor J. M. Rojo, responsible for the overall evaluation of the JRC, and Mr J.-P. Contzen, the responsible Director-General in the Commission.

In addition, the reports from the seven separate visiting groups to individual JRC institutes were available.

Professor Rojo considered that the JRC had improved significantly over the last 10 years, mainly in terms of scientific excellence in a number of areas, especially on basic actinides research at Karlsruhe, and now had a positive external reputation. However, it still had to focus more because research excellence is not possible across the board. In parallel with focusing research, there is a need for increased activity to provide technical support to the Commission. It is clear that several Directorates-General need technical and scientific help with formulating very complex directives.

All visiting groups considered that good progress had been made since the last visit and most of the points highlighted then had been dealt with. All visiting groups welcomed the new competitive approach and challenge, and the success which resulted. This had engendered more positive attitudes and morale. There were some concerns, however, that the competitive spirit should not lead to dilution of effort beyond core competences.

Several visiting groups called for greater focus of objectives, especially in the space applications, on radioactive transfer modelling, and remote sensing of forests. At the same time, some units, for example the Institute for Transuranium Elements, were encouraged to broaden activity

beyond the core to analytical aspects of nuclear safeguards.

In several areas it was felt that work had progressed beyond the point where external testing of concepts was required, for example on multimedia networks, dependable software and sensor-based robotics, as well as on results obtained on 3D holographic images. This links to other calls for the JRC to adopt a more business-like approach, do more marketing and interestingly, set up a commercial incubator at Ispra.

Regarding management, several groups called for better objective setting and project management and the use of external programme user advisory boards containing some industrialists to help focus. Most visiting groups referred to the need for wider collaboration between JRC units and sites, with more staff transfers and more senior staff transfers from the JRC to Directorates-General in Brussels.

Other management aspects concentrated on the old problem of recruitment. While some progress is being made with the new three-year contracts, many inflexibilities still exist and several groups urged that JRC directors are given more flexibility in selecting, promoting and removing scientific staff, with the internal progress review system being better oriented towards the needs of the JRC. Use of head-hunters to find talent internationally was recommended by several groups. These recommendations are made in the knowledge that in several institutes significant bodies of key staff are nearing retirement and will need to be replaced.

Finally, considerable progress is judged to be taking place at the IPTS in Seville. It now has a much clearer brief, formal budgets, a defined set of customers and a skilled and enthusiastic staff. Greater interaction is, however, seen to be necessary, particularly with key customers in Brussels but also with other JRC sites. Electronic communication and Internet usage is encouraged to facilitate this.

Notwithstanding the generally positive nature of the above assessment, two of the specific programme assessment panels comment on the JRC. The Environment and Climate Panel reports that the contribution of the JRC in the field of environment is largely unrecognized by much of the research community served by the 'Environment and climate' specific programme. There are also concerns about the size of the environment RTD budget allocated to the JRC and a question of whether the budget should be reallocated to the specific programme.

In the nuclear fission safety report, lack of clarity is perceived on how the JRC objectives are coordinated with those of the specific programme. In addition, poor working-level contact is cited between DG XII staff managing the specific programme and the managers of the JRC programme.

TABLE 1

FRAMEWORK PROGRAMMES 3 AND 4

Framework programme 3 was broadly designed to meet six major objectives:

- Improving industrial competitiveness.
- Attainment of large market objectives via norms and standards.
- Encouraging transnational industrial initiatives.
- Introducing a European dimension into training of RTD staff.
- Increasing economic and social cohesion while ensuring the scientific and technical excellence of research projects.
- All initiatives to take into account environmental protection and the quality of life.

In industrial programmes, the emphasis was on pre-competitive research and technological development.

Framework programme 4 built on that, with a number of new strategic goals:

- Creation of high-level infrastructures in information technology, communications, transport and energy.
- Greater competitiveness in industrial technologies and their compatibility with quality of life, environmental protection and safety, and smart, clean production technologies.
- Systematic dissemination and utilization of research results, in particular for small businesses.
- Coordination of Member States R&D policies with Community research policy.

TABLE 2

SPECIFIC PROGRAMMES UNDER FRAMEWORK PROGRAMME 4 AND THE EURATOM FRAMEWORK PROGRAMME

Activity 1

Telematics applications

Advanced communication technologies and services (ACTS)

Information technologies (IT)

Industrial and materials technologies (IMT)

Standards, measurement and testing (SMT)

Environment and climate

Marine science and technologies

Biotechnology

Biomedicine and health

Agriculture and fisheries

Non-nuclear energy

Nuclear fission safety

Fusion

Transport

Targeted socio-economic research (TSER)

Activity 2

Cooperation with third countries and international organizations (INCO)

Activity 3

Dissemination and optimization of results (Innovation)

Activity 4

Stimulation of the training and mobility of researchers (TMR)

JRC programmes

TABLE 3

COMMITMENTS FOR EU RTD ACTIVITIES (current prices in million ECU)

A. YEARLY COMMITMENTS BY FRAMEWORK PROGRAMMES (FP)

YEARS	1991	1992	1993	1994	1995	1991-1995
FP 1987-91 (FP2)[1]	1 270.7	230.9	14.8	3.9	0.2	**1 520.5**
FP 1990-94 (FP3)[1]	296	2 160.5	1 929.5	1 264.7	1	**5 651.7**
Supplementary financing (FP3)[2]			150	750		**900**
FP 1994-98 (FP4)[1]				0	3 017.1	**3 017.1**
Total RTD programmes	**1 566.7**	**2 391.4**	**2 094.3**	**2 018.6**	**3 018.3**	**11 089.3**
APAS[3]	**168.8**	**308.4**	**440.2**	**571.8**	**2.1**	**1 491.3**
Total RTD programmes + APAS	**1 735.5**	**2 699.8**	**2 534.5**	**2 590.4**	**3 020.4**	**12 580.6**

[1] As initially approved by decision.
[2] Supplementary financing of FP3 in a separate decision.
[3] Accompanying measures approved by decision.

B. TOTAL COMMITMENTS: BREAKDOWN ACCORDING TO THE FP4 STRUCTURE

COMMITMENTS	1991-1995 Million ECU	%
Activity 1		
Information technologies and communication	4 192.4	33.3
Industrial and materials technologies	1 791.9	14.2
Environment	1 098.2	8.7
Life sciences	1 202.3	9.6
Energy	2 285.3	18.2
Transport	96.8	0.9
Targeted socio-economic research	51.5	0.5
Total Activity 1	**10 748.6** [1]	**85.4**
Activity 2		
Cooperation with third countries and international organizations	717.6	5.7
Activity 3		
Dissemination and optimization of results	293.8	2.3
Activity 4		
Training and mobility of researchers	820.6	6.5
Total RTD programmes + APAS	**12 580.6**	**100**

[1] Including JRC support to other EU policies.

PART B

COMMISSION'S COMMENTS

Introduction

Viscount Davignon and the members of the Independent Panel are to be commended for their report, which has fully achieved the expectations of this first five-year retrospective external assessment of the framework programme. The Panel's recommendations, benefiting greatly from its members' deep knowledge of European research, and the thorough appraisal of the past record of achievement of the framework programme constituted by the specific programme evaluations, are authoritative, constructive and forward looking.

The Commission welcomes the Panel's observation that there are no areas of major concern regarding the quality of research carried out under the framework programme, and its recognition of the networked pool of talent which the framework programme has produced.

The Panel stresses that to be successful the framework programme needs to continue the traditions of scientific excellence, but with more emphasis on social and economic relevance. It concludes that the framework programme has not so far fulfilled its promise because of the lack of a truly European strategic approach. The Commission agrees that a more strategic vision must guide the preparation of the fifth framework programme if its potential contribution to the economic and social welfare of the European Union is fully to be realized.

The Commission fully endorses the Panel's conclusion that the fifth framework programme offers the opportunity for major change, notably in the following respects. It must rise to the challenge posed by the heavy investment of the Union's competitors in R&D. It must be more focused and more effective. At the same time, it must respond more flexibly to changing needs. Its structure should be simplified, management by the Commission should be further streamlined, the dissemination and exploitation of results should be given greater emphasis in the research programmes, and resources should be concentrated through the strict application of selection criteria, including that of European added value. The Commission's practical response is set out in its formal proposals for the fifth framework programme. The following provides more detailed comment on the Panel's recommendations.

Headings below refer to the sub-headings of Section 4 of the Panel's report, 'Key issues for change'.

1. Programme strategy

The Panel proposes a more strategic approach to the fifth framework programme firmly based on programme selection criteria of relevance and European added value, which includes support for infrastructure and coordination with structural funding.

The Commission agrees that a more rigorous application of the criteria of relevance and European added value together in the selection of research themes, taking full account of social, economic and technological trends, will result in a more strategic approach. Relevance must be judged on the basis of both social demand — improving employment, quality of life and health (including security and quality of goods and services for consumers), environmental protection, mobility, etc. — and

prospects for economic development and scientific and technological progress.

The Panel's suggestion that European critical mass applies to networking large-scale facilities should also be taken up in the fifth framework programme; each of the thematic programmes, as well as the 'improving human potential' programme including activities in support of networking and access to research infrastructure. The Commission concurs with the Panel that a high level of mutual reinforcement should be sought between the framework programme and the Structural Funds. Its forthcoming communication on research and cohesion will examine the scope for improvements, whilst respecting the specificity of these two instruments.

2. The legal and management environment

The Panel proposes a package of legal and management changes to improve flexibility and focus in the framework programme:

- ***Legal changes: qualified majority voting in the framework programme co-decision process, a new Union Committee to replace the Specific Programme Committee structure and a management procedure to provide budgetary flexibility during the course of the framework programme***

Efficiency would indeed be significantly enhanced if the Commission were to have more delegated authority for the implementation of the framework programme. In its submissions to the Intergovernmental Conference (IGC), the Commission is strongly supporting the extension of qualified majority voting by the Council. Pending the outcome of the IGC, the Commission is committed to improving development and management of the framework programme to the degree which is achievable under the present rules. In particular:

- the structure of six programmes envisaged for the fifth framework programme should enable a better strategic view to be taken by each programme over a wider range of research;

- the Commission envisages that the main responsibility for implementing programmes should be delegated to the Commission, with the Programme Committees continuing to have their privileged position in monitoring programme implementation and dealing with research priorities, adjustment of work programmes and allocation of funds; not, however, pronouncing on individual measures.

The Commission furthermore shares the Panel's view that holding back a proportion of the programme budgets in the early years of implementation would allow for greater flexibility in later years.

- ***Changes to management procedures in relation to delegation, timescales, transparency and feedback, and to address understaffing***

Continuous efforts are being made to improve management systems for Community research. In the short term, measures are being implemented to reduce oversubscription, improve transparency and consistency of evaluation of proposals, reduce the timescales for evaluation of proposals and contract

negotiation, and simplify financial aspects. These should help to improve access to the programmes, especially for SMEs. In addition, new management formulas are being studied, based on modern best practice.

In accordance with the Panel's recommendations, clear lines of responsibility for management of the fifth framework programme should be established, but this must be combined with adequate arrangements for coordination, within the framework programme, with other policies and with the range of activities outside the Community context, including research programmes of the Member States.

On the question of staff levels, the fact that growth in staff numbers has been well below that of the overall Community research budget reflects the lean management policy of the Commission, as well as the tight limits of personnel and administration costs set by the Council in the specific programme decisions.

Evaluation activities, with broader scope, to include the broader context of programmes, international developments and input and output indicators are required, so as to provide an information base for monitoring and assessment panels.

Focusing research more directly towards social and economic objectives, particularly in the context of 'key actions' should involve clear work programmes with milestones against which future achievements can be measured. Regular updating of detailed objectives and work programmes is also envisaged. To achieve this, the Commission would review progress, while analysing and evaluating developments in the broader scientific and technological arena in the light of social and economic developments, and giving special attention to the international context.

As a result of this process, both programme monitoring and retrospective programme evaluations would benefit from a wider information base, as recommended by the Panel. Nevertheless, and in accordance with the Commission's SEM 2000 initiative, good management practice requires a clear distinction between execution and assessment. It is, of course, essential to maintain the quality and independence of the external monitoring and assessment process and, in particular, of the experts who will be involved.

The Commission is continuing its efforts to develop and make available on a consistent and up-to-date basis management and statistical information on Community research activities. It is also pursuing efforts to develop a wide range of indicators of scientific and technological progress at regional, national, European and global levels, through the European science and technology indicators report.

- ***Further efforts to simplify and reduce the cost of the European patent system***

A working party of IRDAC has addressed the broad range of questions relating to intellectual property in the context of EU research. Its conclusions accord with those of the Panel on the high costs of patenting in Europe. This issue goes beyond the scope of the framework programme. Patenting costs are allowable under Community research contracts.

3. Approach to the implementation of the new framework programme

The Panel suggests that a more integrated approach to support for RTD and innovation is needed, with an enhanced range of modalities.

- *Clear responsibilities for ensuring diffusion*

The fifth framework programme should incorporate a 'life-cycle approach' to project management, wherever possible 'building in' effective uptake of research from the very start of projects. This would allow modalities to be tailored effectively to the specific needs of programmes/projects. A consistent and effective implementation of this approach should be fostered by means of local 'innovation units' in each of the programmes.

- *More help to SMEs on financial and legal issues related to exploiting research*

Special attention is being paid to legal and financial aspects of the exploitation of results, with due regard to the particular circumstances and needs of high-technology SMEs. Ways in which the flow of information can be improved between research projects and the world of innovation finance are being investigated, with the objective of developing more structured and efficient interfaces. In the fifth framework programme, a service could be developed within the horizontal programme on 'innovation and participation of SMEs' to give assistance to projects in the areas of intellectual property rights and access to private finance.

The present scheme of cooperative research should be continued and further developed in the fifth framework programme so as to be able to respond better to the broad range of needs, of SMEs in particular, for access to contract research in order to supplement their own research capabilities, which may be limited or non-existent.

- *Better links with Eureka*

As noted in the Commission's second working document on the fifth framework programme, closer ties with Eureka are being actively sought. Efforts will be made to ensure complementarity between these two instruments, and to guarantee the flow of information from the framework programme to Eureka as work progresses, results are produced and projects move closer to the market. This approach could be developed notably within the key actions.

- *Further development of the concept of advanced European virtual institutes*

The yeast genome sequencing project, cited by the Panel, which involved nearly 100 laboratories within Europe (including 10 SMEs) in coordination with laboratories in the USA, Canada and Japan, demonstrates the effectiveness of large-scale networking of European centres of excellence. The associated 'Industrial Platform' has also been an effective means for keeping industry apprised of the results of the project and their potential commercial implications.[1] This and

[1] The project is being followed up with the Eurofan project, involving 144 European laboratories, to carry out a systematic analysis of genes of unknown function.

other approaches to distributed research are being studied by the Commission as models for application within the fifth framework programme, specifically in the context of key actions. The fifth framework programme can furthermore include research in support of information infrastructure to link research establishments.

- *A multidimensional systems approach to complex technological challenges*

This is precisely the aim of the key actions identified in the Commission's second working document. These actions would bring together the diverse scientific and technological resources, involving different disciplines, technologies and related capabilities, which are needed to attack major social, economic and industrial challenges. This integrated approach would be driven by means of an action plan developed in consultation with the scientific community, industry and more generally those who are concerned with and use research, which would focus, in particular, on overcoming the critical bottlenecks of a scientific and technological and/or socio-economic nature.

Because they are oriented towards social and economic objectives, permanent liaison with other Community policies affecting these matters is intrinsic to the concept of key actions, as is regular review and updating of work programmes to reflect the latest results they have achieved and the changing technological, social and economic context. The systems approach should, however, go beyond Community action alone. The subjects being addressed by key actions are by definition of European interest and it is essential that they benefit from the broadest possible contributions of research. Following the path laid by the task forces, and using a variety of means of communication, formal and informal, the key actions in the fifth framework programme would serve as the nucleus for wider coordination of research, including, especially, that conducted under Member States' programmes, across the Union.

- *Use of Articles 130k, l and n*

The possibility has been raised on a number of occasions of exploiting these Articles of the Treaty in addition to the other activities of the framework programme, notably in order to implement activities which have a particular interest only for a certain number of Member States. This possibility will not become a reality unless the Member States show a firm willingness to enter into this type of initiative. If such willingness were to be demonstrated, one or more activities of this type could be foreseen.

- *More focus and autonomy for the Joint Research Centre*[1]

The Commission fully supports the Panel's conclusion that the JRC has a

[1] In addition to the points made in this section, the following clarification may be helpful with regard to remarks made in the Annex to the Panel's report, which states that 'lack of clarity is perceived on how JRC objectives [in the evaluation report of the 'Nuclear fission safety' specific programme] are coordinated with those of the specific programme', and that 'poor working-level contact is cited' between DG XII and JRC staff. The Commission is of the view that working relations are excellent. However, the nature of these relations must reflect the fact that, in the field of fission safety, the JRC competes (successfully) against other proposers for shared-cost funding. The Euratom specific programme for the JRC is mainly concerned with research on nuclear safeguards, which are not the subject of shared-cost actions.

central role in support of Community policies. It has a neutral status which is of particular importance with respect to many aspects of Community regulation, as well as highly specialized facilities and capabilities which are needed to perform this function, some of which are unique in Europe.

As in the case of national laboratories, the JRC is having to adjust its approach to face up to new realities and the Commission is committed to making the changes necessary for it to do so, including better focus on the areas in which it excels. Since 1988, a major effort has been made to build up contacts between the JRC and the academic and industrial research worlds, with a programme to improve the customer-contractor relationship for policy-related research. This effort has been strongly increased after the decision on the fourth framework programme and on the basis of the Council Conclusions of 26 April 1994 on the role of the JRC. Increasing the autonomy evidenced by the establishment of the JRC as a separate Directorate-General is one of the essential administrative and legal steps in this process.

4. Better programme balance

The Panel recommends that in a number of respects measures need to be taken to ensure a correct balance within the framework programme.

- *A correct balance between fundamental and applied research, including the merging of convergent research areas*

The proposal for the fifth framework programme defines a structure which can reconcile the need to help the Union maintain and develop the flow of ideas and scientific and technological knowledge with that of developing its technological capability in the most critical areas. The role of the framework programme is not to duplicate national funding of 'blue skies' research. Nevertheless, the ever-closer interlinking of more basic and applied research in modern science and technology and in innovation nevertheless must be acknowledged and fully reflected in the fifth framework programme. Two aspects of the framework programme need to be considered in this respect:

- the key actions, where the specific bottlenecks may require focused basic research as well as applied technology development;

- activities for research and development of generic technologies.

The same strict selection criteria would be used to identify all research actions. Moreover, any basic research component would vary as a function of the maturity of the research area and may be modified as progress is made. This is in accordance with the views of the Panel.

Also in accordance with the recommendations of the Panel is the merging of programmes dealing with information and communications technologies and telematics applications (Theme II), and the biotechnological elements within agriculture, biomedical research and biotechnology (under Theme I).

- *A correct balance between thematic and activity-based programmes*

A general principle underlying the structure and content of the fifth framework

programme, as recommended by the Panel, is that research projects should be managed, to the extent possible, from within the thematic programmes. Strong linkages will therefore be secured between the thematic and horizontal programmes, as in the case of exploitation of research where the functions of thematic and horizontal actions have been noted. In the case of training and mobility, the Panel believes changes are needed to improve the image of these activities and reduce delays. The programme on improving human potential will incorporate a number of changes based on experience of the TMR programme. In addition to reducing the timescale of evaluation and selection of proposals for fellowships (the target is three months), new measures will be introduced, such as 'industry host fellowships', which will create a more transparent and predictable environment in which to attract the very best researchers.

- *A correct balance with respect to the international dimension of EU research: further initiatives for aspiring Member States and greater European added value in partnerships with developing countries*

More intensive research cooperation, including with countries aspiring to become members of the European Union, is indeed being sought under the new framework programme. Full association with the fifth framework programme would be possible for certain accession candidate countries, notably in Central and Eastern Europe,[1] should they choose this formula. This would allow participation in the programmes under similar conditions to the EEA States. An alternative would be participation on a project-by-project basis, in principle without Community funding; this being open to Central and East European countries not fully associated, European newly independent States and Mediterranean third countries.

As regards developing countries, cooperation projects will continue to be oriented towards these countries to develop scientific knowledge and technological capabilities which are appropriate to their needs and can assist in solving their development problems. There is also a recognized need to improve cooperation with 'emerging economies' whose markets are growing very fast and which represent important opportunities for the EU.

Conclusions

The Commission's analysis of the report of the Framework Programmes' Five-Year Assessment Panel demonstrates that its detailed recommendations will be very extensively taken up in the proposals for the fifth framework programme. Nonetheless, the Panel recognizes that fully to achieve the substantial changes they recommend, changes are needed to the legislative environment, which go beyond the scope of the Commission's framework programme proposals.

[1] In addition to Switzerland and Israel.

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EUR 17644 — Five-year assessment of the European Community RTD framework programmes — Report of the Independent Expert Panel chaired by Viscount E. Davignon and the Commission's comments on the panel's recommendations

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The Decisions for the fourth framework programme[1] and the Euratom framework programme[2] require that 'the Commission shall have an external assessment conducted by independent experts into the management and progress with Community activities carried out during the five years preceding this assessment. It shall communicate this assessment and conclusions, accompanied by its comments, to the European Parliament, the Council and the Economic and Social Committee prior to submitting its proposal for the next framework programme'.

This communication presents the report prepared by a high-level independent expert panel (Part A). The report, which subsumes the final evaluation under the third framework programme, gives a high-level strategic assessment and a set of corresponding recommendations. The opinions expressed in the report are those of the expert panel and are given under its responsibility.

Part B presents the Commission's comments on the recommendations of the expert panel.

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[1] Decision No 1110/94/EC.
[2] Decision No 94/268/Euratom.

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