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THE SCIENCE AND TECHNOLOGY COMMUNITY

Guidelines for a new Community Framework

Programme of technological research

and development

1987-1991

(Communication from the Commission to the Council and the European Parliament)

The Science and Technology Community : Guidelines for a new Framework Programme of technological research and development 1987-1991

SUMMARY

1. A new deal for Europe

Europe accepts the challenge.

In a world characterized by the acceleration of the process of innovation, the global application of production techniques, the development of services and, lastly, the expansion of defence programmes and the importance attached to space in national technological development, Europe is beginning to organize. The year 1985 saw the launching of the Technology Community, the EUREKA initiative and the formal confirmation, in the European Single Act, of technological R&D activities.

Today, the Commission is presenting its guidelines for a new Framework Programme of technological research and development during the period 1987-91.

2. The contribution of the Community dimension to technological R&D in Europe

The success and reputation of such programmes as ESPRIT, RACE and BRITE rest on an appreciation of the added value generated by Community technological R&D activities.

The Community provides a framework for a synergy of efforts and abilities; it thus promotes the attainment of economies of scale and critical size and provides the opportunities for diversification called for by rapid and expensive scientific and technical development.

Community action creates the fertile soil for greater creativity and cooperation on the part of the scientists and industrialists involved in strategic programmes and priority and significant projects.

The Community framework links efforts in the field of technology to the large European market. In 1992 it will lead to open public-sector markets based on common standards and a common industrial property policy.

The resources allocated to research are drawn from the Community budgetary instruments; as a supplementary measure, the coming months will see the presentation of new financial instruments specially tailored to the particular needs of scientists and industrialists.

The Community context also ensures a link with a dynamic commercial policy which extends and underpins the efforts of research workers and industrialists.

Lastly, the Community provides a coherent framework for the optimization of the efforts of the Member States, the exploitation of their specific potential and avoidance of the duplication of activities, all of which benefits both the Community as a whole and its individual regions.

3. A new institutional legitimacy for technological research and development

The European Single Act provides a new political and legal basis for the development of the Community's scientific and technical strategy.

Community activity in the field of technological R&D will be conducted in a series of programmes at three levels, namely :

- a unanimously approved multiannual Framework Programme, which will provide the basis for the balanced overall development of Community actions;

- specific programmes, adopted by a qualified majority, which are concerned with particular objectives, designed to promote cooperation between all the partners and open to participation by non-member countries;

- supplementary programmes in which Member States will participate on a voluntary basis.

4. What are the priorities for Community action ?

The outline document proposes the adoption of seven lines of action adapted to the new requirements of the 1990s.

These lines of action, which are essentially intended to lead to the improvement of Europe's international competitiveness, a better quality of life and the creation of a genuine research workers' Europe, cover the following seven topics :

- management of resources (particularly in agriculture);

- management of energy;

- competitiveness of industry and services (information technology, telecommunications, etc.);

- quality of life ("Europe against cancer", the fight against AIDS, safety, environmental protection, etc.);

- science and technology for development;

- Europe's scientific and technical potential;

- general suport for scientific and technical development (innovation, scientific networks, machine translation, etc.).

The Commission advocates a substantial increase in activities designed to increase the competitiveness of industry and its services, not only in the light of the changing world scientific and technological context but also because of the increasing pressure of the external challenge facing our continent.

As regards the management of energy, the Commission hopes to consolidate Europe's world lead in thermonuclear fusion which, moreover, is one of the areas where efforts are integrated on a fully European scale.

A fairly substantial reorganization of activities is recommended with regard to other aspects of energy research. Nevertheless the Commission is of the opinion that the present, still unpredictable fluctuations in the price of petrol should not lead to the abandonment of this type of research which remains an important factor for the diversification of the Community's sources of supply and the reduction of its energy consumption.

The Commission is also examining the possibility of including activities on the exploitation of space and the development of aeronautics in the list of actions to be conducted in the next Framework Programme.

The scale of the challenge and the Community's ability to respond will necessitate an appreciable increase in the financial resources, both public and private, national and Community, made available for research and technology. For its part, the Commission puts the total financial commitments required for the implementation of the 1987-1991 Framework Programme at 10.000 MioECUs. Although this amount constitutes an appreciable increase in relation to the budget for the preceding Framework Programme, it represents less than 5 % of total research expenditure in the Member States over the same period.

5. New arrangements for implementing Community research

For the future Framework Programme, the Commission is in favour of a significant increase in shared-cost actions of the ESPRIT type compared with the direct-action projects carried out at the Joint Research Centre, the role and tasks of which are to be reevaluated and discussed in a forthcoming communication.

Furthermore, in addition to those already established for technological R&D in the Community, new implementing arrangements will be prepared, for example through the creation of joint enterprises or the initiation of supplementary programmes for which the European Single Act provides.

The Commission is prepared to examine the possibility of setting up flexible structures of the "agency type" as a means of creating an interface between Community priorities and policies on the one hand and the specific requirements of operators.

Lastly, Community budgetary intervention will be supplemented by a number of facilities deriving from new Commission initiatives in respect of financial instruments or techniques, particularly in the case of technological R&D programmes for industrial-scale application which are close to the market, such as the EUREKA projects.

6. An open, confident Technology Community

The Technology Community cannot withdraw behind its geographical and institutional frontiers.

By adopting an open stance towards the outside world, it will reinforce its international cooperation along the lines already established in the field of thermonuclear fusion.

On a strictly European level, the Commission recommends a strengthening of relations with the European Space Agency, CERN, the European Science Foundation and the Council of Europe.

Bilateral cooperation with the EFTA countries will acquire a new dimension with the implementation of framework agreements for scientific and technical cooperation which have already been, or are about to be, signed.

In the execution of the Framework Programme, considerable importance will be attached to the development of cooperation within the framework of COST, in which many non-Member countries are involved.

Lastly, the Commission supports the EUREKA initiative. It considers that, by virtue of their complementarity, Community programmes and the EUREKA projects constitute a single whole orientated towards the attainment of the same objective, namely improved international industrial competitiveness and greater employment and prosperity in Europe.

Consequently, the Community and, in particular the Commission, can make a variety of contributions designed to ensure that the potential of the EUREKA initiative is fully realized; these include :

- cooperation in EUREKA projects,
- the secondment of qualified staff to the EUREKA secretariat,
- the organization of industrial seminars,
- the provision of access to an information communication system developed within the ESPRIT framework,
- access to the large market,
- suitable, new institutional and financial frameworks.

7. Tomorrow, the 1987-1991 Framework Programme

Following the forthcoming discussion of these guidelines by the Council and Parliament, the Commission will submit its formal proposal for a Framework Programme of technological research and development 1987-1991 in July of this year.

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CONTENTS

The Science and Technology Community

I. Introduction

The Member States of the European Community are today faced with a task of major importance : the practical realization of a Science and Technology Community.

The intention is certainly not to throw away opportunities or fruitful possibilities for cooperation with non-Community countries. On the contrary, these Commission proposals cover the opening-up of Community projects to European countries outside the Community and the improvement of opportunities for cooperation - on an equal footing - with the major non-European partners.

The Community is in fact in a position to define and adopt a technological research and development strategy on a continental scale .

The European dimension is essential in order to meet the considerable and increasing costs of technological R&D, to take advantage of economies of scale and of the resultant opportunities for diversification, and to ensure greater synergy between efforts and capacities in rapidly evolving scientific and technical fields.

The Community framework makes it possible, in an overall strategic context, to optimize the various measures required to improve, with a high degree of complementarity, Europe's economic competitiveness and scientific and technological base, namely :

- cooperation between scientific and industrial participants in strategic programmes and priority and significant projects, the results of which they share at a low cost;

- the creation of a vast precursor internal market through a coherent policy on standardization, the opening-up of markets, industrial property, competition, etc.;

- the provision of appropriate financial resources through the use of existing financial instruments and the new financial management machinery;

- co-operation in the planning, creation and use of complex and expensive infrastructures (telecommunications, instruments and large-scale scientific equipment);

- the establishment of greater cohesion on behalf of the least-favoured regions and population groups through the use of structural funds for the attainment of the Community's economic and social objectives;

- reliance on the common foreign and trade policy for the purpose of adopting common positions in major international discussions;

- the development of education and training on the basis of close cooperation at Community level between the universities and industry and through the development of new equipment and systems designed to

facilitate adjustment to the forthcoming changes in professional qualifications and to make available the high degree of expertise required for the mastery of new technologies.

Thus, the creation of a Science and Technology Community, which has been regarded as a difficult, if not an impossible task to date, can now be guaranteed.

Indeed, the Community has been enlarged to 12 Member States and thus has a new political, economic and commercial base.

The European Council meeting in Milan (28 and 29 June 1985) approved and adopted the Commission's memorandum "Towards a European Technology Community".

The declaration of principle approved in Hannover (November 1985) clearly identified EUREKA and the projects that will result from it as an extension of Community and multilateral European R,D&D activities, with a view to optimizing the industrial potential of these projects.

Furthermore, framework science and technology cooperation agreements between the Community and several other European countries (Austria, Finland, Norway, Sweden and Switzerland) have already been, or will shortly be, concluded.

Moreover, the chapters on the "Internal Market" and "Technological Research and Development" in the Single Act have opened the way to the simultaneous coordinated development of Community scientific, technological, industrial and commercial policy.

Finally, these developments, at international economic, scientific and technological level (aeronautics, space, major military programmes, etc.)[1] confirm the Commission's view that the implementation of an ambitious new European scientific and technical strategy now seems to be both necessary and possible.

Necessary, because the scientific and technological capacities of the great economic powers over the next decade will largely determine their ability to secure growth and jobs.

Possible, because of the close cooperation and climate of confidence which have been established between Community enterprises and scientific organizations in recent years, as well as between the latter and the Commission, particularly within the framework of the ESPRIT, RACE and BRITE programmes.
Possible also, because the Community provides a favourable organizational framework for bringing together and committing the required resources: coordinated use of human and financial resources, concerted and planned growth of national and Community funds.

[1] See chapter III of this document

II. Aim of the document

In the Council resolution of 25 July 1983 which approved - as regards the principles, objectives and criteria for selecting projects - the Framework Programme of Community scientific and technological objectives 1984-87, provision was made for a review of the programme "in 1985 at the latest".

During 1985, research was the subject of much discussion and many initiatives at European level: the European Council in Milan, the EUREKA ministerial conference and the Luxembourg intergovernmental conference. On this basis the Commission, as it announced in particular in its communication "Towards a European Technology Community",[2] feels that this review should now be "carried out speedily so as to ensure that a second Framework Programme for 1987-91 ... is drawn up and adopted without delay".

This document aims to sketch the broad outlines of the Framework Programme for 1987-91 and appropriate ways and means of implementing it.

On the basis of this initial document - which does not represent the Commissions formal proposal and which is completely without prejudice to its final content - the Commission would like to know the opinions and attitudes of the Community institutions, especially as regards:

- scientific and technical approaches,
- priorities and balances,
- the level of financial resources to be set aside for the period 1987-91.

In the light of these discussions and the conclusions reached, the Commission will prepare a formal proposal for the Framework Programme 1987-91 and submit it to the Council and Parliament in July 1986.

III. Current position and prospects: Europe in the international context

In recent years, notwithstanding persistent and disquieting weaknesses which will be analysed below, the Member States have shown not only that they could cope with a serious crisis, but that they could, through joining together and/or cooperating, create an almost unparalleled force in the world.

Furthermore, Europe is maintaining its status as a major world trading power, since more than a third of international trade passes through the Community. 40% of the industrial production of what is the most open economy in the world, the European Community, is traded with non-member states, i.e. 25% to 30% of its gross domestic product, as compared with 10-20% in the case of the United States and Japan.

Europe has, thanks to the EMS, managed to preserve a significant degree of monetary stability in the face of the fluctuations in the dollar and many other foreign currencies.

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[2] COM(85)final, 30.9.1985.

Apart from gaining an increasing control over inflation, the Community Member States have achieved a slow, but genuine increase in investments and in productivity through the improved distribution of added value for the benefit of firms; their growth in this respect is greater than that of the United States, for example.

On the various world markets, Europe's performance has been comparable to that of its formidable trading adversary, Japan (especially in the OPEC area). As far as energy is concerned, in ten years Europe's considerable efforts have reduced its dependence on oil from 65 to 45%, whereas Japan still relies on oil for more than 60% of its requirements.

Lastly, European successes in the field of science and technology (Airbus, Ariane, CERN, JET, ESPRIT, BRITE, RACE...) underline the value and effectiveness of Europe's R,D&D potential.

This very brief survey of some of the encouraging European figures clearly must not conceal the darker aspects of the situation that argue even more insistently for an offensive European research and innovation strategy specifically aimed at the objective of international competitiveness as a means of improving employment opportunities.

Out in the arena with the great industrialized countries, the Community Member States are confronted with those whose scientific and technical potential and dynamism are not only very considerable, but sometimes quite out of proportion to their own. Development of science and technology policies by the European nations is still marked to a notable extent by the economic conditions that prevailed in the seventies, although a certain revival is beginning to make an impression. Because most of the European governments were (and still are) greatly concerned with solving the unemployment problem, science and technology policy was not, for the most part, a major priority and its financing was, therefore, subject to severe constraints, in spite of the close links between technology, growth and employment.

Fortunately, this trend was reversed towards the end of the decade when most of the governments had realized how important strong R&D was for a growth economy. There has been, in particular, a tendency to give priority to applied research, geared to economic needs; most of the European countries now have science and technology policies with increasing emphasis on innovation and improving the links between basic research and industry.

The scale of the effort required must not, however, be underestimated. In fact there is no single European country, however big, which is capable of facing up to today's technological challenges on its own. To appreciate the scale of the effort which is needed, it is worth taking a close look at five trends that have been marked in recent years:

- the acceleration of the innovation process, that is competition through innovation at the international level. It is the force of this current which determines the extent to which new technologies, products and processes make their appearance, together with the support which comes from large-scale research programmes. Thus, European countries owe it to themselves to ensure that there is significant growth in the financial resources devoted to R&D if they do not wish to be left behind, once and for all, in today's race to innovate;

- the spread in all fields of economic and social activity of new technologies which are subject to extremely rapid change (data processing, biotechnology, materials);

- the acceleration of the tendency of productive activities to be developed on a world-wide scale, a significant factor which can also be observed in the world of science and technology and which carries the risk of watering down Europe against the will of its Member States;

- the rise in the number of "non-material" activities, i.e. the rapid increase in jobs in the service sector. The wealth of nations is founded, and will continue increasingly in the foreseeable future to be built, on highly efficient service activities: services to production, financial services, communication and information services, services linked with distribution, training, research, etc;

- lastly and perhaps above all, in the short and medium term, the growth in defence programmes and their repercussions as regards the world system of research, science and technology. Since the traditional frontier between civilian and military research is in fact dissolving, major defence programmes are beginning to have a dual scientific and technological purpose.

The big defence programmes concentrate R&D into a number of key fields, such as telecommunications, sophisticated energy sources, large-scale computers, advanced materials and space. In many countries, this means large contracts for the big industrial groups (whose R&D structure is often geared to specialist military applications). At the same time, these programmes absorb an increasing proportion of the overall research potential in terms of financing and personnel.

It is worth dwelling for a moment, on this point, particularly as regards the USA. There the State is assuming an increasingly significant role through the R&D budgets of the Department of Defense (DOD). The large increase in expenditure on R&D in the United States must be seen in direct relation to its military programmes, the most recent and intensive acceleration being linked with the strategic defence initiative (SDI). In only a few years the proportion of the public expenditure budget accounted for by military R&D - i.e. 40 000 million dollars out of a total of 57 000 million dollars in 1986 - has risen from 50% to 70%.

Apart from the general effect of acceleration that such financial injections have on the development of technologies, the programmes in question frequently involve areas of research which are entirely new and original (serving both civilian and military interests), providing the foundations for the production and services of tomorrow. Furthermore, such programmes are designed with a view to developing systems and not just components or products, a major factor in future competitiveness. Again,the resources which are devoted to such programmes are a direct subsidy to the industries which implement them.

Finally, the latest efforts made by the United States may be seen as a controlled part of the shift towards research on a world scale, given that they have the effect of setting up cooperation networks for technological research as well as development.

This is the picture that should be taken into account in setting up a Community technological R&D system. Unconnected national endeavours are likely for a long time to deprive the Community of the resources it needs to make significant breakthroughs in fields which are just as important to Europeans; this national dispersion is also likely to reduce the role of Europeans to that of subcontractors in projects which they will not have the means to gear to their own interests.

Extending the comparison between the Member States and the rest of the world, even if it is difficult to predict how the industrialized countries' science and technology policies will evolve in the medium and long term it is possible to discern a number of trends.

An analysis of the trends observed over the past decade with regard to public expenditure on R&D shows that the 12 Community Member States should be devoting around 230 000 million ECU[3] of public funds to R,D&D over the period 1987-1991, whereas the gross domestic expenditure of these countries on R&D is estimated at 460 000 million ECU.[4] (As indicated on page 13 of this document, this overall estimate embraces the very uneven breakdown that exists between the various Member States). During the same period, domestic expenditure on R&D should be around 1 000 000 million ECU in the United States and 330 000 million ECU in Japan (according to an estimate based on an extrapolation from OECD figures for the past ten years). As far as R&D is concerned then, the Community falls between Japan, whose technological performance hardly needs reiterating, and the USA.
This position should also be viewed in the light of the comparative economic status of each of the three regions. With regard to GDP, those of the Community and the USA are more or less identical, whereas that of Japan is around 50% less. Assuming that this trend continues until 1991, the Community countries' 460 000 million ECU should thus be compared with 660 000 million ECU for Japan (therefore at a comparable GDP).

Although this is not a flawless argument, it does prove the validity of the dynamic strategy adopted by Japan and the United States as regards future R&D.

It can also be seen that the Community is not in a particularly strong position compared with the other industrialized countries. The total USSR expenditure on R&D in 1983 was 26 000 million roubles, i.e. 38 000 million ECU, as compared with the 55 000 million ECU spent by the 12 Member States. Assuming that these trends continue, the amount corresponding to the Member States' 460 000 million ECU for the period 1987-91 should be around 320 000 million ECU in the USSR; all the same, if the documents of the 26th Congress, are anything to go by, it is highly likely that this figure will be exceeded. It is also worth noting the considerable increase in the number of research workers, which has more than tripled since 1965 and is likely to match the US figure in 1987. Significant too is the signing on 18 December 1985 of the "framework programme for the scientific and technical progress of the COMECON States until the year 2000", a huge, ambitious programme.

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[3] The estimates are all expressed at current rates.

[4] Domestic expenditure on R&D, i.e. public and private expenditure. Around 50% of the total funds available for R&D is accounted for by public financing in the 12 Member States, whereas the corresponding figures are 22% for Japan and 52% for the USA.

Lastly, a number of other countries are emerging gradually in the fields of science and technology - China, Brazil, India, Mexico, Korea, etc. - further intensifying "international competition through innovation".

Against this general background, Europe must be given power, status and competitiveness at international level and be provided with a solid base, i.e. a scientific and technological system able to meet challenges at home and abroad: this the Commission sees as a fundamental objective.

As far as Community activities are concerned, therefore, the Commission considers it vital to give technological research and development special priority together with a correspondingly special rate of growth in the relevant budget appropriations.

IV. The challenge within: achievement of the European Science and Technology Community

Faced with S/T competition from outside, Europe - this heterogeneous collection of ageing countries in a rejuvenating world - is likely to slide gradually into oblivion, despite the substantial advantages it can call on, if it does not make proper use of these advantages and, in particular, of the scale and momentum of the Community.

All the analyses carried out by the Commission, the conclusions of which are widely shared not only by the European Parliament and the Economic and Social Committee but also by those responsible for national R&D policies and by the representatives of the scientific and industrial world show that the European Community must constitute the basis and the heart of any such undertaking.

The Commission believes that it must conduct its activities simultaneously on three fronts; this will involve :

a) completion of the internal market which should be effective in 1992. The establishment of this market should enable the Member States to combine, in the advanced technology field, the opening-up of their public-sector markets with access to the corresponding scientific and technical know-how. An innovative public procurement policy and a common R, D&D strategy are thus to be considered jointly;

b) the adoption of new financial mechanisms, which should make it possible to ensure synergy between public and private financing;

c) the continuation and development of a technological R&D strategy which, in the coming years must involve a fundamental response to the following major objectives :

- the strenthening of the scientific and technological basis of European industry and the development of its international competitiveness (Subsection V, Chapter VI of the Single Act);

- the strengthening of the Community's economic and social cohesion. All the Member States and all the regions of the Community must benefit from the results of the Framework Programme and of the subsequent specific programmes, and must be involved in the development process based on the foundations thus established. The means to be employed and pooled in the context of this dynamic operation will include the ERDF, the IMPs, the coordination of other financial instruments (Social Fund, EAGGF guidelines, etc.) and the definition of new loan instruments;

- a general improvement in the quality of life within the Community (this objective, which covers numerous projects concerning health, safety and the environment, must both complement and offset the goal "technological and industrial competitiveness").

To achieve these objectives it appears essential to increase substantially both public and private funding within the Member States and to ensure a significant growth in Community S/T appropriations which must accompany increased cooperation between the different participants in scientific and technological development (industry, universities, etc.).

At national level, expenditure on R, D&D still seems comparatively slight, averaging only 2 % of GNP whereas, for example, the corresponding figure is already 2.8 % in the USA[5] and should reach 3 % in Japan by the end of the decade.

It should be noted however that there are significant differences between Community Member States; the 2 % of GNP which they devote on average to research covers national efforts ranging from 0.35 % to 2.4 %.

It will be up to the individual States to decide what form any increases should take, either by stepping up public spending or by encouraging an expansion of the industrial research effort.

At Community level expenditure in both absolute value and as a percentage of the Community budget is also modest (about 3% of the general budget of the Communities and 2.5% of total national public spending on R&D). In view of the incentive effect and coordinating force of Community spending on R&D, these funds should be substantially increased and at the same time the aim should be to achieve optimum use of both Community and Member State resources.

Achievement of the major objectives outlined above should help to promote within the Community of Twelve a scientific and technological system that will allow balanced but selective development. This wish for selectivity should not, however, lead to certain fields being excluded which come within the responsibility of the Community (teaching and training, establishment of a research workers' Europe, agriculture, industry, preservation and improvement of the human environment, health, safety, etc.).

This development should be based on a set of projects that make maximum use of the added value offered by the Community dimension. In concrete terms, this Community added value is manifested by the following advantages :

- cost sharing,
- the spreading of scientific risks (discussion of objectives and methods, greater number of scientific responses),- an increase in the range of available skills and expertise

- attainment of critical size as regards financial or human resources

- greater efficiency in R&D activities (more ambitious projects, more rapid acquisition of results with corresponding advantages for scientific and industrial competitiveness)

- the ability to initiate further measures which are essential to success.

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[5] In this connection, it should be pointed out that the proposed federal R&D budget for 1987 totals 63.000 million dollars compared with 57.000 million dollars in 1986 (42.000 million dollars being allocated to the DOD and 4.800 million dollars for the SDI programme alone).

1. Selection criteria

To ensure that the specific projects and programmes selected do in fact offer that Community added value (which distinguishes them from projects suitable for implementation at regional or national level or within other international or multilateral organizations), the Commission considers the choice must be based on a number of precise criteria:

- research on a scale such that the individual Member States could not, or could only with difficulty, provide the necessary facilities on their own;

- research which has obvious advantages in the way of greater efficiency and lower costs resulting from the sharing of work and the mobilization of adequate human and financial resources,

- research which, because of the complementary nature of the work being done nationally and the scale of the problems involved, especially from the geographical viewpoint, enables significant results to be obtained for the Community as a whole;

- research which provides a favourable environment for international exchange and creativity;

- research which, either because of the scale of its financial allocation or because of its incentive and stimulating effect, attains the necessary "critical size" in relation to existing or future national or multilateral activities;

- research which contributes to the implementation of Community policies including, in particular, the completion of the large-scale market.

These six basic criteria often overlap or complement each other and in any case are never mutually exclusive.

2. Lines of action

On the basis of the general considerations outlined above and the criteria set out, the Commission proposes that seven basic lines of action, within which priorities and programmes will be chosen, be adopted for the establishment of the Community's S/T strategy over the period 1987-91.

LIST OF COMMUNITY ACTIONS

1. Management of Resources
1.1 Agricultural and Fisheries Resources
1.2 Raw Materials

2. Management of Energy
2.1 Fusion
2.2 Nuclear Fission
2.3 Fossil, New and Renewable Energy Sources and Rational Use of Energy,

3. Competitiveness of Industry and Services
3.1 Information Technologies
3.2 Telecommunications Technologies
3.3 Integration of Information and Telecommunications Technologies into New Applications and Services of Common Interest
3.4 Cooperation on Basic Research on Information Technologies

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3.5 Technologies for Manufacturing Industry and Special Technologies
3.6 Biotechnologies and Agro-Industrial Technologies
3.7 Materials Science and Technology
3.8 Marine Science and Technology

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3.9 Transport

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3.10 Scientific Norms, Reference Materials and Methods

4. Quality of life
4.1 Health
4.2 Safety
4.3 Environmental Protection

5. Science and Technology for Development

6. Europe's Scientific and Technical Potential - The Researchers' Europe

7. General Support for Scientific and Technical Development
7.1 Innovation
7.2 Communication and Information Networks and Scientific Data Bases
7.3 Linguistic Problems
7.4 Forecasting, Evaluation and Statistical Tools
7.5 International Cooperation

In the Commission's opinion, priority should be given to activities contributing towards:

- competitiveness at international level;
- improvements in the quality of life,
- the establishment of a research workers' Europe.

An initial outline of the scientific and technical orientation to be given to these different actions during the period from 1987 to 1991 and of the corresponding resources which it would seem advisable to allocate thereto is set out in Annex I in the form of information sheets; this orientation will be considered and examined in greater detail throughout the entire preparation of the formal proposal for the new Framework Programme.

The following summary of the scientific and technical orientation described in the information sheets can already be provided:

1st line of action : Management of resources

In the case of agricultural resources, it will be necessary to reinforce the R&D activities conducted to date in the context of the prospects opened up by the Commission's "Green Paper". The coordination of national activities is of particular importance in this sector. Close contacts must be maintained with actions initiated elsewhere (3.6) in the fields of biotechnology and agro-industrial technologies.

A long-postponed Community action on fish resources should finally be effectively launched in conjunction with new activities to be developed in the marine science and technology sector.

The actions proposed in respect of raw materials are essentially based on, and selectively reinforce, the action in respect of which the Council adopted a common position in December 1985.

2nd line of action : Management of energy resources

Thermonuclear fusion is one of the fields in which the integration of European activities is most advanced; the results of this lengthy and exacting research could both determine and guarantee Community energy supplies. It therefore calls for sustained and steady efforts funded from public resources, since it is imperative that existing successes should not be jeopardized by a lack of adequate finance.

In the field of nuclear fission, emphasis will be placed on the safety aspects of the introduction of this energy source; the management and storage of radioactive waste, the regulatory aspects of reactor safety and safeguards for fissile materials are topics in relation to which the full value of Community-level activity can be appreciated.

In the case of fossil, new and renewable energy sources and the rational use of energy, account must be taken of the development of the relevant techniques, with particular reference to the maturity of some, and of the fact of enlargement, which will entail a relatively major reorganization of activities. The current and still unpredictable trends in the price of

petrol, however, should not lead to the abandonment of this topic, which remains an important factor as regards the diversification of our sources of supply and reduced energy consumption.

3rd line of action : Competitiveness of industry and services

Clearly, this must be regarded as a priority objective in view of the existing social and economic situation in the Community, international developments in science and technology and the increasing pressure of the outside challenge. The Community can play a decisive role in this context by encouraging, promoting and supporting all forms of cooperation between State and industries.

The implementation of ESPRIT has led to a remarkable stimulation of information technology within the framework of Community R&D activities. The aim must now be to reinforce existing achievements taking account of the valuable experience gained during the first programme and of the intensive efforts being made in this field in Japan and the USA. Special attention will be given to the field of software, which is both one of the generic technologies in TIT and a key element in the development of applications.

The need for Community action has also been felt with regard to telecommunications, in view of the transnational dimension of this sector and the scale of the new services offered by the development of advanced telecommunications networks and terminals. RACE must provide Europe's response to existing opportunities and shortcomings. In addition to activities deriving from more specifically technological considerations, Europe must turn its attention to the integration of information technology and telecommunications with a view to the development of new applications and services in the common interest: education and transport are suitable sectors for such applications in the common interest in which, moreover, due account is also taken of social concerns, as demonstrated by the IRIS initiative. It will be particularly important to ensure a high degree of coordination of national activities in this case.

Upstream of technological concerns, it is also proposed to establish cooperation in basic research on information technology, in order to provide a constant supply of new know-how in a rapidly developing sector.

Particular emphasis has been laid in Europe on the revitalization of traditional industries through the exploitation of the new technologies. The success of the BRITE programme reveals that the Community initiative in this field is a response to a genuine need. On the basis of the experience gained, new guidelines are being drawn up for actions relating to technologies for the manufacturing industries and special technologies.
Biotechnology has also already demonstrated its enormous potential for transforming several traditional fields of economic activity, such as the chemistry and pharmaceuticals sectors. Recognition of this fact led to the Commission's proposal concerning the reinforcement of actions in the field of biotechnology and the initiation of new actions in the field of agro-industrial technology, which should be closely coordinated with the agricultural R&D programme to enable the latter to benefit from the contribution of biotechnology.

To a large extent, our technological future will depend on our control of the materials sector, a field, moreover, in which the challenge represented by developments in the USA and Japan is particularly acute. The coordinated efforts and creation of Community networks which this situation seems to call for have given rise to the proposals for new activities under the materials science and technology project.

Marine science and technology are the subject of a wide variety of activities in most of the Member States. The Commission is of the opinion that Community action in this vast field is justified on the following grounds : use of large-scale, expensive equipment which would constitute a drain on the resources of individual countries, optimization of the use of existing equipment (oceanographic vessels, underwater machinery, etc.), the pooling of existing complementary skills in the Member States, the application of research results in the implementation of common policies, its potential for aid to developing countries and a contribution to the development of the internal market through the acceptance of common standards.

The transport sector constitutes the preferred field for transnational actions. Although limited as yet to a number of COST projects of acknowledged value, Community R&D activities in this sector deserve to be strengthened, both by the extension of COST projects and by the initiation of original Community activities.

Completion of the internal market represents one of the fundamental goals of the Community in the coming years. Among the numerous initiatives which must be launched with a view to the attainment of this objective particular importance must be attached to the definition and adoption of common standards. The preparation of rules and standards is frequently based on upstream research activites which, if jointly conducted, facilitate the adoption of rules and standards recognized by all parties; this fact has given rise to the new proposals for the continuation and strengthening of Community action in respect of scientific standards and reference materials and methods, particularly within the framework of the JRC.

4th line of action : Quality of life

The importance attached to industrial competitiveness and services should not divert the Community from the aim of improving the quality of life of its citizens.

As stated earlier, the Commission takes the view that special attention should be devoted to attaining that objective, in view of its direct socio-economic value, its impact on the social acceptability of new technology and the effects of research undertaken on citizens' welfare.

Three main lines of action are proposed:

- health, with a reinforcement of activities relating to epidemiology and the establishment of common standards. Special projects on cancer (Europe against Cancer) and AIDS should also be developed;

- safety: a number of recent accidents in industrial plants have in particular highlighted the importance of improving the safety of high-risk plant through more thorough scientific analysis;

- environmental protection : the transnational nature of problems in these areas is self-evident, and Community action is proving particularly desirable in this respect along the lines set out in particular in the Community's environment policy.

5th line of action : Science and technology for development

Europe has a duty to remain attentive to the problems of the Third World; science and technology are an important aspect of development. Community action in the field should be continued and intensified, with due regard to the specific circumstances of both the Community and the recipient countries.

In particular, close cooperation should be established between European laboratories and institutes in the most advanced developing countries, on the basis of which specific or regional schemes should be conducted for the benefit of the least developed countries (possibly through the reinforcement or creation of local scientific and technical structures).

6th line of action : The researchers' Europe

The vitality and creativeness of the science and technology community depend primarily on the calibre of the individuals and teams that organize and carry out technological R&D. The mobility of researchers, the strengthening of scientific and technical networks, training, retraining and the optimum use of present and future major scientific facilities are areas that are now calling for support and action at Community level. The new policy lines proposed reflect that need.

7th line of action : General support for scientific and technical development

Community technological RD&D can only develop in a favourable climate. Recognition of this fact has prompted the Commission to consider including in the new framework programme activities aimed at ensuring that such a climate is created.

These are:

- activities relating to innovation and the utilization of the results of Community research: the Community R&D effort should be able to benefit from improved innovation machinery ensuring that the results of R&D are used by socio-economic operators;

- activities concerning communication and information networks and scientific data banks, which constitute the essential infrastructure for a research workers' Europe: this should produce synergy between geographically dispersed R&D organizations and thus improve the quality and effectiveness of R&D and speed up the transfer processes. Technological developments now make this possible.

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The Commission has examined the desirability of including the utilization of space and the development of the aeronautical industry in the list of activities to be conducted under the forthcoming Framework Programme. As regards space, it is necessary to examine the extent to which, while acknowledging the areas of responsibility of the national and European organizations specializing in space activities, and the European Space Agency in particular, the Community could play a greater role on the scientific, technological and industrial level.

Such a role could involve utilizing in the socio-economic sphere the technologies that have been developed so successfully at European level. In the case of activities relating to telecommunications, the remote-sensing of agricultural resources and the development and protection of the environment, the technologies developed have already begun to be utilized. The Commission is continuing its effort to identify other space-related fields in which action at Community level could contribute added value.

As regards aeronautics, consideration is still being given to the extent to which it is opportune to put forward a specific activity at Community level. A preliminary information sheet on this topic was included in Annex I under the heading Transport.

Clearly, in selecting the appropriate scientific and technical approach, as in the adoption of the financial resources considered necessary for its implementation over a five-year period (see below), the Community must retain the freedom to make any adjustments dictated by changing political, economic, scientific and technological conditions. In particular, it must be able to take account of efforts designed to accelerate the process of discovery and innovation.

It will therefore be essential to include a review clause providing for such adjustments in the text of the decision relating to the 1987-91 Framework Programme.

3. Financial balance

3.1. For each activity, a range of financial estimates is given in the table in Annex I. These ranges correspond to different levels of emphasis as regards implementation of the objectives outlined. Different combinations of these estimates, according to the relative priority attached to the individual activities, add up to the total amount that the Commission is contemplating at this stage, namely 9 000 million ECU at current prices for the five years of the Framework Programme. This amount is supplemented by a reserve representing some 15% of the above-mentioned figure, thus producing a grand total of 10 350 million ECU.

The reserve is intended to cover the financing of activities which, in view of developments in the political, scientific and technological situation, the Commission might be prompted to propose but cannot identify at this stage.

The Commission is aware of the need to increase expenditure on technological R&D gradually; this requirement will be taken into account in outlining the changes in commitment and payment appropriations for the period 1987-91.

3.2. A direct comparison of the major amounts and the financial balance thus outlined for 1987-91 with those of the preceding Framework Programme is hardly possible given the different approach adopted with regard to the very structure of the Programme. Under the 1984-87 Framework Programme, the financial balance related to the objectives to the attainment of which the R, D&D actions contributed, in accordance with varying proposals. Thus, the programme on non-nuclear forms of energy contributed to the attainment of the objectives "Improvement of the management of energy resources" (74 %) and "Promotion of industrial competitiveness" (16 %) and, to a lesser extent (less than 5 %), of other objectives under the first Framework Programme. Under the new structure, financial balance is direcly related to actions covering one or several R&D programmes. Nevertheless, the following table provides a very broad outline of changes in the relative priority of the different topics on which the Coimmunity's action is based.

Topics December 1985	Position in 1982	1984-87 Framework Programme	Execution of 84-87 Framework Programme in December 1985	1987-91 Framework Programme
- Agricultural and fisheries resources, raw materials	3.3%	5.6%	2.6%	2.0%
- Energy	65.4%	47.2%	47.3%	21.0%
- Industrial competitiveness	16.9%	28.2%	35.7%	60.0%
- Quality of life	9.7%	10.3%	10.5%	7.5%
- S/T for development	0.7%	4.0%	1.7%	1.5%
- Europe's S/T potential	0.0%	2.3%	1.6%	5.0%
- General support for S/T development	4.0%	2.4%	0.6%	3.0%
	100 %	100 %	100 %	100 %

V. Implementation of the Science and Technology Community

1. General framework

The European Single Act provides a new political and legal basis for the development of the Community's scientific and technical strategy.

The Single Act fixes the strengthening of the scientific and technological bases of European industry and the promotion of the development of its international competitiveness as Community objectives.

Community activity in the field of technological R&D is to be conducted in a series of programmes at three levels, namely :

- a unanimously approved multiannual Framework Programme, which will provide the basis for the balanced overall development of Community actions;

- specific programmes adopted by a qualified majority, which are concerned with particular objectives, designed to promote cooperation between all the partners (enterprises, research centres) and open to participation by non-member countries;

- supplementary programmes in which only certain Member States will participate.

Pending ratification of the Single Act by the Member States, the Commission's proposal concerning the 1987-1991 Framework Programme is based on Article 235 of the EEC Treaty and Article 7 of the Euratom Treaty.

The specific programmes which are the responsibility of the Community will be adopted in accordance with the procedures laid down by the European Single Act; the Council, acting by a qualified majority, will take a decision on a proposal submitted by the Commission in association with the Parliament; the specific programmes which are the responsibility of Euratom will be adopted in accordance with an identical procedure except that, in this case, Parliament will merely be consulted.

All research, development and demonstration activities will be presented or referred to in the Framework Programme. Nevertheless, the text of the decision to be adopted unanimously by the Council will not mention :

- specific programmes under the ECSC Treaty, which are covered by a Commission decision;

- demonstration projects in the field of energy, since these are intended to demonstrate the economic value of products or processes developed downstream of technological R&D actions, and thus extend the Community's research activity.

2. Preparatory, implementation, financing and evaluation arrangements

Even in preparing the Framework Programme, and in addition to its basic consultation of Parliament, the Economic and Social Committee and CREST, the Commission intends to refer repeatedly to the various consultative committees attached to it (CST, CODEST, IRDAC, ESPRIT Committee, etc.).

These Committees are made up of representatives of scientific and technical circles, industry, the trade unions, consumer associations and the like; the Commission considers that the involvement of all the interested "participants" is essential for the definition of the Community science and technology strategy best adapted to the requirements and aspirations voiced.

A. Existing implementation arrangements - Role of the JRC

In order to implement the actions adopted in the Framework Programme, the Commission intends not only to use the full range of existing arrangements but also to specify a number of new procedures, which the European Single Act in particular makes available to it.

As regards procedures currently in use (direct action, shared-cost projects, concerted action, demonstration projects), the attached table shows the preferred approach to be taken in respect of the procedures proposed for each action.

The shared-cost procedure is obviously the one used in most cases; it makes possible an optimal use of the limited resources available to Europe by combining the resources of industry or national research institutes and those of the Community.

Direct action calls for some comment upon the future role of the JRC. For the implementation of the Framework Programme, the Commission will call on the JRC to undertake the activities most suited to this procedure. The Commission is currently preparing the new JRC programme for the period 1987-91 on the basis of the existing general guidelines for the Framework Programme; together with this new programme, it will submit a document entitled "Guidelines for the Future Development of the JRC". These guidelines derive from the overall evaluation recently carried out by the JRC Scientific Council.

It is clear that JRC's vocation is found essentially in the establishment of norms and standards, that is, the development of the scientific knowledge and techniques necessary to permit regulatory authorities to fix norms and standards on a solid and neutral basis; this being an important element in achieving the internal market. The vocation of the JRC is equally tied to research on industrial safety and the protection of the environment, fields in which the JRC has a special role closely related to acquired competence and to existing experimental installations.

Present research carried out in the JRC already comprises a number of projects which are a good fit with its vocation but which should be further developed in the future programme. As compared to the present situation it is planned to enlarge programmes falling within Community actions relating to the "competitiveness of industry and of services"

LIST OF COMMUNITY ACTIONS	Concerted Action	Shared-Cost Action	Joint Research Centre	Supplementary Programmes	Remarks
1. Management of Resources					
1.1. Agricultural and Fisheries Resources	XXX	XX	XX (1)		(1) see Remote Sensing section
1.2. Raw Materials	X	XXX			
2. Management of Energy					
2.1. Fusion		XXX	XX		
2.2. Nuclear Fission	X	XXX	XXX	XX	
2.3. Fossil, New and Renewable Energy Sources and Rational Use of Energy	XX	XXX	X	XX	
3. Competitiveness of Industry and Services					
3.1. Information Technologies		XXX			
3.2. Telecommunications Technologies	X	XXX			
3.3. Integration of Information and Telecommunications Technologies into New Applications and Services of Common Interest	X	XXX			
3.4. Cooperation on Basic Research in Information Technologies	XX	XX			
3.5. Technologies for the Manufacturing Industry and Special Technologies		XXX			
3.6. Biotechnologies, Agro-Industrial Technologies	XX	XXX			
3.7. Materials Science and Technology	XX	XXX	(2)		(2) JRC Materials section in 3.10 to be specified
3.8. Marine Science and Technology					
3.9. Transport	XX	XX			
3.10. Scientific Norms, Reference Materials and Methods		XXX	XXX		
4. Quality of Life					
4.1. Health	XXX	XX			
4.2. Safety	X	XXX	XXX		
4.3. Environmental Protection	XX	XXX	XXX		
5. Science and Technology for Development		XXX			
6. Europe's Scientific and Technical Potential - the Researcher's Europe		XXX			
7. General Support for Scientific and Technical Development					
7.1. Innovation	XX	XX	X		
7.2. Communication and Information Network and Scientific Data Bases	XX	XX			
7.3. Linguistic Problems		XXX			
7.4. Forecasting, Evaluation and Statistical Tools	X	XXX			
7.5. International Cooperation					

Key : This action will be executed x to a limited extent
xx to a considerable extent
xxx primarily
on the basis of the procedure in question

and to the "quality of life". In contrast, the JRC effort on "energy management" should be reduced. These changes represent a significant step forward in comparison with the present programme. The evaluation report recently issued by the Scientific Council indicates that the JRC is capable of responding to these changes.

To attain the desired end, the JRC must be suitably integrated within the framework of Community research. Still basing itself on the conclusions of the evaluation report, the Commission has the intention on the one hand, of taking measures to ensure better integration between various means of research and, on the other, of guaranteeing better contact between the JRC, industrial circles and national research organizations. It also plans to increase the mobility of JRC research staff as well as to make the necessary arrangements to increase the number of visiting scientists and research fellows coming from the Community.

B. New Arrangements

In addition to applying management procedures and financing arrangements which already exist, the Commission wishes to make use of a set of new methods which are both more flexible and better adapted to the new range of proposed actions. New procedures are already planned or are under study in the Commission's departments.

In this connection, reference can be made to the new arrangements which could be implemented quickly:

1. Joint undertakings: here it is a matter of extending (with or without the participation of the Community, of all or some of the Member States, and possibly of non-Member States), the system laid down in the EAEC and EEC Treaties, after amendment and simplifications.

2. Supplementary programmes: programmes of this type - such as those which have existed or which still exist in the EURATOM framework - can from now on be developed on the basis of the EEC Treaty. These programmes, with or without a contribution from the Community budget, would be defined and carried out only by the Member States concerned and financed by national funds.

3. Minority participation by the Community in national and multinational actions or projects. With this arrangement it would be possible to involve the Community in actions or projects of Community interest in exchange for a degree of financial support.

4. Community budgetary intervention will be supplemented by a number of facilities deriving from new Commission initiatives in respect of financial instruments or techniques, particularly in the case of technological R&D programmes for industrial-scale application which are close to the market, such as the EUREKA projects.

5. Lastly, still with a view to ensuring the same complementarity in relation to existing arrangements, the Commission is prepared to examine the possibility of creating flexible structures of the "agency" type which can provide an interface between Community priorities and policies and the special requirements of operators.

C. Evaluation of results

To complete this set of arrangements, the Commission intends finally to reinforce the system for evaluating its research programmes and their results in the light of the experience gained over several years.

In particular, evaluation by independent experts which has already been applied in respect of numerous Community activities (JRC, programmes on renewable sources of energy, the ESPRIT mid-term review, etc.) will be conducted systematically and periodically for all R&D programmes.

3. Accompanying measures

In order to support the implementation of R, D&D programmes it will, moreover, be possible to make use of a range of accompanying measures. By way of example, reference can already be made to the following :

- all of the initiatives appropriate to the organization of the large market (standards, free movement of goods and capital, tax harmonization). In particular, the Commission will endeavour to facilitate inter-industrial R&D agreements and the exploitation of their results within the framework of its competition policy. In applying Community competition rules, the Commission will accord favourable treatment to state aid for technological R&D.
- The implementation of specific activities of particular interest to those states or regions of the Community whose scientific and technical development calls for special efforts.
  As pointed out earlier, a balanced development of all the Member States and regions of the Community will essentially depend on the translation of the Framework Programme into a set of approriate specific programmes.

  In addition, the use of the ERDF and the IMPs for certain infrastructure projects can be considered together with the creation of new financial arrangements which could support infrastructure projects and at the same time meet the needs of small and medium-sized firms.

  Furthermore, other proposals have already been submitted by the Commission, such as the programme relating to the development of certain less-favoured regions of the Community for improved access to the advanced telecommunications service (STAR Programme, COM/85/836 final). In the framework of shared-cost R&D programmes the Commission's departments are studying ways and means of systematically linking laboratories or firms in less-favoured regions to R&D institutions in those Community countries which are most advanced in science and technology, in fields in which this type of association facilitates valuable cross-fertile cooperation.

- the implementation of measures concerning small and medium-sized undertakings with a view to involving them in the progress of the Community and allowing them to exploit the Community's large-scale market potential to the full.

The Science and Technology Community must take account of the fact that the advanced industrial economies are going through a period of intense technological change, during which small and medium-sized businesses are frequently best suited to the adoption of innovatory policies and the maintenance of a high degree of competitiveness based on innovation. These businesses can guarantee Europe's place in the new international division of labour and the competitive dissemination of its technology. Consequently, the Community will seek to create a suitable environment for the development of a network of healthy, dynamic and innovatory small and medium-sized European businesses. The Commission will shortly send the Council a communication specifically concerned with this type of action.

- finally, increased support for the training and retraining of research workers. It should be mentioned here that in the Framework Programme of Community scientific and technical activities only initiatives favouring postgraduate research workers and scientists will be considered. These activities therefore go beyond the scope of the COMETT programme (Community Programme for Education and Training in Technology), which is essentially concerned with the further training of student, teachers, engineers and technicians with regard to changes in the new technologies and thus constitutes a necessary complement to the actions planned under the technological R&D Framework Programme.

4. An open, confident Technology Community

The reinforcement of Community action in the field of technological R&D certainly does not represent an isolationist withdrawal behind its geographical and institutional frontiers on the scientific and technical level. On the contrary, it must be accompanied by increased international cooperation, especially in a field such as thermonuclear fusion and more particularly at European level.

- The close links established with the European Science Foundation, the European Space Agency, CERN and the Council of Europe must be maintained and, where appropriate, strengthened, in particular by the execution of joint projects.

- Bilateral cooperation with the EFTA countries will acquire a new dimension with the implementation of the framework agreements on scientific and technical cooperation which have already been, or which are due to be, signed. These countries, which are already involved in a number of Community programmes both under the Euratom (fusion, radioactive waste) and EEC (environment, raw materials) Treaties should in future cooperate more closely with the Community in several sectors, such as telecommunications, information technology, manufacturing techniques and materials.

- Lastly, in preparing the new Framework Programme, particular attention must be paid to existing links with two multilateral cooperation initiatives, namely the extremely new EUREKA programme and the much older COST. At the present stage of planning, the following links between the Community action and these two initiatives can be outlined.

EUREKA

The EUREKA initiative is the expression of the wish of the Government's of eighteen European states and the Commission to implement a policy centring on the joint confrontation of the challenges posed by the development of new technologies and their incorporation in the industrial innovation process.

Twenty-six cooperation projects involving industries from several states and, in many cases, the Community have been launched since the declaration of principle defining, in particular, the goals and implementing conditions of this initiative was adopted by the European Ministers of Foreign Affairs and of Research in Hanover on 5-6 November 1985, following the launching of the initiative at the European Technology meeting in Paris on 17 July 1985 in response to the initial discussion at the Milan European Council on 28-29 June 1985.

The declaration points out these "EUREKA projects are not intended to replace existing technological cooperation in Europe - such as the programmes of the European Communities - nor its subsequent development. On the contrary, their purpose is to extend or supplement this cooperation".

Whilst the Community will continue to develop scientific and technological programmes on the basis of objectives, criteria and priorities defined jointly with the Governments and industries of the Member States, EUREKA projects will essentially be implemented on the initiative of individual enterprises seeking to cooperate. These enterprises will be responsible for project management including, in most cases, financing. The projects will mainly relate to the joint development of advanced techniques close to the market or of infrastructures of transnational interest.

The Commission has supported this initiative from the start, considering that, if conducted in a consistent and symbiotic manner, the Community programmes, together with their resultant projects and the EUREKA projects, can, by virtue of their complementarity, constitute a whole which will make possible the attainment of the common objectives of these two categories of action, namely the increased productivity and competitiveness of European national industries and economies on the world market and a resultant contribution to greater prosperity, and higher levels of employment.

In this connection, it should be emphasized that the general budget of the European Communities for 1986 contains a new Chapter 78 on "Expenditure arising from the participation of the European Communities in Scientific and Technological Prospects of Community Interest - EUREKA and others".

The Commission believes that the Community must make a variety of contributions to EUREKA to enable the full potential of this initiative to be realized. These include :

- the immediate and direct involvement of its experts in the preparation of the procedures now under discussion concerning the execution of the project, and its agreement in principle to second qualified staff to the EUREKA secretariat.

It will also be necessary to provide access in conjunction with Ireland, to the EUROKOM information communication system developed within the framework of ESPRIT.

- participation in the organization of industrial seminars such as that on gallium arsenide and biotechnology.

- direct Community participation in certain EUREKA projects of recognized Community interest.

- Community cooperation in EUREKA projects representing a direct extension of activities conducted within the framework of Community projects (e.g. projects on amorphous silicon, software portability, membranes, the environment and research networks).

- the Community's contribution to the success of research cooperation through the creation of a large internal market which will provide the optimum conditions for the economic exploitation both of Community programmes and of EUREKA projects.

- lastly, the creation in the future of the abovementioned flexible institutional and financial frameworks suitable for EUREKA projects whose implementation would be in the Community interest.

Links with COST

The Commission has repeatedly stressed the importance that it attaches to furthering cooperation within COST. This form of cooperation had its beginnings in 1971 and it has enabled a wide range of activities to take place in different scientific and technical sectors by combining the advantages of a flexible procedure, of variable association between States - depending on their specific interests - and of participation by non Member States in the scientific and technical activities of a wider Europe.

Since COST was created, its background has of course altered profoundly. The expansion of the Community from six to twelve States, the diversification of the range of Community R&D programmes, the opening of those programmes to more and more non-Member countries, the strengthening of the bonds between the EFTA and Community countries as a result, in particular, of the Luxembourg Declaration of April 1984, and the launching in 1985 of the EUREKA initiative are all factors which cannot be disregarded when examining the future of COST.

There must be provision in future for a symbiosis between Community programmes, COST and EUREKA projects. As one of the avenues of activity open to Europe, COST seems particularly suited to:

- highly specific activities which are limited in time and are not well adapted to inclusion in the Community's major long-term programmes and which, moreover, while adopting the EUREKA "bottom-up" approach, are unable by their very nature to share EUREKA's background owing, for example, to their distance from the market.

- activities in areas inadequately covered, if at all, by Community programmes, such as transport or aquaculture.

The Commission will pursue its dialogue with the Member States and the other COST States on the direction in which to steer COST in future. It must be accorded considerable importance when the new Framework Programme is put into effect.

VI. Conclusions

The initial responses - whether informal or not - of all of the advisory bodies consulted (CREST, CODEST, IRDAC, CGC, ESPRIT Committee, ...) have confirmed the Commission's conviction that the creation of a European science and technology community is both necessary and feasible.

A great effort by all the participants (public institutions engaged in R&D, large-scale enterprises, small and medium-sized businesses and national and Community bodies capable of contributing to the attainment of this objective) is thus called for.

Among this vast array of activities to be conducted and initiatives to be launched, it will be necessary in the coming months to define the action to be taken by the Community, that is that part of the undertaking to be conducted jointly.

The vehicle for this undertaking must be the "1987-91 Outline programme of Community scientific and technological activities" forming the basis of Europe's scientific and technical strategy.

That is why, before preparing a formal proposal for an outline programme, the Commission hopes to draw upon this document, which does not constitute its formal proposal or prejudge its contents,and its annexes in discussing the following with the Community institutions:

- the general S/T lines to be followed,
- the priorities and balances to be respected,
- funding and the gradual "increase in power" to be provided for in terms both of commitments and of payments.

The Commission will draw up its formal proposal as regards scientific and budgetary aspects, in the light of these discussions and the conclusions drawn and will send it to the Council and to Parliament in July 1986.

SUMMARY LIST OF COMMUNITY ACTIONS	Range in * MioECUs
1. Management of Resources	
1.1. Agricultural and Fisheries Resources	90- 180
1.2. Raw Materials	60- 90
2. Management of Energy	
2.1. Fusion	1060-1200
2.2. Nuclear Fission	600- 700
2.3. Fossil, New and Renewable Energy Sources and Rational Use of Energy	250- 350
3. Competitiveness of Industry and Services	
3.1. Information Technologies	2200
3.2. Telecommunications Technologies	1000
3.3. Integration of Information and Telecommunications Technologies into New Applications and Services of Common Interest	700- 900
3.4. Cooperation on Basic Research in Information Technologies *	40- 50
3.5. Technologies for Manufacturing Industry and Special Technologies	600- 900
3.6. Biotechnologies, Agro-Industrial Technologies	350- 460
3.7. Materials Science and Technology	200- 300
3.8. Marine Science and Technology *	pm**
3.9. Transport *	50- 80***
3.10. Scientific Norms, Reference Materials and Methods	300- 350
4. Quality of Life	
4.1. Health	140- 160
4.2. Safety	230- 280
4.3. Environmental Protection	285- 320
5. Science and Technology for Development	100- 200
6. Europe's Scientific and Technical Potential - the Researchers' Europe	400- 500
7. General Support for Scientific and Technical Development	
7.1. Innovation	80- 150
7.2. Communication and Information Network and Scientific Data Bases	20
7.3. Linguistic Problems	80- 100
7.4. Forecasting, Evaluation and Statistical Tools	30- 35
7.5. International Cooperation	50- 60
Supplementary programmes (outside own resources) identified to date : HFR	100

* in July 1986, the Commission will submit a formal proposal, as regards the scientific and financial aspects, in the light of its discussions with the community institutions.

** the sum subsequently decided upon will be taken from the reserve

*** does not include a possible action in the field of aeronautics which would be funded from the reserve

ANNEX II

BACKGROUND MATERIAL ON COMMUNITY ACTIONS
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TABLE OF CONTENTS

1. MANAGEMENT OF RESOURCES

1.1. Agricultural and Fisheries Resources

1.1.1. Agricultural Resources

a. Community actions in agricultural research have for fundamental reasons and in the general interest to aim at increasing the effectiveness of the human and financial resources devoted to agriculture:

- seeking to avoid, through better coordination, useless duplications of effort;
- stimulating the development of an agricultural scientific community in Europe;
- orienting research efforts in line with the requirements of the common agricultural policy.

This policy faces a series of challenges which will influence its future development; excess production of the principal agricultural products, consequent pressure on prices, the need for high quality food products, the need to find non-food outlets, the need to stabilise the rural population in certain regions by revenues of non-agricultural character, the concern caused by the risks to the environment posed by certain methods of modern agriculture, etc.

Community agricultural research has to take account of these challenges and strive to develop research actions capable of anticipating the difficulties which they are inevitably going to impose upon agriculture and the common agricultural policy.

b. Community research, development and demonstration activities will be based upon four major orientations :

1. Efficiency of production techniques : in plant (including forestry) and livestock productivity, integration with industrial activities upstream and downstream (see corresponding references under "agro-industrial"), energy utilisation, integrated biological control, new technologies in agricultural engineering, and in all areas, the application of information technologies;

2. Utilisation of soil and water : soil degradation and fertility, alternative uses, water management, and the development of advanced technologies (particularly teledetection and related information technologies);

3. Regional balance : integrated rural development (particularly in Mediterranean regions), specific production problems of less favoured regions, diversification;

4. Utilisation and quality of agricultural products : research on : traditional products, new products and derivatives for food or industrial use, improvement of nutritional quality of products.

These orientations, which largely reflect the options discussed by the SCAR (Standing Committee on Agricultural Research) for the coordination of agricultural research in the European Community, have to be considered also in close relationship with the actions "Biotechnology and agro-industrial technologies" (see § 3.6).

For all these areas, the Community dimension offers particular advantages in enabling the costs of pre-competitive and generic research to be shared and its benefits diffused; or enables research to be undertaken in areas where national efforts are inadequate. For areas such as harmonisation of methodologies and analytical methods, it is essential for coherent standardisation.

c. The proposed effort incorporates the experience of earlier years, (the 3rd programme runs from 1984 to 1988, value 30 MioECUs) but reflects both the impact of new technological tools, and the evolving new policy priorities. Thus, for example, the soil map work has renewed relevance with the growing need for new uses for land, and the regional needs of Mediterranean agriculture acquire increased importance in view of the new Member States.

d. It is envisaged that most of the proposed actions should be shared cost, including scientific stimulation. Demonstration projects are also indispensable elements to ensure the useful exploitation and dissemination of results. In some areas, concerted actions may be employed. The JRC will contribute through its teledetection activities.

e. To reach the minimum level of efficacy, the funds required are estimated between 60 and 150 MioECUs for the period 1987-1991. Some of these objectives are covered by research under article 41 of the Treaty and correspond to an amount of 100 MioECUs.

1.1.2. Fisheries Resources

a. Fish production is an important source of high quality protein for the Community but although EEC output is now of the order of 6 million tonnes, the Community is in deficit. The aim of EEC Common Fisheries Policy (CFP) is therefore to increase production wherever this is possible without damage to fish stocks and to make better use of the material landed. There is a considerable potential of the application of new methods of resources management, of reducing waste and of increasing production from certain areas which have so far received relatively little attention.

b. Since the elaboration of the CFP fisheries research has been an integral component of Community strategy. There is no question of separating research from the other elements making up overall policy with regard to Community fisheries. Apart from this fact, there is every reason why fisheries research should have a high priority within the CFP. This has become even more important since the enlargement of the Community to Spain and Portugal, where fisheries have a particular importance. It is clear that if the Community fishing effort is to be applied on a rational basis, research into socio-economic aspects of the fishery must be a major consideration.

At the same time there are also a number of areas of research which are of very considerable interest to the Community, in particular those relating to :

- management of fishing resources : assessment of stocks by modern techniques (including remote sensing), biological models taking account to the interaction of species, multidisciplinary approach (biological, technical and socio-economic) to the management of fishing operations;
- catching techniques : improvement of fishing gear and methods;
- aquaculture : growth, survival and feeding of the species cultivated (fish, molluscs and crustaceans), diagnosis and treatment of diseases, genetic research to develop breeds suitable for rearing;
- processing of produce : refrigeration, sterilization, storage, optimum use of small fish and byproducts, control and improvement of food quality.

The main criteria to be borne in mind in the selection of research topics, as already stated above, are the requirements of the Community market and the need to maintain fish stocks for the future.

c. So far, the Community has not undertaken any significant action in the research field but this situation is about to be remedied with the expected implementation of a multiannual research programme, prepared by the Commission and now under discussion in the Council. The programme will be achieved in two ways. Firstly, the Community will fund investigations undertaken by several Member States on a collaborative basis and secondly it will aid and co-ordinate an exchange of research workers, the publication of data and the organisation of symposia and seminars. Moreover cooperation with third countries may be envisaged under COST procedures, particularly in the field of aquaculture.

d. These activities imply Community funding of about 30 MioECUs on a five year basis.

1.2. Raw Materials

1.2.1. Non-Fuel Minerals(*)

a. Despite the entry of Spain and Portugal in the Community which will bring sizeable mineral reserves, the EEC trade balance deficit for primary minerals raw materials (12,000 MioECUs in 1984) will remain high for a number of strategic and critical metals (although decreasing for base metals). This situation makes it necessary to promote the exploitation of domestic primary and secondary (recycling) resources, and to increase its cost-effectiveness. Furthermore, the mining and metallurgical sectors must remain competitive in their operations throughout the world. Such objectives cannot be met without an adequate research effort.

   The market for raw materials is cyclical. To a large extent, publicly funded research should be anti-cyclical, particularly as experts predict in the long term an upward change from the currently depressed situation.

b. Research on **primary raw materials** will focus on problems of common interest in exploration (preparing concepts and methods in view of a future revival of exploration activities), mining technology (improving the economic viability of existing mines and developing advanced technologies for future mines) and ore processing (treating complex, lean and refractory ores and ores which contain metals for advanced materials technology). An overall objective is to reduce investment and operating costs.

   Research on those topics can greatly benefit from a coordinated multinational approach. Main reasons for believing this are :

   - the same types of deposits and of mines occur throughout the Community,
   - modern exploration concepts will rely more and more on the combined processing of data from several disciplines and particularly on developments in areas of high technology; this may exceed the expertise available in any Member States,
   - the modernisation of processing plants and of mines can be achieved only through joint research efforts implying adequate scale of work and appropriate dissemination of results to industry.

   Other possible orientations :

   - research on sea-bed resources, particularly in the 200 miles-EEZ,

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(*) excluding steel, which is covered under ECSC activities

- Continental lithosphere studies for basic research on processes of ore concentration (links to be set up with national and international programmes). The scope for investigations here clearly exceeds the potential of any one Member State.

In the area of **secondary raw materials**, the Community dimension of research arises :

- from the similarity of problems encountered in all Member States,
- from the need to spread through industry the results of research, thus promoting innovation in a rapidly evolving field,
- from environmental protection considerations.

For example, new materials such as special alloys and composites will be used more and more in industrial sectors having high technological development, and will have to be recycled.

Research in the recycling of urban and industrial waste (plastics, glass, paper and organic matter) will concentrate on the economic recovery of materials which can compete on the market with primary sources.

c. With respect to the current effort, which has yielded encouraging results in the evaluation report, the foreseeable trend for future research is as follows :

- in exploration : less focus on base metals, more on minerals needed for new materials and technologies,
- in mining technology : emphasis on robotics, rock fracturing, transportation and underground safety,
- in mineral processing : emphasis on developing advanced techniques and on new flotation reagents.

d. Most of the EC sponsored research is to be carried out under cost sharing contracts in projects involving firms and/or research organizations in at least two Member States.

Part of the funding is to be devoted to coordination activities, either on topics which are already studied in the national programme, or to arrive at common methods and standards.

1.2.2. Wood

a. As stated again most recently in the SILVA conference (Paris, 1986), the EC trade balance deficit for wood and wood products comes to 17.000 MioECUs per year, and is second only to petroleum products. Yet, the 12 Member States have a large forest resource, at least 53 MioHa, but it is far from yielding its real potential due to a variety of technical, social and economic reasons.

Forests play other useful roles. Beside wood production, they regulate water resources, prevent soil erosion, decrease air pollution and provide invaluable amenities to the population, be it close to urban centres or in remote areas. Yet, they are threatened by man-made enemies (pollution, fire), pests (insects, fungi, viruses), meteorological phenomena (droughts, wind), encroachment by urbanization.

The afforestation of land which agriculture may relinquish in the near future will require careful management to make it profitable and avoid considerable financial losses.

Research may help considerably in addressing the multiple problems of European forestry.

Wood-using industries must also be encouraged to develop and apply the most sophisticated technologies in order to make the best use of basic products which are often of relatively low quality and compete more successfully with their larger, vertically integrated U.S. and Scandinavian counterparts.

b. Community-sponsored research in this field is justified and needed for attacking problems of common concern. Similar types of climate and soils are found throughout the Member States : the same tree species and ecotypes are found or must be introduced. Pests spread freely across national borders, so do pollutants and wind storms or droughts. The problems of utilization of forest products are similar.

   Community coordinated research is also justified in that it may provide a sound technical basis for the development of Community policies (environmental protection, norms for the internal market, regulations on land use, development of less-favoured regions, integrated Mediterranean programmes and more specific forestry actions, etc..).

   To be most effective this research should be integrated for the whole "wood chain" from seed production to the final use of wood and other forest products, including problems such as genetic improvements, tree physiology, protection against pests and pollution, wood utilization as a source of fibre and as chemical feedstock.

c. EC research carried out since 1982. has made it possible for European specialists to cooperate closely and also produce a number of patents and industrial applications in such areas as sawing, pulp making, paper recycling, etc.. (it may be noteworthy that Sweden and Switzerland joined this programme). Future research will capitalize on the results obtained and place more emphasis on joint projects of common interest. Whereas results can

be acquired fairly rapidly in technological developments, they are much slower in forest production as such, and here continuity of the effort is essential.

d. Community research in this field is carried out mainly through cost sharing contracts with research organizations and industrial firms but coordination of national programmes must be greatly expanded in relation to what has been done heretofore.

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e. Considering the importance of this action for many Member States, in particular the new ones, and in order to achieve a significant impact, it is estimated that this action on raw materials should be funded at a level of 60 to 90 MioECUs for the period 1987-1991.

This level of effort would represent about 5 to 7% of the funding of this field of research in the Member States.

2. MANAGEMENT OF ENERGY

2.1. Fusion

a. The long-term potential of fusion, namely to open a new way of power generation, friendly to the environment and using practically inexhaustible fuel, remains a valid and strong argument to vigorously continue its development. Fusion could contribute in a few decades to strongly reduce the economic, ecological and political vulnerability of Europe.

The way towards the prototype reactor (DEMO, which should prove the economic feasibility of fusion) goes first through the demonstration of the scientific feasibility of fusion (hopefully to be made by JET and its foreign equivalents in the early nineties), and second through the demonstration of the technological feasibility of fusion (to be achieved by NET, the Next European Torus, and its equivalents; NET is presently in the phase of conceptual design).

Fusion has already today a large high-technology content : JET, the specialized devices in construction or in operation in the associated laboratories, and the NET oriented components development, are by themselves a demonstration of high technology, with spin-offs (in particular in the fields of superconducting magnet technology, robotics, and high power microwave systems) to the benefit of other branches of science and of European industry. The role of industry is expected to grow appreciably when NET will enter the phase of engineering design.

b. In conformity with reiterated Council Decisions, "the Community Fusion Programme is a long-term cooperative project embracing all the work carried out in the Member States in the field of controlled thermonuclear fusion. It is designed to lead in due course to the joint construction of prototype reactors with a view to their industrial production and marketing."

A large scale well integrated programme is made necessary by the difficulties and the length of the road towards commercial fusion power, together with the high costs and the scientific uncertainties involved. In Europe, all activities of the Member States (plus Sweden and Switzerland) constitute a single programme supported by the Commission. The Community approach makes Europe an appealing partner for international collaboration (USA, Japan, USSR, Canada...) and has led, not only to added, but also to created values such as JET, the setting up of the NET team, and the mobility of Staff.

The main objectives of the 1987-91 fusion activity are :

- to establish the physics and technology basis necessary for the detailed design of NET; this implies the full exploitation of JET and of several medium-size specialized tokamaks in existence or in construction and the strengthening of the technology programme;
- to embark, possibly in 1989/90, on the detailed design of NET;
- to explore the reactor potential of some alternative lines (Stallarator and Reversed Field Pinch).

c. The scientific and technical achievements of the European programme place Europe in the forefront of world-wide magnetic fusion research. JET is the leading fusion experiment in the world, which achieved its initial objectives for the basic performance phase on time and in budget, and hence made formidable progress towards the demonstration of the scientific feasibility of fusion. The European medium-size machines contribute in a powerful way to the progress of fusion and to the future success of JET. Europe is also leading in research on stellarators and reversed field pinches, which are alternative configurations to the Tokamak. European industry has built all these devices (to give an example, more than 98 % in cost of JET contracts has been placed within Europe) and has already been entrusted with some long-term advanced development (for instance high frequency, high power RF Generators). Its involvement should make a qualitative and quantitative jump towards 1989/90, when a decision could be taken on the start of the engineering design of NET.

d. The structure of the fusion programme is that it is driven by the relevant national institutions coordinated by the Commission within the system of Associations. All fusion activities in the Member States (plus Sweden and Switzerland) and in the JRC are integrated into "the European programme".

   The fusion activity is carried out along three modes of action, the first two of them corresponding to shared-cost actions :

   - JET (a Joint Undertaking);

   - the General Programme (Associations, NET and Technology);

   - the JRC (technology concentrated on fusion safety, including the tritium handling laboratory, on materials and on support to NET).

e. On the basis of an analytical cost estimate of the various elements of the activities sketched above, the Community funds required amount to approximately 1060 to 1200 MioECUs, which cover the fusion programme proper and the fusion activities at JRC. The fusion programme proper encompasses the same activities which are covered by the March 1985 Council Decision.

2.2. Nuclear Fission

a. Development of the nuclear fission energy is one of the main ways of reducing - through diversification of energy sources - the Community's dependence on imported fossil fuels such as oil. In the long term, through advanced technologies - notably fast breeder reactors - fission energy can virtually be considered as a renewable energy source. Therefore, continuation of a resolute effort on nuclear energy remains an essential aspect of the European energy policy.

The strategic objective of increasing energy source diversification and reducing energy dependence from imports must be compatible with the objective of protecting the population and the environment. A two-pronged approach is therefore necessary :

- while the safety and the benign environmental impact of the present generation of nuclear technologies must be maintained and confirmed,
- further progress and innovation towards more performant systems should be assured by conceivable technological improvements.

b. The proposed R, D&D will be carried out according to the following main lines :

Reactor safety problems - including those raised by the mature light water reactor industry - extend beyond frontiers : progressive harmonization of safety requirements and criteria is necessary to be developed and maintained at the Community level in order to provide an equivalent and satisfactory degree of protection of the population/workers/environment, and to assist development of trade. The main thrust of the effort will be directed to light water reactor safety and reliability (including feedback from aging plants), fast breeder reactor accident progression analysis and circuits integrity, and codes and standards convergence.

Work related to the radioactive waste management will receive particular attention. Problems raised by radioactive waste operations involve a combination of issues of social/ legal/ administrative/ financial/ technical nature which need to be resolved in one and same context. The effort will progressively concentrate on demonstration of safe waste disposal options with a view to reach a European concensus and to harmonize policies within the Community.

Other more technical oriented problems are those related to decommissioning operations. In this field, the effort will concentrate on demonstration of relevant technologies with a view to harmonize the approach and policies within the Community.

The Commission is a safeguarding authority in its own right (Chapter VII of the Euratom Treaty) and has carried out R, D&D in support of this institutional task. In the future the transportation and handling of nuclear materials are going to increase as reactors and other nuclear installations now under construction will become operational. Therefore, the Commission will have to further develop methodologies and techniques to adequately deal with the increasing number and variety of facilities to be monitored.

c. While the 1987 "photograph" of Community R&D will be determined by the current activities, the orientations for Community research in the second part of the period 1987-1991 will be along the following lines :

Continuation (but reoriented, to take account of results and their evaluation) of the actions on :

- solar energy (possibly merged with a programme on building technologies),
- energy from biomass
- energy conservation,
- solid fuel utilisation,
- hydrocarbon exploitation and use,
- new energy vectors (possibly merged with the hydrocarbons sub-programme),
- energy systems analysis.

Depending on the needs of the Member States, current R&D on geothermal energy will progressively be terminated while high technology work in the field of exploration, instrumentation and hot-dry-rock-technology should be carried out in other, new, separate activities. The solar energy chapter might concentrate on "passive solar", data collection and testing. Wind energy research should be brought to an end. Energy conservation might be concentrated on certain very advanced technologies (batteries, clean car, fuel cells) and important horizontal areas (combustion science, sensor techniques, etc.).

As already pointed out, many of the above actions will be re-shuffled (with the assistance of the CGC) in order to concentrate on very specific advanced technology objectives (for example : clean use of coal in the solid fuels area) and horizontal fields. This re-shuffling might also lead to devote separate chapters to :

- photovoltaic technology and systems,
- bioethanol,
- advanced building technologies (energy saving, solar architecture).

In addition, a completely new area should be addressed by an activity on :

- deep gas and deep geology (possibly including hot-dry-rock technology).

It must be pointed out that the choice between the different options outlined above as well as the more detailed content of each action should be determined in consultation with the CGC and in the light of the first results of the third non-nuclear energy R&D programme and of its corresponding JRC actions, becoming gradually available.

d. The major part of the work under this action will be carried out through contract research; the specific activities on standards and testing (solar, buildings, conservation) will be carried out within (or under supervision of) the JRC, and certain other activities could be carried out via (reinforced) concerted actions.

e. Community funding required for research in this action is estimated between 250 and 350 MioECUs for the period 1987-1991. This amount represents between 7 and 12 % of the total spending of Member States in the same areas.

Beyond those activities mention should be made of the energy demonstration projects and of the coal research carried out in the frame of the ECSC Treaty.

3. COMPETITIVENESS OF INDUSTRY AND SERVICES

Information technologies, telecommunications technologies and their applications
(Introduction to items 3.1., 3.2., 3.3. and 3.4.)

1. Because of their enabling character and of their pervasiveness, information and telecommunications technologies (IT&T) play a key role in all scientific, economic and social activities. Performance in these domains will heavily influence the socio-economic choices open to Europe.

   Already 2/3 of the GDP or 55% of the labour force are classified as concerned with information activities (acquisition, processing, transmission, storage, selling) and thus rely on performance in IT&T. The competition between economic regions worldwide will strongly depend on their ability to use IT&T in an effective and timely manner to meet economic and social objectives

   Because the deployment of IT&T enhances skill content, and thus the efficiency of all factors of production, these technologies are particularly appropriate to Europe which has both to optimise the utilisation of its scarce natural resources and also to compensate for the cumulative negative impact of industrial production on the environment and to maximales its relatively important scientific assets and skills.

   IT&T offers a tremendous potential for creation of new products, processes and services addressing economic problems but, maybe more importantly, offers new ways to address urgent social problems in domains such as health care, road safety, adult education and others.

   The United States and Japan, but also other countries are steadily increasing and concentrating their efforts in IT&T by funding big projects such as INS, 5th generation computer, SDI or by creating favourable conditions, stimulating cooperative R&D between universities and companies.

2. The Community wide dimension, framework and instruments are particularly appropriate for the development of R&D activities in the field of IT.

   Research and technological developments in this sector are characterised by :

   - The importance of R&D expenditures to devote in order to keep the pace. European or american semi-conductors industry must spend some 7 to 10% of their yearly turnover in R&D.

- The increasing speed of technological evolution (with a shortening of the delay between two technological generations to some 2 years).

- The relative scarceness of human resources (limited amont of specialists in areas characterised by very fast changes).

- The increasing need of pluridisciplinary approach.

- The fruitfullness of innovations gained through the work performed by small groupings such as University scientists, SMEs...

The constraints set out by this situation (difficulty of recouping R&D expenditures below a minimum threshold of some 5 to 10% of the world market; fierce competition between companies; heavy technological and financial risks) may be overcome at Community level by cooperative actions allowing :

- The definition of common objectives and strategies.

- The pooling of scarce human and financial resources, and the consequent work sharing.

- Economies of scale for instance (european companies in the IT sector must devote to R&D twice or three times as much resources, in percentage of their turnover, as their American or Japanese competitors, with much poorer results).

- The broadening of the research areas and of the technological options investigated.

- A concerted and coherent approach in the field of standardization and of complementary measures.

- A stimulation of skills and centers of excellence existing all over Europe, as demonstrated by the participation of, all Member States in ESPRIT.

3. In order to answer this challenge, and to exploit the Community advantage it is necessary to pursue and strengthen the actions initiated during recent years at the level of technology base as well as complement them so as to create synergy and favourable conditions for their translation into applications.

   This process indicates a set of specific concerted actions, addressing a number of key factors or issues which are closely related to each other :

   - Further strengthening of the technology base.

   - Improving the use of industrial R&D capacities by cooperation and work sharing.

- Contributing to the formation of a Community wide market for IT & T products, equipments and applications by reinforcing efforts in standardisation, certification and opening up of public procurement.

- Stimulating demand by infrastructure projects, pilot schemes and by creating a favourable environment for the wide use and diffusion of new applications.

- Diffusion of technology into less privileged regions.

- Improving the level of education and training.

4. Concerning the technology aspects, the content scope and objectives of the actions related to IT & T and their applications are established according to the following pattern :

   - Preliminary analysis of the strategic importance of the envisaged action for Europe.

   - Definition with the interested partners of key factors and of the subsequent action lines to be set up.

   - Establishment of a definition phase to precise the detailed objectives and the necessary human and financial resources to gather.

   - Permanent evaluation of the actions and yearly review of the workplan.

   The actions proposed in the 1987-1991 Framework Programme will build on previous actions, in particular the :

   - Microelectronics Programme,

   - Pluriannual Informatics Programme,

   - ESPRIT phase I (initiated in 1984), and

   - RACE definition phase (launched in 1985).

   Based on the evaluations carried out on the above mentioned programmes and in consultation with industry, the scientific community and the national administrations, the new Framework Programme should include the continuation of :

   - ESPRIT I with ESPRIT II, in accordance with the recommendations of the Council, of the mid-term Review (Autumn 1985) and of industry.

ESPRIT II will put the emphasis on technology integration and on more ambitious and more focused projects, including also increased attention to the generic technology requirements of advanced applications.

- RACE definition phase with RACE main. The main phase of RACE (to be launched in 1987) will establish the technology base, the precompetivive developments and the work necessary for common specification and standards which are required for progressive introduction of integrated broadband communication infrastructure and services.

- Exploratory academic research in order to strengthen European cooperation in basic research related to IT&T.

Moreover, greater emphasis will be put on developing new applications in concert with the respective users, drawing on synergy between parallel developments.

Complementary actions addressing major objectives of common interest (and covering some of the seven areas mentioned in the IRIS initiative) include the use of IT&T for supporting :

- Learning, teaching and training, which will permit the overcoming of some of the distance and access constraints to learning (DELTA).

- Road-safety, traffic guidance, and mobile communication, which can be addressed by exploiting synergy between parallel technological developments and could result in an integral solution offering major advantages in terms of costs and infrastructure requirements (DRIVE).

- Bioinformatics and medical informatics, which can benefit in cost performance by a systematic and timely introduction and integration of advanced IT&T (BICEPS).

Other areas which may offer opportunities for Community action are being actively explored and may result in the next two years in proposals for action. These concern :

- the domain of laboratory equipment technology (to improve R&D productivity) and financial technology which would make financial transactions speedier and more secure;

- other domains contributing to social objectives in Europe.

The follow-up of the microelectronics and the informatics programme will occur in the framework of ESPRIT.

The proposed actions will take the form of shared cost programmes and will be carried out in close concertation with national and intergovernmental activities.

The required resources will be estimated in concertation with the respective actors and Member State administrations. At this very preliminary stage, and under the assumption that the current modalities would be applied, the efforts would be situated approximately between 3940 and 4150 MioEcus over 5 years.

This amount corresponds to a few percents of the overall efforts made at national level by Member States.

As this Community effort focus on key areas of strategic relevance, and on the strengthening of technological cooperation, it will exert a multiplier effect and will produce results far beyond the rather limited appropriations requested on the EEC budget.

3.1 Information Technologies

a. This action covers the ESPRIT programme the objectives of which are to take advantage of the Community dimension :

- to enhance the technology base in IT on the precompetitive level, enlarging scope and applying economics of scale, in order to meet successfully the requirements of the world market in the nineties
- to improve the use of scientific and industrial R&D capabilities by cooperative efforts,
- to pave the way to widely accepted international IT standards, and
- to promote the transfer of technology in the IT sector with particular emphasis on needs of SME's.

b. The programme has just been reviewed by an independent high level body (ESPRIT Review Board). The results of this review, which demonstrate that ESPRIT has been successfully established and is well on its way to meeting its objectives, has been transmitted to the Council and the Parliament (COM(85)616 final). Moreover, the yearly workprogramme of ESPRIT is a unique characteristic, ensuring that the programme is under constant assessment.

In accordance with the recommendations of the ESPRIT Review Board, and as a result of an extensive conslutation process with industrial experts a consensus view on the scope and content of the programme from 1987 onwards is emerging along the following axes:

1. Microelectronics and peripheral technologies

- Silicon technology. Silicon technology represents the foundation of the IC industry and silicon-based devices are responsible for the dramatic reduction in the cost of electronic equipment that has occurred in the past years and will continue in the future. Specific technological targets would be eg. 4 million transistors on a chip using 0.5 micron technologies and 3D-integration.

- Compound semiconductors. The use of compound semiconductors for high-speed circuits is expected to become increasingly relevant in future computer and telecommunication systems as well as in other applications. Europe has the potential opportunity to become a significant supplier of compound semiconductor devices. To ensure a sufficient European capability in this area, a significant increase of the current R&D level is required.

- Computer aided design (CAD). The availability of CAD for very large scale integration for the overall success of the efforts in microelectronics continues to be a crucial factor. Future CAD projects will take advantage of the results achieved so far in ESPRIT and will in particular focus on very high performance systems, testing aspects as well as standardisation aspects.

- Peripherals. Peripherals represent an ever increasing proportion of the total cost of IT systems. A major technology push in response to future market demands requires, in particular, substantial R&D efforts in magnetic, optical and magneto-optical storage, printers, sensors and displays.

2. Information processing systems

- Systems design and architectures. The overall aim is to ensure that IT industry has the necessary facilities to produce high quality systems, quickly and economically. Systems, of similar complexity of those being developed in 1985, should within 10 years be developed with 10% of the resources required to develop the systems today. Furthermore, novel architectures for IT systems will be developed and analysed with respect to their reliability and performance.

- Knowledge engineering. The use of knowledge based systems is expected to provide a qualitative jump in future applications of IT. The level of cooperative generic research in this area needs to be maintained in order to successfully meet the competitive requirements in the nineties.

- Signal processing. The ability to process speech and complex images, are expected to be important new characteristics of future IT systems. Accordingly R&D in this area will be on continuous speech recognition with large vocabulary, and advanced image processing systems.

3. Integration of IT into application systems

- IT support systems. This area is concerned with the basic IT technologies relevant to the office, production, other professional applications and the home sector. It includes eg. R&D on workstations, I/O subsystems for broad spectrum applications, man-machine interfaces and interfaces with the physical environment. Its potential impact on medium-term market requirements is expected to be particularly relevant.

- Factory automation. IT applications in production environments are of utmost importance to European economy. Key target is to establish open systems architectures, promote CAD/CAM systems and shop floor control systems. The level of R&D in this area needs to be considerably increased.

- Integrated IT systems comprise technology integration projects building upon different technologies, and oriented towards selected applications.

4. Measures with respect to the dissemination of the results of R&D projects play an increasing role in the further progress of the action.

5. A broad-scale participation of SME's to the action is considered to be vital in order to maintain and stimulate its innovative character, which is a prerequisite to meet its overall objectives.

c. Expected results :

- enable the European information technology industry to successfully meet the competitive requirements of the world market in the nineties,
- diffusion of these technologies through different sectors of our economy leading to product, process and service innovations.

d. Motivation for EC action :

- pooling of resources and worksharing is necessary to compete with the massive public programmes in the US and Japan,
- coordinated approach is also necessary to develop common standards and to encourage industrial cooperation in Europe.

e. Industry representatives currently estimate the overall efforts necessary to carry out the above described work to 30000 manyears to be invested progressively from 1987 onwards. These estimates need to be consolidated in the forthcoming months. These efforts would correspond to approximately 2200 MioECUs Community contribution.

3.2 Telecommunications Technologies

a. For the competitiveness of European economies the price-performance of telecommunications services plays a decisive role in the emerging global market-place. In order to maintain a strong position and lead in the transition towards fully digital operation Europe will need to invest in a timely manner in the advanced telecommunication technologies and make optimal use of its resources.

The EC telematics industry and Telecommunications Operators Research Establishments have, in 1984, established a broad based consensus on the objective :

Community-Wide Introduction of Integrated Broadband Communication (IBC) by 1995 taking into account the evolving Integrated Services Digital Networks (ISDN)

and worked out common requirements for :

R&D in Advanced Communications-technologies in Europe (RACE)

which aims at establishing the technology base for progressive introduction of Community IBC infrastructure and services.

RACE distinguishes several phases or stages of commitments which correspond to progressively improved definition of the objectives and requirements. Specifically:

Definition phase (decided in 1985), to execute initial work as required to focus the main programme R&D accurately on future functional requirements of the network, the terminal area and future applications, and the evaluation of key technology options.

Phase I (1987-1991) will have the objectives:

- the technology base for IBC,
- the precompetitive developments necessary for the provision of trial equipments and services for IBC demonstration,
- support for the work of CEPT and CCITT in the formulation of common proposals for specifications and standards.

Phase II (1991-1996), depending on the outcome of phase I, would have the overall objectives of developing the technology base for enhanced IBC equipments and services beyond 1995.

b. Scope (Phase I) :

1. Specific system aspects

Part 1 addresses the system engineering aspect of IBC and will explore systems architecture, subscriber environments, network sub-systems, operations and maintenance related issues. In doing so, it will take into account ISDN and alternative carrier concepts and mixes.

The work addresses three closely related but distinct aims:

- exploration and identification of IBC systems evolution,
- identification and specification of functional requirements serving as objectives for the R&D on the sub-systems and basic technology levels, and
- specification of the verification and testing required before full scale development is considered i.e. the definition of the requirements for demonstration and trials.

2. Research into the requirements of the users and service providers

The understanding of the user and service provider Requirements is a key condition for the conception and design of future infrastructure and services. Some requirements can be assessed on the basis of past experience with sufficient accuracy to serve as an orientation for the technical development. However, new services and operational concepts for users and service providers require careful research. This is in its own right a significant multidisciplinary R&D effort.

Past experience with the introduction of new communication services clearly demonstrates the risks of separating technical from market, application and user oriented research. Accordingly part 2 has been designed to address the link between the users and the service providers on the one hand, and the developing technology options on the other.

3. Enabling and supporting technologies

This part addresses the three main families of technologies on which the successive generations of IBC implementation will build:

- electronic components used for communications,
- optics and optoelectronics, and
- design tools for communication systems.

The aim of the R&D in these domains will be to advance the performance characteristics for their applications in telecommunications, i.e.

- performance in terms of bandwidth and complexity,
- system compatibility, i.e. aptness to standardisation, and
- live-cycle costs, including quality, reliability and maintenance.

Although the main thrust of part 3 is at the basic technology level, some sub-system considerations are implicitly included since some components (e.g. microprocessors) represent in terms of complexity, sub-systems in themselves.

4. Dedicated communication software

This part addresses the software R&D issues which are particular to the application in telecommunications. It is assumed that progress in software technology aimed at in national programmes and ESPRIT are realised and that the work in RACE can benefit from it.

A considerable effort will be required to develop adequate tools that will meet simultaneously the operational and managerial specifications of telecommunications. This applies particularly to IBC which will require a very large, complex, and functionally rich, software implementation.

5. Terminal technologies

Having a powerful and low-cost IBC technology is an essential pre-requisite for the introduction of broadband services, but insufficient unless parallel major progress is made in improving the cost-performance of terminal technology.

IBC aims ultimately at serving the public at large, i.e. cannot be seen just under the aspect of specialised services for the business community which may be prepared to pay comparatively high system costs. For IBC to achieve high penetration rates and wide acceptance, costs have to be very much reduced.

Terminal equipment with the right characteristics enabling easy and friendly use and the right cost-performance will require major technological advances and prolonged efforts of a considerable scale. This kind of technology cannot be expected to derive automatically from business applications.

Part 5 defines the R&D which promises to offer adequate performance for the use by the general public at sufficiently low cost levels.

c. The thrust of RACE would be to establish on the world market a strong, if not leading, position of the Community telecommunications manufacturing and service industries in broadband communications and accelerate the emergence of a strong and competitive Community market for telecommunication equipment and services. The phase I will result in a common technology base and contribute to the convergence in technical and functional specifications, which is of decisive importance for the emergence of a Community-sized market for broadband infrastructures, equipments and services.

d. The objective of providing Europe's economies in the 1990s with telecommunications services leading in cost-performance can only be realised by making full use of Europe's integral assets in technology, industrial capacities, human resources, markets and finance. A concerted approach offers advantages of scale and scope comparable to those available to Europe's main competitors. The investments associated with developments are so high that it goes largely beyond what operators and industry can invest on the economies national markets can offer.

   The RACE programme which will be carried out with the participation of all Member States, will be instrumental in harnessing Europe's considerable technological expertise in areas such as optoelectronics, advanced semiconductors and software for multi-service broadband telecommunications systems. This will service business needs on a community scale for low-cost, reliable and secure data, voice and image communication as well as providing a wide variety of communications and entertainment services for private users.

e. In 1984 a planning exercise has been carried out by the telecommnication industry and operators, which identified the pre-competitive effort offering significant advantage of Community scale. This planning exercise led to an approcimate level of 14.000 man-years for five years. The Council of Ministers decided in July 1985 a definition phase, which will define the scale and scope of the effort to be engaged in the main phase. On this basis and supposing a 50% Community financing, this evalution leads to an estimation of 1000 MioECUs.

   The Council of Ministers decided in July 1985 an 18 months definition phase, which will further define scale and scope of the efforts to be engaged under this action.

3.3. Integration of Information and Telecommunications Technologies into New Applications and Services of Common Interest

Progress in information technologies and telecommunications (IT&T) is rapidly transforming the socio-economic conditions and the basis of the world economy. This offers new opportunities to solve present and future societal problems in all spheres of life. The benefits of this change will depend on mastering these technologies and their conscious application and choice governed by societal needs and aspirations. The successful exploitation of these new possibilities requires a well considered and systematic approach involving the respective main actors since in most cases traditional sectors undergo in this context profound transformations.

Besides the direct application of IT&T the systems-integration with other technologies, leading to new applications and services, opens up a most important potential for the future, both in terms of economic opportunities and of contribution to societal objectives in Europe.

A. The systems-integration of IT&T with

- learning and teaching permits the realisation of advanced open learning concepts which will not only provide the educational community with enhanced tools but also remove constraints in access to learning (DELTA);

- road-safety and mobile communication offers powerful means to reduce traffic accidents, improve traffic management and thereby transport economics (DRIVE);

- bioinformatics and medical informatics can be developed to considerably further improve research, diagnostics and health care (BICEPS);

- laboratory technology offers major improvement in the productivity of research, development and experimentation (PERT);

- financial technology offers advances towards the realisation of Community-wide financial services, markets and a reduction of crime (DIME).

Background and method of elaboration of the actions:

The identification of these actions has resulted from the consultation of the respective actors and have been indicated in the COM(85) 350 and COM(85) 530 "Technological Europe" as areas where the Commission is developing action proposals. Some of their objectives have been confirmed in the framework of IRIS as corresponding also to the socio-political perception of Community priorities.

The method of elaboration for these actions follows a consistent sequence of steps:

1) an initial in-house analysis of the importance and the likely "value-added" of a Community approach resulting in the identification of overall objectives and lines of action;

2) exploratory investigation and definition of the detailed objectives and the optimal approach to an effective use of the overall Community resources with the respective main actors;

3) preparation of proposals for concerted actions embedding the Community measures in the context of national and international activities;

4) launching of a definition phase serving the systematic development of the action by the respective main actors;

5) implementation including periodic reviews and assessments of developments which might require adjustment of objectives and approach;

6) on-going critical evaluation and adjustment in the light of the experiences gathered in the implementation.

The first step is guided by the priorities of the Community and the political orientation of Council and Parliament as it translates for the domain of IT&T.

During the second step each action is subject of systematic investigations drawing on external expertise as well. The best qualified organisations are identified in an open bidding procedure in the Official Journal.

Step three is referred to as "planning exercise", it consists of a systematic involvement of the main actors in developing the action proposals.

The definition phase represents the last step before the implementation of an action. It consists of initial work as may be required to verify the objectives, approach and assessment of the requirements to realise them.

With the implementation the task of evaluating is taken up which extends both to external changes, i.e. requirements, state-of-the-art, etc. as well as progress of the projects making up the action. In yearly intervals the workprogramme and resource allocation is systematically re-examined.

At a suitable stage of the implementation, an independent review aids the Council and Parliament to assess the action in the light of its objectives.

For each of the subjects described below it is indicated which stage has been reached.

B. Other actions aiming more specifically to societal objectives will be identified in the coming months according to the orientations given by the Research Council of December 1985 in its debate on IRIS. In this context, preliminary studies will be launched to explore Community initiatives in priority areas dealing with objectives such as :

- better health;
- safer life;
- domestic and home applications;
- improvement of services and facilities for people living in rural areas.

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The estimates of the resources derive from the detailed workplans; therefore it is at this preliminary stage not possible to provide reliable figures. Still based on initial assessments one could envisage Community contributions situated between 700 and 900 MioECUs.

DELTA (Developing European Learning through Technical Advance)

a. A skilled population can rightly be considered as the single most important asset of Europe. With rapid changes in human activities, the importance of life-long education and training increases and with it the need to extend the formal education for it to become more flexible and adaptable to the needs of the learner and teachers. Progress in information and telecommunication technologies opens up the possibility to overcome distance and access constraints and the economic realisation of advanced open learning concepts (i.e. an approach to learning under which the barriers relating to formalities, location and time are dimished).

Learning technology represents, moreover, a major future world market opportunity for the Community equipment and service industry and teaching professions.

DELTA is to concert the development by Community industry and academia of the equipment, systems and tools for advanced open learning. This action will bring together at the Community level the potential users and producers of open learning systems and associated equipment, thus enabling the Community to achieve economy in scope and scale, which are now lacking. DELTA will benefit from synergy with on-going actions in the field of information technologies (ESPRIT) and telecommunications (RACE).

The programme identifies the technological efforts required to reach the following objectives:

1988-90: overcoming of distance and access constraints, via the adaptation of existing infrastructures, systems, equipment and technology

1990-95: enhanced handling and access of information, based on progressive digitisation of IT&T complemented by specific learning-oriented features

1995-2000: smart learning aids, based on the features of "5th generation" computing and integrated broadband communication (IBC).

b. Scope :

1. Interdisciplinary concertation on present and feature learning support requirements

By developing in a timely manner an understanding of the requirements and opportunities it will be possible to establish synergy, share work and cooperate throughout the Community and thereby improve the effectiveness of the resources available.

In order to support this process and optimise the use of Community resources and focus the research efforts, a systematic analysis and systems engineering evaluation of the learning system and its functions is required. This will be achieved by means of the development of a learning systems reference model.

2. Learning Technology and Systems R&D

This entails a systematic development of the features specific to the learner and authoring/teaching requirements. The programme will place particular emphasis on improving delivery to the learner, communication between learners and tutors/teachers, the ease of authoring and the economics and management of the overall system.

3. Testing and validation

The importance of the "human factor" in this domain requires the thorough testing of learning technology and concepts at all stages of the development. The programme foresees the realisation of a satellite-based open testing facility accessible from all parts of the Community.

4. Developing interoperability

In order to achieve acceptable economies as well as flexibility in use, multi-media interoperability will need to be established. This requires, over and above the on-going standardisation work in IT&T, the application-specific development of standards and conventions facilitating progress in this domain.

5. Creating favourable conditions

While learning technology is potentially very attractive and offers advantageous solutions, this process will be retarded unless specific accompanying measures are adopted lowering the "entry-barrier".

c. DELTA will help to accelerate the emergence of new techniques, facilities and tools to support learning, in particular the realisation of new Open Learning concepts. It will provide the technologies to educationalists and learners to reduce the distance and access constraints.

d. In this emerging new domain, human expert resources are rare and sparsely distributed throughout the Community. In addition to re-inforcing efforts to exploit the opportunities opening up in the use of learning technology, it will also be necessary to focus efforts by concertation and work-sharing within a defined framework of objectives and measures. The opportunities for industry will depend on reasonable market sizes as can be offered in a Community framework. DELTA will provide a vehicle for better use of resources and attracting industrial support.

e. The resources estimated necessary will be indicated at a later stage.

DRIVE (Dedicated Road Safety Systems and Intelligent Vehicles in Europe)

a. Each year 55.000 people are killed and 1.8 million people injured on roads in the Community. The overall societal costs of these accidents is very high and it has been estimated that 3.2 billion ECU a year could be saved by applying information and telecommunication technologies to avoid car collisions.

Moreover, the indirect effects of road safety on the quality of life and the economy are numerous and of great importance, e.g. on the congestion of roads.

Recent advances in IT&T are progressively opening up new and much more cost-effective ways of improving road-safety and transport management in general.

b. Scope :

DRIVE will contain application-specific R&D&D&T addressing in particular the systems engineering and systems-integration aspects.

1. Accident avoidance system

This area is concerned with the integration of various "safety-related" electronic subsystems into an integrated vehicle control and management system.

2. Vehicle communication systems

In the coming decade mobile telephony will increasingly become standard equipment of vehicles. The infrastructure provided for this service can at the same time support safety and traffic management functions.

3. Traffic management and control

The use of IT&T as part of an integrated application will permit considerable progress to be made in avoiding congestions, navigation in towns, re-routing in case of blockages and the clearing of routes in emergency situations.

c. The Programme DRIVE is to provide the framework in which industry and administrations can Europe-wide develop the technological means to achieve

- a drastic reduction of serious road incidents, and
- economies of scale and scope required for an early development and introduction of these techniques.

d. Improving road-safety is a common objective of all Member States and sharing the burden of developing new means of improving road safety and communications are clearly to the advantage of both the citizens as well as the industries concerned. The way for such a development is prepared in R&D&D&T efforts as to be undertaken in the framework of DRIVE.

e. For 1987 a definition phase is envisaged preparing the main programme foreseen to be implemented in 1988. This will permit a precise formulation of the work offering the greatest advantage of Community scale and being complementary to work carried out on the Member State level.

   The resource estimates are to be indicated at a later stage of development of this action.

BICEPS (Bio-Informatics Collaborative European Programme and Strategy)

a. The continuous growth of medical expenditure has become a major issue. In the European Community, the total expenditure for social services has in real terms, increased by 27% since 1975 and its accounts now for more than one quarter of the GDP. Of the total ECU 720 billion expenditure more than 75%, ie ECU 540 billion relate to medical services and care for the aged. As life expectancy grows the demand for further improvements in the quality and cost-effectiveness is also likely to increase.

   BICEPS develops IT&T to meet the specific needs of medical services and the use in medical and biotechnological R&D&D&T.

b. Scope :

   1. Medical informatics

   A further improvement of health care and better economics of providing it will depend on progress in numerous domains. One of the opportunity areas for progress builds on the consequent exploitation of the potential of IT&T. Their application in various functions can ring very significant improvements in quality, availability and cost-effectiveness of medical care.

   2. Bio-informatics

   A major part of the medical expenses in associated with pharmaceutical products and medical research. In this domain there is strong dependence of progress in biotechnology and medical research with bio-informatics.

   Therefore, BICEPS addresses both the medical-informatics and bio-informatics needs.

   Links with Community actions ESPRIT, RACE and the BAP exist as well as with actions on the level of Member States.

c. The results of BICEPS are expected to provide for a rapid development of advanced techniques for both the medical services and medical/biotechnological R&D&D&T.

d. ESPRIT is resulting in generic information technology on with specific efforts in bio-informatics can build. The IT-industry is collaborating already on a Community scale. This offers particular opportunities to assemble the expertise and industrial capacities to support the work in this domain. Furthermore, there are considerable advantages in worksharing and cooperating for both the speeding up of development and the gathering of experiences which is crucial for building up the confidence of the medical profession in new techniques.

e. For 1987 a definition phase is envisaged preparing the main programme foreseen to be implemented in 1988. This will permit a precise formulation of the work offering the greatest advantage of Community scale and being complementary to work carried out on the Member State level.

   The resource estimates are to be indicated at a later stage of the preparation of this action.

PERT (Professional Electronics and Research Technology)

a. The Community's productivity in R&D and here particularly in high-technology domains is significantly below that achieved in the USA and Japan which have made enormous advances in this respect in recent years based on a consequent use of advanced IT&T.

The objective of PERT is to improve the productivity in Community R&D equal to or better than that of its main competitors.

b. Scope :

1. Information resource management in the laboratory environment

The information resource management is one of the central problems in laboratory work. Advanced techniques using recent progress in IT&T offer the potential of major improvements. However, the laboratory conditions and diverse requirements demand a systematic effort in developing compatible components and subsystems which can interoperate to meet a wide range of conditions. This represents a major task in systems-R&D, systems engineering and systems-integration.

2. Data capture

Rapid gathering of data and their pre-processing is a key factor in speeding up technological analyses. New techniques using progress in sensoric and IT&T permit the development of more versatile devices for these needs.

3. Information interpretation

Increasingly screening and alternative interpretation of technological data, concepts and conditions require sophisticated tools for interpretation and simulation. While these tools have been developed for engineering purposes their use for designing and interpreting experiments is still in its early stages. PERT is to develop generalised laboratory/scientific tools for these functions. This includes the development of knowledge-based used friendly applications for the interpretation of information.

c. PERT is to result in a significant improvement in the productivity of technological R&D and the provision of high performance tools for accelerating the industrial development processes.

d. Besides being a problem common to all Member States the investment and the specialists in this domain are comparatively limited. A work-sharing and cooperative approach not only improves the chances for each project but because of the systems interdependencies synergy and cross-fertilisation will be important. Within a Community action, defined jointly with the main actors, this can be realised.

e. For 1987 a definition phase is envisaged preparing the main programme foreseen to be implemented in 1988. This will permit a precise formulation of the work offering the greatest advantage of Community scale and being complementary to work carried out on the Member State level.

   Resource estimates are to be indicated at a later stage of the preparation of this action.

DIME (Development of Integrated Monetary Electronics)

a. Already most financial transactions are carried out by electronic transmission and also electronic theft outweighs by far armed robberies. This and recent developments of using IT&T to implement special finance technologies such as the "smart card" (microcomputer on a bank card) are signalling the emergence of "electronic cash" and major changes of the way citizens receive and spend money.

With a consequent development of the technologies now within reach 'personalised electronic money' could be developed which could only be used by the legitimate owner, i.e. eliminate the risk of unauthorised use or stealing. Conventional bank robberies could soon be made a thing of the past.

Furthermore the 'smart card' will be able to serve numerous other functions in all spheres of human activity requiring authentication.

DIME is to carry out R&D in the use of IT&T for financial services and other services with the objective of taking the lead in the development of 'personalised electronic money' and the development of 'smart card technology' suited to serve as a generalised tool for crediting and authentication.

b. Scope :

1. Intelligent credentials

The use of monies depends basically on the ability to provide "evidence of having credit". In conventional money this is achieved by authorised bank notes. More recently bank or credit cards have been introduced which can be considered a first generation of personalised money. However, this development is far from having reached its end. The heart of 'personalised electronic money' may well be a 'microcomputer on a card-like device'. This device will use personal characteristics of the bearer, e.g. fingerprints, to be protected against use by others. The device could store any amount of credit the bearer chooses to put on it and in paying the corresponding amount would be withdrawn from the card as from an account.

The principles of how this can be realised are comparatively simple, but its technical realisation with the degree of reliability required for general use requires systematic R&D&D&T of considerable scope.

Much the same technology will also serve numerous authentication functions. In order to avoid excessive proliferation of different cards systems and operations, research will need to establish the optimal approach.

2. Falsification counter measures

Bank notes and even credit cards are increasingly exposed to being forged. In developing 'new forms of credit' this problem is of utmost importance. The potential of a 'microcomputer on a card' is largely sufficient, but the implementation of counter measures needs to be consistent with the functions of the device and of the numerous options possible the most practical has to be identified and researched.

c. DIME is to result in providing a sound technological basis for the introduction in Europe of 'personalised money' which reduces the possibility of money being stolen or falsified.

d. Money and the protection of personal property and safety is an objective all citizens and their governments throughout the Community share. Furthermore, for realising the full benefit of such a new financial technology it will be essential that it can be used throughout the Community. In view of the required investment for the terminal equipment and the objective of good economics, the size of the Community market will be a decisive factor.

e. For 1987 a definition phase is envisaged preparing the main programme foreseen to be implemented in 1988. This will permit a precise formulation of the work offering the greatest advantage of Community scale and being complementary to work carried out on the Member State level.

Resource estimates are to be indicated at a later stage of the preparation of this action.

3.4. Cooperation on Basic Research on Information Technologies

a. This action covers collaborative research and concerted actions with the objective to improve the use of scientific capabilities in computer science by cooperative efforts.

b. It is expected that universities and research institutes will be active in industrial projects, but there remains the necessity that present and future efforts in precompetitive research with commercial application should be supplemented by promoting research into IT at a more fundamental level without immediate direct application. Basic research is also an important element for the training of the highly qualified manpower, which is strongly needed by IT as well as other industry. This type of research is, of course, mainly carried out in universities and in public or private research institutes.

One positive way was indicated by the ESPRIT Review Board, which recommended that one of the benefits of the programme is the breaking of geographical isolation of certain institutions.

The Review Board viewed on to propose that a few selected European centres of excellence in IT should be encouraged to become international in their orientation.

Such centres would preferably be based on existing activities and would also build on efforts developped at European level, notably in the framework of COST activities related to computer science.

The Commission could support such research in areas of strategic interest, provided that:
- the European dimension be guaranteed by an ambitious common work programme to be agreed by a High Level Board drawn from leading experts,
- the best organisations in that field (a maximum of 4 or 5) who would be sufficiently motivated by the task to willingly work to this common work programme in a reasonable manner.

There should be strong focus on promising selective research areas, which have not yet reached maturity, and where therefore Community action could provide some visible impetus. These would include e.g.:
- molecular electronics;
- special sectors of cognitive science and artificial intelligence;
- special sectors of solid state physics applied to IT (amorphous silicon, magneto-optical research ...)

c. Expected results

- enable European IT science to develop excellency in sectors of strategic relevance by critical mass efforts;
- improve the use of scientific R&D capabilities in IT by cooperative efforts and concerted actions.

d. Motivation for EEC action : scarce and scattered resources need to be coordinated and directed towards critical mass efforts.

e. It is estimated that between 40 and 50 MioECUs Community contribution would be necessary for a five-year period.

3.5. Technologies for Manufacturing Industry and Special Technologies

a. In the recent years, a recovery of European industry has begun to become apparent. Technology is a major factor in sustaining this recovery. In the 90s, this factor will increase even further in importance in facing competition from the USA, Japan and other countries of the Pacific. All sectors will need high technology and nowhere is this more the case than in sectors like motor vehicles, chemicals, textiles, clothing, shipbuilding, construction, furniture, which employ over 25 million people - nearly 70 % of the industrial workforce of the Community - and in all countries will continue to represent the largest contributor to that part of the GDP provided by industry.

Increasingly, the dividing line will not be between sectors like electronics and the mature industries but, irrespective of sector, between those who make full use of the newest technologies and those who do not. The potential for change is greatest in sectors which so far have been the slowest to absorb new technology and it is therefore on those that efforts will need to be concentrated and where the encouragement given by Community programmes will bear fruit.

The problem consists not only in the development of appropriate new technologies (especially multidisciplinary technologies) at the precompetitive stage and their application, but also in the need to use research resource more efficiently through co-operation across the frontiers.

Among the major priorities supported by the governments in the USA and Japan are research projects of an inter-disciplinary character in new production technologies and in the engineering aspects of new materials. For example, in the USA the university-industry co-operative research centres in fields such as polymer processing, welding, process control and triboloby and, in Japan, the R&D project on basic technologies for future industries receive annually several hundred million dollars from the central governments. Moreover, as is well known, the US Department of Defense and NASA both continue to fund research in these fields on a major scale which has a rapid impact on industry and there is a constant flood of technical information. These programmes are ample evidence of the strategic importance which these countries attach to these technologies.

b. BRITE continues to develop in constant and continuing close consultation with industry and the fields currently of the highest priority but constantly under review together with industry are :

- the improvement of the strength and inherent reliability over long periods of time of engineering materials and components,
- the reduction in the deterioration of materials through corrosion, wear, biodeterioration, etc...,
- the tribology of mechanical systems,

- laser technology for manufacturing,
- joining techniques : new and improved welding techniques, and adhesive bonding,
- new testing methods including non-destructive testing, on-line testing and computer-aided testing,
- advanced design and manufacturing techniques, in particular those suitable for SMEs and for specialised industrial purposes,
- membrane science and technology,
- catalysis and particle technology,
- specific applications of advanced materials (see 3.7 for enabling R&D on materials),
- applications of new technologies in manufacturing processes with special problems, e.g. production processes involving the use of flexible materials.

The reaction of manufacturing industry to the first call for proposals has confirmed its interest in co-operative precompetitive research aimed at :

- improving the co-ordination of work otherwise carried out independently in several Member States by industry and other organisations,

- helping cross frontier collaboration between different industry sectors and between industry and university.

The conditions for participation (participants from more than one Member State with at least one industrial participant, 50 % industrial participation in the costs) have ensured the industrial nature of the projects proposed and their overall high quality.

559 projects were received nearly all of great interest and of high quality (with on average four participants in each project) of which only 102 could be accepted because of the budgetary constraints. This represents much too high a disappointment rate and could discourage firms - in particular SMEs - from participating. Despite intensive information campaigns, many firms had not heard of BRITE in time to prepare for the first round and the adhesion of Spain and Portugal will increase the number of potential participants. It would not be surprising if the number of proposals for the second round of BRITE was several times that for the first round.

In view of the need to create for manufacturing industry a European cross-frontier co-operation infrastructure and to respond to the international competition a major increase in the budget is necessary for the second call for proposals (IRDAC has advised that for the second round this should be at least 300 MioECUs).

c. Ultimately, BRITE-type projects should become self-supporting and co-operation within a revitalised Community become a natural and accepted procedure without support from Community funds. There is nevertheless likely to be a continuing need fro BRITE well into the 1990s.

A follow-on activity (BRITE revised) is therefore envisaged to be developed in close consultation with industry.

The experience of the first and second rounds of BRITE will make it possible to deepen and concentrate its strategic approach by tackling in depth new areas including

- the problem of bringing new technologies emanating from many sectors to the manufacture of a wide range of new or technologically improved products including furniture, textiles, paper-based products, machine-tools, etc..,

- the use and means of use of new materials by including all aspects finally needed for economic performance such as design, handling, manufacturing, inspection, standards and training.

This activity is likely to include a range of pilot and demonstration projects. IRDAC has already explained the need for cooperative projects based on the "pilot demonstration plant" or "demonstration factory" approach in order to encourage the wider adoption of the new technologies in European industry. Moreover, many BRITE projects will within a few years, need follow-on action to demonstrate at larger or at full-scale the technological and economic viability of the processes developed.

d. The financial amount estimated necessary for these activities for the period of the Framework Programme is situated between 600 and 900 MioECUs.

Research and pilot demonstrations in favour of the steel sector (new and improved production processes and improved steel properties and fabrication procedures) will continue to be funded from the ECSC budget.

3.6. Biotechnologies and Agro-Industrial Technologies

3.6.1. Biotechnologies

a. As in the 1984-87 version of the Framework Programme, the recognition of biotechnology as a specific action is motivated by the major impact that the applications of modern biology to agriculture and industry will have on the activities of several traditional economic factors. Some 40% of manufacturing output in a developed economy is biological in nature of origin and numerous advances of fundamental significance (production of new crop plants, synthesis of vaccines, drugs and chemicals with high added value, development of techniques for processing, transformation, extraction, detoxification, ..) are now being made or are expected before the end of the present century.

b. The main reasons for current relative weaknesses of the Community in modern biotechnology have been identified (COM(83)672) and can be attributed to the fragmentation and dispersion of research efforts, a shortage of scientists with advanced training adapted to the requirement of Biotechnology R&D and the absence in the Community of a supportive context for the rapid development of modern biotechnologies. The objectives of the proposed activities are to provide, in the most important areas of biotechnology, a transnational dimension to the isolated efforts carried out in each Member State for :

- encouraging mission-oriented research and the reinforcement of R&D contextual infrastructures in those sectors where important bottlenecks have clearly been identified which cannot be rapidly overcome without the pooling of competences and facilities dispersed throughout the Community;
- organizing these dispersed competences and facilities in a Community training network of exceptional quality from which young scientists in each Member State can fully benefit.

The fields of biotechnology R&D where Community efforts for transnational research and training should be conducted in priority, through cost-shared actions and training contracts, are the following :

- data banks : modelling of biological structures, processes and systems;
- collections of biotic materials;
- enzyme engineering and protein design;
- genetic engineering;
- physiology, genetics and molecular biology of species important for agriculture and industry (area, essential for long term innovations in biotechnology, not covered by the current RAP Biotechnology (1985-89);
- technology of cell and tissue culture in vitro;
- development of in vitro tests for pharmacology and toxicology;

- evaluation of risks associated with modern biotechnology.

- promoting the concertation of the Member States for the effective implementation of the Community action priorities which, in addition to research and training, and concertation itself, comprise : raw materials of agricultural origin, regularoty regimes, intellectual property, demonstration activities.

c. What is proposed above by the Commission is in fact a continuation and amplification of the work carried out in the biomolecular engineering programme (BEP) (April 82 - March 86) and in the RAP Biotechnology (1985-1989). The results obtained in the biomolecular engineering programme and the launching in 1985 of the RAP Biotechnology have demonstrated the possibility and utility of Community research and Community training in biotechnology. Transnational networks of laboratories of high scientific quality have been constituted throughout Europe which undertake joint research for the elimination of important bottlenecks to innovative applications and which provide an array of services and training facilities adapted to the complex requirements of modern biotechnology. It remains, through additional efforts during the period 1987-1991, to intensify the activities of this large multi-disciplinary, polyvalent "institute without walls" distributed throughout the entire territory of the Community and, now that the foundations of a transnational network are firmly established, to stimulate much more actively than in the past, joint partnerships at Community level between universities and industries. A very important task, in this connexion, will be the continuation and amplification of long-term Community research leading to the development of new crop plants adapted to the industrial requirements of the Community and to the promotion of innovative technologies for the exploitation by industries of agricultural feedstocks.

   As far as concertation is concerned, the work initiated in 1985 for assessing the strategic significance of new developments in biotechnology and for promoting the necessary coherence between the various areas of Community policy affecting or affected by biotechnology needs to be continued and amplified, together with the promotion of the concertation necessary between Member State and Community activities in biotechnology.

d. The action includes work to be carried out as cost-shared actions (research), training and concerted actions.

3.6.2. Agro-Industrial technologies

a. The advances of modern biology and biotechnology have increased and will continue to increase agricultural productivity; throughout the world, developed economies face the prospect of growing surpluses, with heavy economic and political problems of disposal, unless they can find nex uses for land, new ways of creating real value from the products of agriculture. Advances in animal and plant genetics, in the applications of science on the farm, and in the conversion and addition of value to agricultural outputs, particularly by biotechnolgy, enlarge the range of possible source materials and of industrial products obtainable from agriculure. The need in Europe is particularly urgent because of past successes of productivity; the scope for innovation expands as we increase our understanding of plant molecular genetics and physiology, of microbial and cellular metabolism, and of enzymology and fermentation science. The future of agriculture in the EC will depend increasingly on developing sources of non-food income.

b. In order to exploit these new possibilities, a "total system" approach is needed, and its feasibility needs to be developed and convincingly demonstrated by exploratory, pilot and demonstration activities. The detailed choice of activities will typically be driven by market considerations, but the industries concerned must interact in close partnership with the research laboratories and with agricultural expertise. Research, development and pilot/demonstration activities will be sought in three areas :

   - the industrial inputs to agriculture;
   - new product and/or production opportunities through agro-industrial technologies;
   - quality and production competitiveness in food products.

   The influence of the Community on agricultural policy, the importance of a "total system" approach within which a favourable (or non-obstructive) policy context is required at European level, and the desirability of pooling experience Europe-wide, all indicate the value of setting these initiatives in the context of a Community framework.

c. The biomolecular engineering programme (1982-86) has been focussed on agriculture and food industry topics, and has led to important advances in plant genes and enzymology; such work is being continued in the biotechnology action programme. But these and other breakthroughs at a pre-competitive level require innovations at the boundary between agriculuture and industry to enable them to contribute to socio-economic objectives. Evidence from other areas (e.g. energy demonstration projects) demonstrates the value and need for propagating innovation in this way. Hitherto no such provision has been made in Community biotechnology research programmes; although the importance of such systematic promotion is increasingly recognised both in Member State national programmes and by our major industrial competitors.

d. It is envisaged that the proposed actions, carried out in close correlation with the actions in agricultural research, should be shared cost, (up to 50 % of full costs). Industrial co-finance and collaboration will be actively solicited.

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e. The Community contribution necessary to fund these activities should be in the range of 350 to 460 MioECUS. This would allow to provide a transnational dimension to the main efforts carried out by each Member State in the most important areas of biotechnology, as well as starting in agro-industrial technologies three projects per year and per Member State for each of the last four years of the planned period.

3.7. Materials Science and Technology

a. Advanced materials are already, and will remain for the future, crucial elements in almost all important manufacturing industries. The scientific and technical progress linked with materials will have a considerable effect on the prosperity of sectors such as motor vehicles, aerospace, shipbuilding, railways, electronics, telematics, building, energy production, biomedical and many others.

This field includes a wide variety of items such as metals, plastics, ceramics, concrete, glass, electronic materials and composites. Equally, the properties to be improved are also numerous : mechanical strength, lightness, stiffness, cheapness, flexibility, electrical and magnetic properties, high or low temperature related properties, etc.

The considerable economic significance of this area is best highlighted by the following figures : the added value generated by the materials industries for all OECD member countries may be estimated at about $ 500 billion and the corresponding number of jobs at 20 million.

It is with advanced materials and their rational use that manufacturing industries will be able to improve the performance of their products and thus make them more competitive. Advanced materials will also contribute to the rational use of raw materials and energy and the control and reduction of pollution.

b. Europe has lost some ground to the United States and Japan. Although there are materials laboratories with a high reputation in Europe, their innovative capacity is in decline. This failure to keep up in the field of advanced materials bears a certain similarity to what has happened in the field of information technologies. Europe's creative spirit is receding and its laboratories are less efficient than their overseas partners. 4 out of 5 patents on materials are applied for by American and Japanese companies and a major part of the high technology materials available in Europe is either produced under license or imported (carbon fibers, special polymers, etc.)

No single Member State can afford the resources necessary to be competitive over the entire spectrum of advanced materials. A Community action is essential to encourage worksharing and pooling of financial and manpower resources on the european scale. Only by reducing duplications and sharing large research facilities and equipments can Europe maintain the pace with its overseas competitors.

Effective use of advanced materials is essential for the success of the products of European Industry. Development of improved materials and development of improved techniques for exploiting materials make complementary contributions to this goal. Although generally distinct, these activities must be carried out in continuous close inter-action. For this reason the work in the area of materials science and technology and the work in the area of technologies for manufacturing industry (section 3.5) are and will be carried out in close consultation.

c. The former materials research programme on substitution and technical ceramics was rather small. It was limited to the fundamental aspects of substitution of strategic metals such as chromium, cobalt and tungsten, and the investigation of technical ceramics in regard to ceramic powder preparation and characterization.

A Community action commensurate with the challenges will need to address the following wide range of advanced materials which are promising in terms of improved or new performances, functions and applications.

The effort will cover fundamental research (understanding of properties and phenomena) as well as technological R&D on means of processing, testing, characterising and producing these materials :

- engineering ceramics : powder quality and processing, reliability, brittleness, shaping;

- polymers : in particular investigation of new types of polymers with high thermo-mechanical properties, large stability area, polymer blends, and conducting polymers;

- composite materials and fibres : further development of organic matrix composites and high strength fibres; optimisation of metallic matrix composites with ceramic fibres; special composites with amorpheous, vitreous, or elastic matrices; matrix/fibres interface phenomena;

- advanced metal alloys : light and hard metal alloys, magnetic alloys; powder techniques (rapid solidification), near net shape forming;

- electronic materials science : including special semi-conductors (II/VI, amorphous, organic, etc...) and biomaterials (detailed work to be defined in relation with activities described under items 3.1 and 3.4);

- amorpheous and disordered materials : special materials including glasses, vitreous materials, non crystalline solids, such as amorpheous metallic alloys, prepared by fast quenching.

Other areas which could also be considered at Community level depending on resources available include : superconducting materials, advanced building materials, and biomaterials.

A Community pilot laboratory integrating equipments for advanced materials synthesis and processing research should be set up in the JRC. This ion/laser/electron foundry, would operate as a demonstrator project open to industrial participation and researchers from all Member States.

More specific orientations and the allocation of the Community resources between fundamental research and technological R&D and among the various material families, materials for specific functional applications, and processes will be defined and reviewed on the basis of economic studies and surveys on new opportunities and industrial requirements and taking into account the national activities.

d. Most of the research will be carried out through cost-shared projects with an average Community funding of 50 %.

   Concerted projects will also be considered, where appropriate, to encourage sharing of information and experience between well established teams from different Member States.

   The Community will also promote the development of data bases, the training of scientists and the transfer of knowledge through conferences and symposia.

e. Considering the strategic importance of materials research for the European industry, the Community R&D effort should be substantially increased to improve the strategic coherence of the national efforts which are still too fragmented and to keep up with the massive efforts in the United States and Japan.

   The effort estimated necessary for the 1987-1991 period is estimated between 200 and 300 MioECUs. This level of effort corresponds to about 20 % of the present Member States effort (excluding military research).

3.8. Marine Science and Technology

a. The oceans are the last frontier, the least known part of our planet. They cover 70 % of its surface area, have been used by man from times immemorial to reach other continents and to supply him with food and other resources. Yet, it is only fairly recently that their multifarious role has been fully apprehended.

They play a fundamental function in the mechanism of climate, provide living resources for food, feed, fertilizers, drugs; their continental shelves conceal large reserves of hydrocarbons, the deep ocean bottom is a potential source of minerals. Sea water itself is a solution of many chemicals useful to man. The ocean is also the ultimate depository of the wastes from human activity, which may threaten its equilibrium. Its capacity to absorb carbon dioxide from the atmosphere may determine whether man will eventually cause an irreversible and unfavourable modification of the climate.

The increasing realization of the importance of the marine environment to man has led recently to the preparation and adoption by many countries of the Law of the Sea.

It is important for the EC to gain a better knowledge of the seas around it in order to better protect and exploit them. In fact, a sizeable research effort is already devoted to marine sciences and technologies in the Member States, in the civilian and military sectors. It is estimated that public non-defense R&D expenditure in this area amounts currently to about 400 -500 MioECUs per year. This is comparable to US funding for non-military research, whereas Japan spends about 200 MioECUs.

It appears at this juncture that many of the national research programmes are being re-assessed or renewed, or that new integrated programmes will soon be launched. A coordination at Community level appears thus particularly timely.

A specific EC action(*) in this broad field is justified on several grounds : use of large or expensive equipment straining the resources of any single country, the optimization of the utilization of existing facilities (research vessels, submersibles, etc.), complementarity of skills and competences available in the various Member States, the application of research results for the implementation of Community policies, aid to developing countries, the contribution to the development of the internal market through the acceptance of common norms and standards, etc.
There is indeed a large scope for cooperating at EC level.

b. In marine sciences, the objectives would be :

1. A better knowledge and understanding of the EEZ (exclusive economic zone) of the Member States (physical, chemical, biological, geological). Regional oceanography projects would deal respectively

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(*) There are at present several ongoing or proposed EC research programmes concerned in part with marine problems : environmental protection, remote sensing, navigation, materials, energy, fisheries, radioprotection, radio-active waste disposal, etc., but no integrated action.

with the Mediterranean, the East Atlantic, the Channel and North Sea, the Baltic. Developing countries could be aided in similar studies of their EEZ.

2. The scientific basis for coastal management and protection, for which Member States share common problems and preoccupations.

3. A contribution to the understanding of the arctic and antarctic regions.

In marine technologies (which would contribute i.a. to solving the above-mentioned problems), the objectives might be :

1. To develop jointly the next generation of marine instrumentation (buoys systems, underwater acoustics, unmanned submersible vehicles, autonomous pollution monitors, etc.).

2. To promote the construction of a deep ocean drilling ship, which would provide a European capability in this field.

A number of supporting and less costly initiatives could also be implemented to further European marine sciences and technologies such as :

1. The establishment of a "clearing-house" to optimize the use of the high sea oceanographic vessels and other expensive equipment such as the existing exploration submarines and facilities to study large marine ecosystems ("mesocosms"), etc.

2. The training of scientific manpower in the oceanological disciplines, including for scientists from the developing countries.

3. The development of data bases on marine science and technology.

4. The acquisition of a minority participation in large facilities, mobile or not, in order to gain access to them for the Member States which were not involved in their initial funding.

A sharper definition of the EC activities will require further consultation of government authorities, industry and the scientific community, possibly by means of "announcements of opportunities".

c. In view of the substantial activities carried out by Member States, it is likely that the action will be executed by means of (reinforced) concerted action, shared cost action and, possibly, minority participation and joint undertakings.

d. The means required for a significant action at Community level should be determined at a later stage, before the formal proposal of the Commission is submitted. The corresponding amount will be drawn from the financial reserve mentioned in the summary table.

3.9. Transport

3.9.1. General Action

a. Research in the Member States has produced results that put the Community on the same footing as the most advanced industrialized countries in terms of new transport techniques.

However, these results have often been obtained from rival research programmes which, although possibly spurred on for that very reason, lead where uses are concerned to damaging situations :

- projects for public services or captive markets have great difficulty in finding uses in the Community or the rest of the world. This is the case, for example, in high-speed track guided transport on land and in urban transport;
- projects for normal commercial purposes that have met with competitive worldwide success up to more recent years are affected by the crisis and will face growing international competition. This is the case, in particular, of road and maritime transport.

On the other hand, projects involving international cooperation, after the disappointing commercial showing of certain technical successes that were poorly suited to the market, have finally given transport operators the products they need, the chief example being the airbus programme.

The Community's technological capital in the transport sector must therefore break out of the usual national straightjacket. It is on this that the productivity of research and utilization of results hinge, and what is at stake is whether the Community transport sector can :

- adapt to the new demand in trade within the Community and with the rest of the world (network changes, effects of new techniques, changes in the quality and quantity of traffic patterns);
- respond to the constraints of the economic situation and the social environment;
- be competitive in the Community economy and rise to the challenge from outside Europe and, in so doing, be a carrier market for the Community transport equipment industries.

b. The common transport policy is designed to ensure that the Community transport system does its job with the help of all modes of transport, without favouring or penalizing one or the other. The provisions to emerge from the Treay are conceived on this basis.

But research must provide the way for the transport system to adapt in the long-term to requirements.

In this respect, the changes and increase in demand, the economic situation, the constraints and the effects produced by other sectors are considerable factors and will continue to develop.

Research must therefore centre on the following :

- for track-guided transport :
  . automation of traffic monitoring, signalling and track equipment;
  . simulation of train-driving;
  . lightening, noise reduction and aerodynamics of vehicles;
  . linear motors;
  . effects on passengers (e.g. travelling through tunnels) and on the environment (e.g. noise, unsightliness).

- for road trafic :
  . analysis of road accidents;
  . improvement of the safety of heavy goods and passenger vehicles;
  . optimation of the electric vehicle.

- for maritime transport :
  . ship management, maintenance, functions, condition, economic routing;
  . configuration and performance of the ship, sturdiness of the hull, resistance to forward motion;
  . new types of ship and unconventional propulsion equipment to meet commercial requirements;
  . management of maritime traffic;
  . man-ship system.

- for air transport :
  . flammability and toxicity of materials used in the cabin;
  . rationalization and modernization of air traffic control.

Community action will be called upon :

- both as a complement to schemes in the Member States when national programmes coexist and cooperation is needed for greater efficiency and easier dissemination of results and, possibly, standardization;
- and when themes require a Community dimension because of the resources needed, the lack of incentive from regulations or commercial prospects, or the final use of Community interest.

c. Although no R&D programmes in the transport sector have been implemented by the Community a number of projects concerning transport have shed a certain amount of light :

- COST projects on transport;
- concerted Community action (COST 301) on navigation aids;
- transport projects in the "Non-Nuclear Energy" programmes or the "Energy Saving" demonstration programmes.

This gives rise to the need for :

- either shared-cost projects or concerted action schemes depending on the case in question;
- possible association with non-Community countries that are members of COST;
- possible additional programmes for a certain number of projects.

The importance of transport research differs widely from one Member State to another although it is a major item in non-member countries that are geographically significant for Community transport, such as Switzerland, Austria and the Scandinavian countries. It sometimes requires substantial funds but in a large number of cases its prime need is for momentum, incentive or even simple cooperation.

d. A general research action with a budget of 50-80 MioECUs would enable considerable impetus to be given to the transport sector. This action is complemented in the field of road safety with a specific activity aimed at applying information technology and telecommunications (see "DRIVE", described in point 3.3.).

3.9.2. Aeronautical Technology

a. The European aeronautical industry is a major source of strength to the countries of the Community. It designs and manufactures a full range of fixed and rotary-wing aircraft. Substantial volumes of aircraft, engines and equipment are exported. The industry is a "leading-edge" developer and user of advanced design techniques, materials and manufacturing methods. Over and above the direct benefit of advanced technology in its own business, the industry transfers important technological benefits to other industries - in areas such as composite materials, joining techniques, etc..

The commercial success of an aeronautical product is vitally dependent upon the quality of design and manufacturing technology which it incorporates. Thus, all readily available advanced technology is routinely exploited and further advancement of the state-of-the-art is costly, not only because of the refinement of technologies as such but also because of the extreme care which is taken to verify the adequacy of new technologies from a flight safety point of view.

Despite the high cost of furthering technology, the pace of advance in the world market is high. Although European research continues to make notable contributions to aeronautical technology, the prevailing state-of-the-art is overwhelmingly determined by the very large US aeronautical research effort. This US research effort is partly funded by the US industry, but it benefits in addition from very large US government support under programmes pursued by NASA and by DOD. The scale of US research activity, both generally and in notable programmes such as SDI and the hypersonic transatmospheric aircraft, is such that the pace of technology advance outstrips the capacity of the European aeronautical industry, supported by national government programmes, to remain abreast of the prevailing technological state-of-the-art.

b. The Commission believes that this situation calls for remedial action at European level. Reliance upon licensing or importation of US technology does not seem to be an acceptable basis for the long term success of the industry. Equally, solving the problem by increasing individual national support programmes does not provide an efficient remedy. For these reasons, the Commission believes that steps now must be taken to review the longer term research needs of all the European aeronautical industry with a view to developing a harmonized programme for medium to long-term research requirements. In doing so it believes that the very favourable experience of the management approaches used in the ESPRIT programme and in the BRITE programme, involving a major participation of the industries in the definition and guidance of the programmes pursued, should be taken into account. Specific proposals for the construction of an action are not yet possible since further consultation with industry and with Member States' administrations will be required.

c. As regards the scale of activity which should be contemplated, it can be expected that to achieve a significant effect, the scale of action must be some measurable fraction of the present level of aeronautical research. This would imply, for the Community as a whole, activity at the level of some hundreds of MioECUs per year. The corresponding Community contribution would be drawn from the financial reserve mentioned in the summary table.

3.10. Scientific Norms, Reference Materials and Methods

a. The satisfaction of the need for further harmonisation and standardization is one of the major objectives of a number of Community policies : the completion of the internal market, energy, consumer protection, agriculture, environment and health.

In addition to the need for harmonisation of written standards is the need to demonstrate the quality of a product and to prove that it conforms to either a standard or regulation, (this requiring testing, measurements and analysis). Further there is a need for research and data bases to promote and facilitate the establishment of written standards.

Each Member State possesses a metrology service. This functions as a high level scientific body ensuring the standardization of the most fundamental units and that there is agreement throughout the country of all measurements.

The provision of such basic metrological infrastructure necessary for industrial developments, is in every country - also in the USA and Japan - considered to be a public service.

Problems of this kind have, however, often a transnational character and the Community can, because of its neutrality, play an essential role in overcoming differences in particular by using know-how developed in its laboratories and by coordinating the efforts of national, public and industrial laboratories.

b. The actions of the Community in this area are threefold :

1. The BCR programme has established efficient means of collaboration between the metrology institutes within the Community, which have allowed a large number of measurement problems to be resolved via the more than 80 collaborative projects sofar executed. This collaboration will be expanded in particular with regard to the development of the measurement methods required by the new technologies.

   The BCR programme will also establish, for those areas not covered by national authorities, collaborations leading to, above all, improvements in analytical techniques and the production of ancillary measurement methods recognized at the Community level. In this way it will be possible to ensure traceability of analyses and tests in such difficult and varied fields as health, the environment and food, not forgetting the need of industry.

   The emphasis on standardization for the completion of the internal market and other policies and the introduction of new technologies will increase the demand for such activities.

2. The programme of reference measurements and materials will continue in our own uniquely qualified laboratories in Geel, and in association with similar large institutes both within the Community and the rest of the world, to establish nuclear data, principally for neutron induced reactions, where this is

necessary for applications involving nuclear fusion and fission. In addition an important part of the measurement and reference material activity will relate to radioactive sources, neutron flux and doses, target materials and the analyses of fissile materials and isotopic compositions. Geel will also use its experience in the nuclear field to collaborate increasingly with BCR in other areas.

3. The JRC activities on materials and structures, conducted in Petten and Ispra, will be increased to respond to the growing need for improved reliability and standardization. The emphasis will be on the development of reliability methods, models and codes of practice for industrial structures and on research and data bases on the behaviour of materials under extreme performance conditions with the aim to promote standards.

   Increasingly, collaboration will be established with Community shared cost actions (e.g. BRITE and EURAM) and with national laboratories.

c. The Community financial effort necessary to carry out this action is estimated between 300 and 350 MioECUs.

4. QUALITY OF LIFE

4.1. Health

a. Each Member State, with its long experience and vast resources, is primarily responsible for promoting and preserving the health of its citizens but becomes increasingly overcharged by the steadily mounting costs of health care which is escaping national control.

Global health expenditures are presently estimated to superate yearly 150 milliard ECU in the Community of which less than one percent (about 1.2 milliard ECU) are spent for medical and public health research. However, research efforts at national level alone prove to be insufficient.

Since most national programmes consist of a large number of relative small projects carried out by relative small and scattered research teams, co-ordination of cooperation is indispensable. Especially a Community effort of pooling in advanced fields (such as application of modern biotechnology, medical informatics, advanced medical technology) the more or less scarce national expertise and of jointly exploring new R, D&D avenues will create a real innovation potential capable to solve major health care problems and to curb health care expenditures efficiently, and will contribute to the industrial development.

b. The Community effort will focus on three main R, D&D areas :

Co-ordination of medical and public health research, oriented towards :

- major health problems common to all Member States, by including as new targets **CANCER** (as follow-up of the Luxemburg summit) and **AIDS** (at request of the European Parliament), and by continuing either ones referring to age related (including disabilities) and to environment and life-style related health problems, respectively.
- improvement and joint use of health resources, encompassing both medical technology R, D&D and health services research (research on health care delivery and organization).

For such an effort there will be a high return value for low-cost investment at Community level (e.g. electrocardiography : improvement in processing with cost reduction of only 10% will save 100 Mio ECUs per year!)

Development of predictive medicine and novel therapy : this new intention will promote the application of modern biotechnologies in their most advanced aspects to the medical field and, in particular, to very early diagnosis of diseases and novel methods of treatment. Its R, D&D will mainly be oriented towards better knowledge of the human genoma, immunity technology (applicable to cancer, auto-immune diseases, infections), genetic engineering procedures permitting to repair DNA defects (e.g. in congenital diseases of genetic origine), and industrial production of diagnostic tests kits (e.g. AIDS).

Such Community attempt will fill in some gaps subsisting in the scientific and technological knowledge (gaps which prevent the full utilization of modern biotechnologies in the medical field), favour a European transnational cooperation, speed up the implementation of technologies already applicable, and at the same time promote a European scientific milieu which generates a high innovation potential with promising economic impact.

Improvement of occupational medicine as continuing institutional task is carried out under the ECSC Treaty. The inherent activities are oriented towards presenting health problems and occupational diseases associated with the specific environment of coal and steel industries. They will include research on chronic diseases such as those of the respiratory system, physiopathology, as well as on other diseases of workers in steelworks, cooking plants, coal and iron mines such as back problems, skin diseases,... and aim at further improvement of health standards in the ECSC industries by establishment of links between occupational diseases and workplace nuisances, and by development of preventive measures, early detection techniques, mitigation measures.

Occupational diseases are among the major cause of morbidity, both among miners and among workers in cooking plants and in the iron and steel industries, and hence present a community-wide problem.

c. The medical and public health research include two new targets (cancer and AIDS), the continuing ones will undergo changes in their S/T content (by terminating several projects, reorienting other ones and adding new ones). Thus, the total number of projects will increase from presently 30 to more than 70. Past experience has confirmed the importance of gradual co-ordination and all evaluation reports proved its scientific, medico-social and economic value.

The predictive medicine and novel therapy is a new undertaking based on past experience from the Biotechnology programmes which gives confidence in a real efficiency of such operation.

The third area includes continuing activities under the ECSC Treaty.

d. The medical and public health research will be carried out by means of the concerted action method with increased support to centralized facilities, the predictive medicine and novel therapy by shared cost (or marginal cost) action, and the occupational medicine through contracts.

e. The Community funding needed to support R, D&D in the above areas for the period 1987 to 1991 is estimated to amount between 140 and 160 MioECUs. Additional to this amount is the research on occupational medicine covered by the ECSC budget.

As a comparison, in the sole field of the medical and public health research the yearly cost of research , performed in Member States, is estimated at more than 200 MioECUs in 1987 at more than 400 MioECUs in 1990, which then corresponds to a co-ordination of 25% of total national activities.

4.2. Safety

a. No human activity can be risk free. People are exposed to a variety of hazards in every aspect of life : physical from various human activities and the forces of nature, chemical from acute and chronic poisons, or even biological ones. In addition, with the advance of technology, new risk factors are added and their control becomes more complex. Against this background, public interest and concern in maintaining a safe environment are growing.

Many of the safety issues that are encountered are similar in nature throughout the Community, and thus permit common solutions to be economically developed and used. Community approach is often the best solution when a considerable investment in time, money and effort is required, and the knowledge gained by research effectively transferred into application.

b. The proposed effort will focus on selected safety issues such as risks inherent to industrial and other human activities, fires, special technologies for hazardous environments, and natural hazards. Primary prevention will have a high priority.

1. Characteristic for many industrial activities is that they raise a diversity of safety problems whose solutions call for sizeable effort, considerable expertise, and in many cases due consideration of issues of social, legal, etc... nature. An integrated approach for safety - allowing environmental and other constraints and also technological advances to be taken thoroughly into account as they become known - is playing an increasing importance.

The work will concentrate on technological hazards of potentially significant importance, occupational groups exposed to a higher accident risk than the rest of the population, and major risk factors that are common to several industries :

- The research on major technological hazards will be oriented towards the understanding, prevention, and mitigation of consequences of important chemical/petrochemical accidents. The problem of preventing and mitigating such events is shared by the entire chemical/petrochemical sector; the need therefore is felt for appropriate Community regulation and research support. The EC directive "on major hazards of certain industrial activities" is a first step.

- Improvement in occupational safety in the coal and iron/steel industries as a continuing institutional task is carried out under the ECSC Treaty. In this field further co-ordinated work is needed at the Community level to assist in the application of research results.

- The rationale for activities concerning radiation protection originates from the obligations of the Commission to maintain relevant competences as laid down in the EURATOM Treaty and in directives. Scientific support is important for the assessment, management and political evaluation of problems of radiation risk, which is an area of Community-wide public concern.

2. Almost 80 % of all accidents are happening in the private environment, i.e. in connection with activities at home, recreation, sport, etc... The corresponding costs for insurance, medical care, etc... are several tens of billions of ECUs every year. In addition, there are considerable losses of production.

   At the Community level no common effort has been made sofar to reduce the above expenses while there are ongoing activities in the USA and Japan.

   The proposed research will concentrate on the elimination of risks in the private environment, in particular it will focus on accidents due to the introduction of new kind of home-equipments, on relevant data banks, on consumer protection against dangerous products, on special products for the elderly, handicapped, children, etc...

3. The overall cost of fires within the Community has been estimated to an average of almost 1 % of GNP. Whereas fire-fighting techniques are generally well developed, methods of optimizing levels of protection are still at the empirical stage.

   The proposed fire safety effort should produce a scientifically based approach and develop relevant quantitative engineering techniques. The work will focus on three areas : research for harmonization and regulation purposes, basic fire research, and applied research.

4. Remote handling technology has the potential to extend man's access to the natural wealth of the world and the range of his productive activities in incompatible or dangerous environments. Such hazardous domains include plants in key industries (handling radioactive, biologically active, toxic or combustible materials), the space and the oceans. There is also a public service domain concerned with firefighting, etc...

   An estimated Community market for this technology of 500 MioECUs/year from 1990, of which at that time about 1/3 would be nuclear, is large enough to serve as a springboard into a world market, but only if the R&D effort can be focused and user-led demonstrations coordinated.

   The proposed effort will focus on the three most relevant problem areas : demonstrations of prototypes (each typical of a class of applications), user and technician education, and underlying research.

5. Although destructive natural events may occur locally, their economic impact is going to be shared by all the Community. Moreover, some hazards, as for instance earthquakes, are shared by various countries of the EC, so that the ways and means of early alert, and efficient prevention and mitigation, are a matter of Community cooperation in a multidisciplinary approach and in a coordinated adoption of corrective measures. Community cooperation is therefore particularly appropriate in fields where it is necessary to build up efficient means for rapid information exchange, thorough data storage and trans-frontier establishment of survey networks.

Natural disasters research in the EEC will focus upon a selected yet typical and frequent events such as earthquakes, storms, floods and forest fires, which are likely to cause increased loss and damage to densely populated areas. Depletion of land resources due to drought in vulnerable ecological and societal contexts should also be taken account of.

c. Safety R, D&D by its nature requires continuity. The following evolution is foreseen :

The scope of the current programme on technological hazards/industrial risks will be broaden.

The occupational safety effort includes continuing activities under the ECSC Treaty.

As far as work on radiation protection is concerned, projects of a more fundamental character will be gradually diminished, increasing emphasis will be given to scenarios of accidental and environmental exposure, their consequences for man and society, and the reduction of exposure using risk evaluation and optimization, in support of EC Basic Safety Standards.

The coordinated efforts in the fields of private environment, fire safety, and special technologies for hazardous environment represent new initiatives.

The existing climatology and natural hazards research programme includes the study of the mechanisms and impacts of some extreme climatic events and of earthquakes, but so far with appropriations which are very much below the real needs.

d. Work will be apportioned according to the best availability of competences and with a view to the maximum possible benefits :

The major technological hazards effort will be carried out by means of in-house-, cost shared-, and concerted actions, the occupational safety through contracts, and the radiation protection through cost shared action.The work on risks in private environment will be carried out mainly by means of cost shared actions and to a lesser extend by the JRC, whereas the work on fire safety by concerted- and cost shared actions, the efforts on special technologies for hazardous environments and on natural hazards through cost shared actions.

e. Community funding required to support R, D&D in the above safety related areas for the period 1987 to 1991 is estimated between 230 and 280 MioECUs. Additional to this amount is the research on occupational safety covered by the ECSC budget.

It is estimated that the work on radiation protection will cover a significant part (35 to 45 %) of all pertinent national research (which in EUR 12 is estimated at 80 to 100 MioECUs/year) in collaboration with almost all national centres of expertise. The effort on special technologies for hazardous environments and on natural hazards could represent between 5 to 10 % of the Member States spendings in those fields.

4.3. Environmental Protection

a. Preserving and improving the environment is now universally recognized as an absolute prerequisite to ensure man's survival and his material and psychological well-being. Long-term economic development is contingent upon the conservation and wise use of natural resources. Of utmost importance is also the prospect of climate modification and consequences thereof. Increasing emphasis is given also to the protection and conservation of our cultural heritage.

The problems involved are essentially of a trans-frontier nature. The economic implications of environmental policy have made it imperative to give it a Community dimension. Science and technology are needed to provide a sound basis for regulations as well as the techniques needed to correct or prevent environmental damage. Setting high environmental quality objectives spurs technical innovation. Industry is induced to develop environmentally safer technologies which may find a market at home and abroad.

b. Community cooperation in environmental research is thus particularly appropriate as it supports one of the main policies of the Community which must rest upon a body of sound scientific and technical knowledge. Whilst the EC research action in this vast and diversified field should not, and could not, substitute national efforts which are often very important, it should coordinate them, complement them, and evaluate the results achieved. It can also mobilize, in large international projects (such as epidemiological surveys), the expertise, skills and equipment spread over the territory of the Community.

EC research on the environment must have the triple aim of :

- solving immediate problems for the preparation or implementation of current acts of the EC environmental policy;

- identifying and investigating environmental issues which will emerge in the foreseeable future, in view of the often long lead time necessary to obtain results;

- developing the basic understanding of ecological processes, and of the climate system.

It should be stressed that the problems posed by the environment not only need a multidisciplinary (hence often international) approach for their solution, but also, due to their strong economical implications, they are of capital importance for resource planning in an integrated economical unit such as the EC.

c. EC environmental research was initiated in 1972 and has yielded many useful results as attested recently by an evaluation panel. (Research Evaluation Report No 14, 1985). These results have been applied in the formulation of environmental policy measures.

Over the years, research has evolved from a corrective to a more preventive approach, as well as towards more fundamental concerns. Consequently, the research efforts on straight-forward effects of major pollutants, on which now a considerable body of knowledge is available, has been considerably reduced and is now limited to rather few unsolved problems.

For the 1987-1991 time frame it is proposed to carry out research under this heading in the fields of environment proper, climatology and cultural goods.

1. Environmental research will deal in particular with :

   - detection, measurement, analysis and monitoring techniques for a wide range of pollutants and environmental conditions (including aerospace remote sensing);

   - effects of pollutants on health and on ecosystems (e.g. consequences of "acid rain"), and on the cultural heritage (buildings, monuments);

   - assessment of human activities on environment quality, such as testing and evaluation of chemicals;

   - elucidation of basic principles of environmental process (ecosystem research, bio-geochemical cycles);

   - development of technologies for the reduction and prevention of pollution, and waste management;

   - restoration of the deteriorated environment, in particular of damaged ecosystems.

2. Climatological research concerns a most important component of the human environment, the one upon which our harvests, water resources, health and energy needs depend. It should aim at a thorough understanding of the climate system, and at developing techniques for climate forecasting and for assessing the ecological and societal consequences of any climate change, such as the one likely to occur in the course of the next century because of the warming induced by the atmospheric CO2 increase due to fossil-fuel burning.

   In either case the inclusion of Spain and Portugal in the Community brings with it new or intensified environmental problems (e.g. water conservation, desertification) which must be taken into consideration.

3. Research on the protection and conservation of the cultural goods is not limited to assessing the effects of pollution on materials already mentioned, but has also to aim at establishing methods for damage prevention, the elimination of the man-made increment to natural decay and to investigate methods for the restoration of

irreplaceable cultural objects. The emphasis, placed until now on historical buildings and freely accessible monuments, has to be enlarged to public collections of art, printings and books and archeological objects, etc.

d. EC research on environmental protection encompasses in-house, contract research and concerted actions. Tasks assigned to the JRC in this respect tend to be those of a central nature such as the constitution of data bases (e.g. ECDIN on environmental chemicals) reference measurements for environmental monitoring (e.g. the Central Laboratory for Air Pollution Measurements) the organization of joint field experiments etc. Concerted actions, which involve several European non-Member States within the COST system, are carried out on subjects for which a sizeable programme exists at the national level. Shared-cost contracts are the instrument used to fill research gaps and to stimulate cooperation between research organizations in the Member States.

e. In financial terms, the EC effort should represent a significant fraction of the total amounts spent within the Community (EC plus national programmes), in order to ensure an efficient coordination on European level by means of complementary, gap-bridging contract research and concerted actions. A share of about 15 % of the total public spendings in the Community for environmental research seems adequate to achieve this goal.

In view of these considerations it is estimated that EC funding in environmental research should be between 285 and 320 MioECUs for the 1987-1991 period.

5. SCIENCE AND TECHNOLOGY FOR DEVELOPMENT

a. The action concerned with a scientific and technical aid to development envisaged for the period 1987-1991 follows the first Community programme "Science and Technology for Development" 1983-1986[1]. The latter represented the very first initiative aimed at applying science and technology to the solution of Third World problems within a well structured multiannual R&D programme.

The new Community action will continue to play an important role in the revival of European tropical research, in decline after the acquisition of independence of former colonies. The new action must also allow for a more extensive and successful participation of Third World research institutes in the research projects which interest them.

b. The action covers two main research areas:

1. Tropical and subtropical agriculture including:
   - food production: development of food crops resistant to adverse natural conditions (drought, disease, pests etc.), improved management of forage resources, fisheries and livestock (animal genetics, veterinary medicine);
   - forestry production: species suitable for humid and arid zones;
   - land conservation and regeneration: protection from desertification, improvement of water resources;
   - improvement of farming systems taking into account the needs of the rural population and the preservation of natural resources;
   - post-harvest technology and product processing in liaison with human nutrition and animal feed.

   To support these activities, modern techniques such as remote sensing or techniques adapted to local needs (especially for energy supply in rural areas) will be applied.

2. Tropical medicine, health and nutrition including:
   - transmissible tropical diseases (prevention, diagnosis, treatment) and non-transmissible tropical diseases (such as haemoglobinoses);
   - health systems and the population: socio-medical research carried out with the help of the populations with a view to organizing health systems; demographic studies and surveys, applied research on populations in relation with ecosystems;
   - interdisciplinary research taking into account the agricultural, socio-economic and medical aspects of nutrition into the problems of nutritional deficiencies, malnutrition, food toxicology.

The research already undertaken or planned in the above-mentioned sectors contributes to the consolidation of the Community "Development" and "Science and Technology" policies. Science and technology are considered essential instruments of development which on the medium-long run will make the developing countries true partners of the EC Member States.

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[1] O.J. n° L352 of 14.12.1982

In particular, Community-promoted research on tropical medicine offers more opportunities to develop diagnostic tools and to prepare appropriate drugs and vaccines to fight the most frequent diseases, thus improving the world position of the Community from a humanitarian, political and economical point of view. And the agricultural research, through Community action can count not only on the European genetic resources, but also on those still largely available of developing countries.

The importance of this Community action resides also in the training possibilities and therefore in the learning opportunities it offers not only to people from developing countries, but also to young European scientists.

Furthermore, the action, as well as other EC R&D programmes, will permit to avoid duplication of national and international efforts and will make the results more meaningful and of wider application.

c. The new action covers essentially the same sectors considered within the first programme "Science and Technology for Development" 1983-1986. The evaluation of the research potential expressed by the about 2.000 proposals received in reply to the calls of the first programme and the analysis of the preliminary results of about 430 research contracts concluded have permitted to individuate the research priorities to be taken into consideration within the new action. In its implementation the action :

- will place more emphasis on the stimulation of the research activities of developing countries, thus improving or creating their endogenous capacities in science and technology;
- will provide those countries with appropriate infrastructure and scientific equipment when necessary, according to appropriate contractual procedures;
- will contribute to the improvement of cooperation between scientists as well as to the setting up of associative networks;
- will include an enlarged training component with possibility of an exchange of scientists between laboratories and/or assignment of experts to projects requiring a competent aid;
- will aim for a more effective application of the research results, for the benefit of the people of developing countries.

d. The action will be implemented by means of shared cost contracts between CEC and institutes from developing countries and member States. However the possibility to organize some concerted actions, especially for the creation of associative networks is not excluded.

e. The estimate of the financial resources considered necessary for the implementation of the new action is based on:

- the research potential expressed in the course of the first programme, especially by developing countries;
- the impact the action should have on the bilateral and multilateral activities of Member States in order to ensure a coordination effect (7-8% of national R&D activities);
- the impact on Community activities implemented in the framework of its development policy.

The overall financial means should amount between 100 and 200 MioECUs for the period 1987-1991, taking into consideration the above conditions and the enlarged context (12 Member States). This enlargement certainly requires increased efforts for the attainment of the objective of a common policy and a common structure in the implementation of the new action, but it will also offer the opportunity to benefit from the historical links existing between the two new Member States and the Latin American countries.

6. EUROPE'S SCIENTIFIC AND TECHNICAL POTENTIAL
The Researchers' Europe

a. To improve the Community's scientific and technical competitiveness by breaking down the compartments in Europe's "science space" and establishing a true "researchers' Europe"; this is a major requirement in the Community's medium and long term socio-economic development.

b. Faced with the need to strengthen the effectiveness of their potential to undertake research and produce inventions, Member States have implemented measures to stimulate scientific and technical creativity at a national, as well as at the international level. However these measures, which are often close to individual fields of activity (such as molecular biology) or exclusively linked to specific research topics, and which are confined to what is essentially a national or binational geographical area, correspond only partly, despite their undeniable value, to the constantly changing needs of the Community and its Member States. A multinational activity is therefore needed in order to reinforce and develop the range of existing measures.

It would seem therefore that the Community level is the most appropriate one to achieve this aim. Modern science and technology requires a multitude of views and complementary approaches, often of a multidisciplinary character, which call for synergy between men and ideas as well as for research teams possessing a certain "critical size". This implies of necessity that there be a "geographical context" such as the Community, which is as big as possible.

In these circumstances the Commission proposes to develop its activity in two main directions :

1. Researchers :

   Reducing administrative and social obstacles to the mobility of researchers.

   Research training, developing specialities, supplementary training for scientists.

   Developing intra-European scientific and technical cooperation and the mobility of researchers.

   Retaining and supporting high calibre researchers in Europe.

2. Facilities :

   Optimising the development and exploitation of major scientific and technical installations.

   Eliminating obstacles to and providing help for the free circulation of scientific and technical equipment.

c. With its "Plan to Stimulate European Cooperation and Scientific and Technical Interchange 1985-1988", which followed on from the experimental activity 1983-1984, the Commission followed this route.

Up to date some 650 teams of researchers in the Community have been linked in this way, in 265 joint projects, and several dozen

"scientific networks" have been set up thanks to the Community action, which has been recognised in all the circles concerned as a success.

It has aroused a deep interest, not just in the Member States some of which have now started similar activities themselves on a national level, but also in international organisations such as the Council of Europe and in European non-Member States (Austria, Finland, Norway, Sweden, Switzerland). Some of the latter have officially made known their wish to take part in the action and, in accordance with the mandate given by the Council in March 1985, negotiations have been started to agree the conditions, particularly the financial conditions under which such participation could take place.

Encouraged by this success and by the interest which it has aroused the Commission now proposes to build upon the activity which has been carried out up to now. In this respect the Commission considers that a particular emphasis should be placed on the social and cultural aspects of the "researchers' Europe" and on making full use of the Community's potential so far as major scientific and technical installations are concerned.

d. Avenues for actions :

1. Researchers :

The Commission proposes to identify and implement contextual measures of an administrative and regulatory nature both to eleminate obstacles and support mobility.

Again, it is intended that incentives in the shape of financial support will be made available in various forms (research grants, laboratory twinnings, operations contracts, sectoral "bourses", advanced courses, scientific awards and prizes) to promote training, scientific and technical cooperations, the mobility of researchers and the retention in Europe of high calibre researchers.

2. Facilities :

The Commission feels that it would be opportune on the one hand to provide Community support so as to enable researchers in the Community to make use, free of charge, of time and experimentation facilities at a major scientific and technical installation. In return, the installation could, thanks to the Community contribution, be adapted, given special features and operated more economically.

e. With a view to involving, ultimately, 5% of European researchers in transnational cooperation activities of this kind the Commission feels that the goal of 2.5% of researchers (10,000 people) should be adopted for the year 1991.

To this end and on the basis of the experience so far gained, the financial resources required may be estimated between 400 and 500 MioEcus for the whole period 1987-1991 (corresponding to 0.2% of public R&D expenditure budgeted for the Europe of 12 during the same period).

7. GENERAL SUPPORT FOR SCIENTIFIC AND TECHNICAL DEVELOPMENT

7.1. Innovation

The European Council has underlined the importance of reinforcing the scientific and technical foundations of European industry and of promoting its international competitiveness.

To this end, the Commission proposes to stimulate the whole innovation process in the Community through two specific fields :

- an improved dissemination and exploitation of the results of Community research, demonstration and technological development (RDTD) activities;
- a strategic programme for the transnational promotion of innovation and technology transfer (SPRINT).

7.1.1. Dissemination and Exploitation of RDTD Results

a. The proposed amendments to the EEC Treaty explicitly confirm that "dissemination and exploitation of the results of Community research, demonstration and technological development (RDTD) activities" constitute one of the four inter-related types of action to be undertaken by the Community in the field of technology.

   In the context of a Community-wide market, improved dissemination and exploitation of results will lead, throughout the enlarged Community, to an increase in general scientific and technical knowledge, a general improvement in economic competitiveness and an increase in the number of jobs created. Certain investigations indicate that, even with the scarce resources so far available, this action has already led to the creation of about three thousand (direct and indirect) permanent jobs, at a cost per job substantially lower than costs which are usual in either the public or the private sector. About half of these new jobs involve transnational activities.

b. This horizontal action will be implemented to the benefit of all regions through three lines :

   1. An activity covering the dissemination of all Community RDTD results including :

      - patent screening, filing and defending, to ensure that exploitable material is protected;
      - translating Community RDTD results into several languages and providing appropriate ways and means for dissemination to the scientific community, to decision takers in the public and private sectors and to the general public.

   2. An activity covering the exploitation of the JRC's R&D results: market evaluation of JRC inventions; support for constructing prototypes and pilot plants; search for industrial partners for exploitation or further development; granting licences; publicity.

3. An activity covering the exploitation of the results from all other RDTD activities as far as the Community as such is involved (shared-cost actions, including demonstration projects, COST, EUREKA and cooperation agreements with third countries, etc..) :

   - to ensure proper exploitation by adherence to the relevant legal and contractual obligations for protection, exploitation and licensing in the interest of the Community;
   - to offer selective and precompetitive support in the field of protection, exploitation and licensing, limited to certain types of contractors (research centres wholly or partly publicly owned, SMEs and universities), providing that the work has a transnational character or cannot be adequately supported by national measures and that provision is made via royalties for repayment of the Community's financial support.

   The experience of the Commission's services has proved that these tasks are far better handled by an approach which enables specialized services for the protection of inventions, the dissemination of information and the exploitation of research results to be put at the disposal of individual research activities.

c. A notable strengthening of this existing horizontal action, which could be achieved at a cost modest in relation to the overall research budget, would lead to benefits far in excess of that cost.

d. In close collaboration with managers of RDTD activities, researchers and inventors and, where appropriate, the technical assistance of the JRC, the work listed under b. will be implemented - notably for reasons of competence, cost effectiveness and budgetary rules - by the Commission's specialized services (which should be adequately reinforced), assisted by external experts working under contract. Exploitation projects requiring the further development of inventions, or the realization of demonstration installations, will be carried out by external enterpreneurial bodies acting under contract with the Commission.

7.1.2. Strategic Programme for the Transnational Promotion of Innovation and Technology Transfer (SPRINT)

a. The proposed amendments to the EEC Treaty confirmed that "The Community's aim shall be to stengthen the scientific and technological basis of European industry and to encourage it to become more competitive at international level. In order to achieve this, it shall encourage undertakings including small and medium-sized undertakings, research centres and universities in their research and technological development activities; it shall support their efforts to co-operate with one another, aiming, in particular, to enable undertakings to exploit the Community's internal market potential to the full ...".

Consequently a horizontal action is proposed aiming at the development of a European supporting infrastructure for innovation and technology transfer, particularly for the benefit of small and medium-sized enterprises (SMEs).

It has indeed been shown that SME's are not in a position to exploit effectively the results of research and to innovate without the support of an infrastructure giving them access, across national borders, to the finance, the information and the wide range of advisory services, etc.. which they require. In this connection, it should be remembered that it has also been shown that the largest potential for innovation is to be found in SMEs.

b. It is thus fully in the interest of SME's that this infrastructure should be Community-wide, because this enables them to take advantage of the size of the European internal market.

This action is split into three chapters :

1. The establishment of "human networks", namely tha transnational interconnection of the various intermediaries that hold the know-how which SMEs need : technology transfer specialists, Chambers of Commerce, technology management consultants, marketing consultants, venture capitalists, etc...

2. The development of "instruments", enabling SMEs (or the intermediairies that work for them) to have easy access to the information, originating from all Member States, which they require : technological conferences, information systems on technologies available for licensing or on the research laboratories which can provide them with support, on technical standards and specifications to be respected in each country, on research reports issued at a national level containing data which could be exploited by industry, etc..

3. Systematic concertation between Member States on measures to be taken at a national level to promote research, innovation and technology transfer, with the aim of not only enabling Member States to take advantage of each other's experiences, but also to suggest new measures to be taken at Community level.

c. The proposed action is designed to follow on from a first 3 year experiment, decided by the Council of Ministers on 25 November 1983, concerning the "Plan for the transnational development of the supporting infrastructure for innovation and technology transfer".

The Commission has been implementing this plan for over 2 years. On the basis of the experience acquired it can be confirmed that the "infrastructure" approach is essential. It has at the same time become very clear that the most important elements of this infrastructure are transnational "human networks" and an effective system of concertation between Member States.

It should be pointed out that this concertation, apart from the exchange of experience to which it leads, provides feedback into the Plan and generates specific new actions to be undertaken at a Community level.

d. The action requires both a number of preparatory studies or pilot projects and the implementation of full-size transnational operations on the basis of shared-cost contracts.

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e. The financial resources necessary to carry out these activities are estimated between 80 and 150 MioECUs for the duration of the Framework Programme. Additional funding for activities relating to dissemination and exploitation of research results will come from individual programmes.

7.2 Communication and Information Networks and Scientific Data Bases

a. The establishment of Europe-wide communications and information networks is a key element to:

1. Strengthen the European research infrastructure :

   Fundamental, technological and engineering research requires good computer based communication media to help researchers

   - to work effectively while geographically dispersed, through better and quicker access to relevant information sources and improved communication with other scientists;

   - and to sharpen their fundamental research capabilities in Europe in order to use them more quickly than our competitors.

   The creation of a European integrated computer network should create a network scientific culture, initiate and intensify cooperation between separate national research groups.

2. Improve the process and speed of innovation and stimulate the industrial exploitation of industrial results, through the links and bridges provided between universities, industrial research centres, standardisation specialists and marketing people.

3. Lead to consistent approach and implementation of European common standards. (Furthermore a European Computer Network should provide a welcoming structure for EARN members when IBM finance ceases supporting the EARN network).

b. The objective is the provision of a common integrated computer communication infrastructure and associated services, using public data networks and linking the computers and individuals of universities as well as academia state and industrial research centres. It will allow exchange of data, software, messages and research results on a European-wide basis and also allow for the sharing of massive and expensive resources such as information data bases, super-computers, specialised services centres for expert systems and artificial intelligence.

   This infrastructure will build upon efforts being made in order to develop and implement OSI standards and to provide the EEC with high speed and/or broadband communication services (in the framework of ESPRIT and of RACE).

   Created under the auspices of the Commission, the RARE association (Réseaux Associés pour la Recherche Européenne) aims to provide a high quality networking infrastructure using the data services operated by the PTT's, for the support of research and academic endeavour on a European basis.

   The European research network (ERN) constitutes another important European project of which the Commission is a partner. It has similar objectives. Internal discussions are currently taking place within the Commission to define its active participation and contribution.

c. Motivation for EEC action :

- use of EEC wide capabilities in R & D and contribution to the creation of the European community of researchers;
- coordinated approach required to develop and implement common standards (in liaison with CEPT);
- substantial cost savings compared to a multiplicity of incompatible national networks designed for the same purpose;
- improvement of European-wide transfer of technology, including SMEs and less favoured regions by setting down geographic barriers to access of information.

d. At this very preliminary stage, one could envisage a Community contribution of approximately 20 MioECUs. A first estimate of the actual expenditure from the different national programmes of the Community is in the order of magnitude of 80 MioECUs per year.

Furthermore part of the work which does not involve RDDT is carried out within other programmes such as INSIS and IT & T standardisation action plan.

7.3. Linguistic Problems

a. Language is the principal medium for human communication and for recording of knowledge. For the Community with nine official languages two classes of problems arise which are both decisive for its success or even survival :

- Multilingualism : the national and cultural identity of the Members is inseparably tied to their national (and regional) languages. It is therefore a duty of the Community to make sure that all Members can communicate with the Community institutions and with each other in their own languages, without being discriminated against. This calls for fast, cheap and reliable translation and interpretation services, which are only possible through an extensive employment of advanced information technologies. Only if the language barriers are effectively overcome can Europe hope to avoid both external and internal linguistic and cultural colonialism, with all its economic implications, and to achieve equal chances for all its Members.

- Language understanding : the Community and its Members are making a considerable effort to close the gap in the domain of advanced information technologies which are recognized as one of the main factors for future economic growth. IT research includes as a priority area advanced information processing including knowledge engineering expert systems, man-machine communication (written and spoken), etc. Since the large majority of human knowledge is recorded and communicated in natural language, the success of the technologies ultimately depends on our ability to open this information source to advanced information systems, and to communicate the knowledge to the users in their own language.

Our competitors in the USA and Japan attribute a high priority to natural language understanding in their respective IT programmes. Together with the hardware, they export in a growing measure natural language components (mostly in English) such as text processing, data bases, speech synthesizers etc. At stake is not only the competitiveness of the Community in the fast growing language industry, but ultimately its own identity. The multilingual dimension and the past efforts both at Community and at national level have given Europe a certain advance over its competitors in this domain. This advance must be maintained and increased through a coordinated effort of all those concerned.

b. The long term objective of a Community R&D programme (coordinated with national programmes) is the creation of methods, tools, technologies, knowledge bases and prototype systems which can become the basis for the development of an autonomous and strong European language industry. The principal motivation for a Community action is the fact that the fundamental problems to be resolved, such as the analysis and synthesis of written and spoken language, interfacing linguistic modules with information systems etc., are to a large extent common to all languages, and require common solutions. These common methods and tools should be used by the Member states (in cooperative ventures) to create the monolingual and multilingual analysis and synthesis modules, which in turn can be integrated into a variety of (prototype) application systems.

While many of the problems are unlikely to be fully solved within this century and require long-term basic research, the main concrete lines of action for the period 1987-1991 are the following :

- Completion by 1990 of a first multilingual prototype machine translation system (EUROTRA) capable of dealing with all official Community languages and operational in a limited subject field and for limited text types. EUROTRA was approved by the Council in November 1982 (5 1/2 years, 16 million ECU). After the accession of Spain and Portugal the Commission has proposed an extension of the programme by 18 months and of the funding by 11 million ECU to cover the increase of languages from 7 to 9 (and language pairs from 42 to 72).

- Support to the industrial development of an automatic translation system which can be used in a multitude of domains and environments (Community institutions, industry, commerce, services, information and documentation). The preparation of this programme should start in 1988, and the programme itself in 1990 (EUROTRA-II).

- Development of methods and tools for the reusability of lexical resources in computerized applications, and creation of standards for lexical and terminological data (LEXTERM). This action should also include the support to the creation of national terminologies in domains where they are missing (preparation phase 1987, execution 1989)

- Long-term basic research for the next generation of high-quality machine translation systems and other natural language processing systems. This research should include advanced semantic methods, subject field expert knowledge, inference techniques, interfacing of language processing modules with information and expert systems, speech analysis and synthesis (EUROTRA III).

c. The cooperative decentralized organization of the EUROTRA project has proven its adequacy as it acted as a stimulating and catalyst factor. But it also showed some structural weakness of R&D in the domain of linguistic problems at national level, which in a few cases lead to considerable delays in the start-up of the national contributions to the programme. Especially objective-oriented contract research is insufficiently organized in many of the Member States and future programmes should contribute to the improvement of the structures and to the training of professionals.

d. For all projects a cost-shared action is foreseen. Projects with a prevalent research orientation should be funded by the public sector (Community, national contributions) while for projects with a clear development component contributions from the private sector should be expected.

e. The overall effort is estimated at about 280 MioECUs to which the Community would contribute between 80 and 100 MioECUs, the Member States 80 MioECUs and the private sector 110 MioECUs. This Community level of effort would represent 15 to 20 % of the present overall public effort of the Member States.

7.4. Forecasting, Evaluation and Statistical Tools

7.4.1. Forecasting (FAST)

a. Forecasting and assessing the implication and consequences of long term scientific and technological change for the economic and social development of the Community Member Countries remains one of the principal tools available to the Commission in view of identifying new objectives and new priorities areas for its action in the field of RDTD.

b. During the execution of FAST II, an entire new generation of R&D programmes and actions has come into life (ESPRIT, RACE, BRITE, CUBE, STIMULATION...) which have increased the capacity of the Commission to analyse long term scientific and technological development and derive strategic orientation.

Furthermore, greater and more systematic attention is paid to technological change and its economic and social implications and consequences by other services within the Commission (particularly by the Directorate General for Employment, Social Affairs and Education). The European Parliament itself has also decided in 1985 to set up a Parliamentary office for the evaluation of scientific and technological choices.

Thus, the FAST programme will no longer be the unique place within the Commission and the Community Institution where activities comparable to forecasting and assessment in the field of science and technology are carried out.

A renewed interest is equally shown in the member countries, both at executive (government) and legislative (parliament) levels, into the analysis of long term societal implications and consequences of scientific and technological development.

These new developments call therefore for :

1. an intensification of the specific role of the FAST programme;
2. opening new directions in the FAST research approach and portfolio

c. Ad 1. The intensification of the specific role of the FAST programme within the new Commission environment and in relation to recent developments in the Member Countries.

This means :

- a strenghtened emphasis on the entire spectrum of technological "families" and particularly in the long term prospects of their integration (between IT, materials and biotechnologies, between oploelectronics, IT automation and materials, etc...) and the consequences for the European R&D structure, industrial and education systems;

- greater focus on assessment of the implications and consequences of new emerging fields of science and technology applications;

- a greater emphasis on the "network" approach, in order to bring together the forecasts and analyses made within the Commission and Community institutions, and in the Member States, and to integrate their results in science and technology policy options.

Ad 2. Opening new directions in research approach and portfolio :

This means :

- improvement and diversification of the proper tools (information data bases, promotion and ad hoc European "observatories") for better observing and analysing the changes in the scientific and technological system;

- greater attention to the long term factors and dynamics in the innovation processes, transfer and diffusion;

- carry out, on a more systematic manner, studies focussing on the world development, problems and prospects of science and technology, taking into account the accelerated transnationalisation of economy, technology and R&D;

- and, in close relation with IRIS, strengthening the links with the world of producers and users of new application of advanced science and technology.

d. The work will be carried out as a shared costs action, as it is the case since the beginning of FAST.

e. The amount to be spent on this action during 1987-91 is estimated between 15 and 18 MioECUs.

7.4.2. Evaluation

a. A close scrutiny of scientific activities is necessary not only for the development of more effective science policies, but also for ensuring that in an era of growing demands for accountability, society at large is provided with the necessary assurances that public funds expended on research are effectively contributing to the attainment of social and economic objectives set by the Community and its Member States. Furthermore the increasing awareness of the importance of R&D for economic growth has resulted in a growing recognition of the value of R&D evaluation. This is proven by the interest shown by the Member Countries and by several international organizations such as the UN and the OECD.

b. For the period 1987-91 the Commission will continue to follow the principles exposed by the plan of action relating to the evaluation of Community R&D approved by the Council on 28 June 1983. This evaluation is performed at the level of each individual activity in time to provide input for the formulation of the next programme. Its methodology is based on the "peer evaluation" carried out by external groups of independent experts, without neglecting, whenever possible, the use of quantitative indicators.

   In order to carry out this activity in an effective way, the Commission will encourage research in this field in the Community and continue its efforts in the development of appropriate evaluation methodologies and in the establishment of a Community evaluation network.

c. Evaluation techniques will reflect the growing Community R&D priority towards programmes contributing to industrial competitiveness. This implies that a specific effort will be devoted towards the analysis of all aspects contributing to industrial innovation and competitiveness.

   The importance of socio-economic impact assessments has been repeatedly stressed by several Member States. A full consideration of this aspect will require evaluations at a higher aggregation level than carried out up to now.

d. The amount to be spent on evaluation activities during 1987-91 is estimated between 10 and 12 MioEcus.

7.4.3. Statistical tools

a. Support of forecasting and evaluation in the form of comprehensive statistical data bases is essential. Such support consists not solely of the data themselves but should also attempt to embody the expertise of those who collect and use the data. This support should be developed in the form of knowledge based expert systems. The objective of such systems is to improve the productivity of statistical information by enhancing its value to the user.

b. This activity should include a fundamental study of the problems underlying the construction of expert systems in the field of statistics, proposals for standards to be applied in order to ensure compatibility of future work in this area and complete prototype systems designed to operate in selected areas. In addition to the specific results in the field of statistics, experience of more general applicability will be acquired which will be relevant to the wider field of research in the development of expert systems.

   A Community approach is necessary to coordinate and reinforce the current efforts scattered in a few Member States by providing a general integrating frame, and to develop common standards to promote the generalised use of these new tools.

c. This new Community activity should be carried through cost-shared projects and would require an amount in the order of 5 MioECUs for the 1987-91 period. This would represent 5 to 10 % of the efforts of the Member States in this field.

7.5. International Cooperation

a. A more active scientific presence in developing countries is becoming an important part of the Community strategy. An appropriate response can only be decided upon through a detailed knowledge of the needs of its partners. A true transfer of technology to developing countries can only be achieved by strengthening this cooperation between Europe and these countries.

As a consequence of the strengthening of scientific relations with all countries, economic opportunities arise through the opening up of export markets and at the same time more assistance can be given with the development of poorer populations.

The individual countries of Europe have available a remarkable science and technology potential; however, only a collective effort will enable the Community to respond to the increasing demand for cooperation from developing countries.

Scientific and technical cooperation provides one of the pillars on which increasingly rest the worldwide cooperative agreements which the Community signs with Third Countries. The industrialized countries, and the members of EFTA in particular, wish in effect to join the Community in order to increase their scientific potential and to rationalize the resources necessary to sustain a research effort.

Developing countries, in their turn, await the Community's scientific and technical aid that is so necessary to speed up their development.

b. A Community action was launched in 1984 with a modest budget, in order to support actions on scientific and technical cooperation with industrialized countries on one hand and with developing countries, more specifically non associated Third World countries, on the other. These scientific and technical actions aim at strengthening the cooperation established in a more general frame within other Community policies.

The objectives and the methods of carrying out international science and technology cooperation differ according to whether they relate to developing countries or to industrialized countries.

1. For developing countries these actions are aimed either at complementing the R&D programme "Science and Technology for development" (see point 5) or at preparing future R&D programmes. For developing countries, the need is for aid intended to strengthen local research, especially through the establishment of links between European institutes and those in developing countries. The joint execution of research work on topics of common interest is the final objective of the cooperation which we wish to attain.

The main ways of achieving this objective are the following :

- assistance with the establishment of research programmes;
- training of scientists;
- exchanges of information;
- joint organization of seminars, workshops and conferences;
- creation of research networks between European and Third World institutes;
- joint research.

2. Scientific and technological cooperation with the industrialized countries, on the other hand, aims essentially at strengthening exchanges of information and scientific personnel between the Community and these countries, in order to :

- increase research capacities,
- reduce research costs,
- avoid duplication of research activities, and
- coordinate the work involved.

The principal actions which are in progress in this regard are the following :

- exchanges of information;
- seminars, workshops;
- organization of joint meetings;
- visits and periods of training and information;
- joint projects and exchanges of research workers.

These actions are complemented, in the case of non-EC European countries, by their direct participation in Community R&D programmes.

c. The fields covered by this new initiative are most diverse and vary according to needs and mutual interests. Agriculture, environment and new technology have been the sectors in which the greatest number of research actions have been initiated, especially in developing countries. Cooperation with industrialized countries, by contrast, is centred in the field of more advanced technologies and fundamental research.

d. Identification of themes for cooperation takes place jointly with the partners, and financial participation is also negotiated by mutual agreement. It is normally fixed with regard to the degree of development, especially scientific, and the financial capacity of the country concerned. With certain developing countries (China, the ASEAN states, India, Brazil, Mexico, etc.) the funding has been set, initially at least, as almost entirely a charge on the Community.

The tendency now, however, is to transform aid into a true cooperative relationship and for the developing countries to be responsible for a percentage of the costs of the research activities. Among other things this permits an increase in the number of activities that can be carried out.

e. The attainment of "joint funds" with our partners and the negotiation of framework-contracts are the important administrative and budgetary instruments on which to base the enlargement of this international cooperation.

In order to be able to respond to the demand for scientific cooperation which is destined to increase considerably, especially regarding the newly associated countries in Latin America (and also following the Community entry of Spain and Portugal), substantial credits must become available. A Community action, taking account of the needs to be met and the objectives to be followed, must be able to count on a sum estimated between 50 and 60 MioECUs for the period 1987-91 in order to be of significance.