COUNCIL DECISION

of 23 April 1990

concerning the framework programme of Community activities in the field of research and technological development (1990 to 1994)

(90/221/Euratom, EEC)

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community, and in particular Article 130q (1) thereof,

Having regard to the Treaty establishing the European Atomic Energy Community, and in particular Article 7 thereof,

Having regard to the proposal from the Commission (1),

Having regard to the opinion of the European Parliament (2),

Having regard to the opinion of the Economic and Social Committee (3),

Whereas the Single European Act incorporated a Title VI (Articles 130f to 130q) into the EEC Treaty; whereas that Title constitutes a new legal basis for Community activities in the field of research and technological development; whereas, in particular, Article 130f lays down that the Community's aim is to strengthen the scientific and technological basis of European industry and to encourage it to become more competitive at international level;

Whereas it is necessary for the Community to encourage enterprises, including small and medium-sized undertakings, research centres and universities in their research and technological development activities and, in order to achieve that, to support their efforts to cooperate with one another by appropriate measures;

Whereas it is recognized that small and medium-sized undertakings are able to make a significant contribution to the innovative process and should play a substantial role in the implementation of Community research and technological development activities, thereby contributing to the improvement of industrial competitiveness on a broader basis; whereas, therefore, particular attention should be paid to the specific needs of these undertakings in order to encourage their access to information, their effective participation in Community programmes and their ability to exploit the results of Community research;

(1) OJ NO C 243, 23. 9. 1989, p. 4.
(2) OJ NO C 15, 22. 1. 1990, p. 356.
(3) OJ NO C 56, 7. 3. 1990, p. 34.

Whereas under Article 130i all the Community activities referred to in Article 130g should be set out in a multiannual framework programme;

Whereas, following an initial framework programme for the period 1984 to 1987, a second framework programme for the period 1987 to 1991 was adopted by Decision 87/516/Euratom, EEC (4) amended by Decision 88/193/EEC, Euratom (5), and is in the process of being implemented; whereas it should be possible to continue implementing it, for specific programmes which have not yet been adopted, even after adoption of the third framework programme for the period 1990 to 1994;

Whereas the Commission submitted a communication on 'a framework for Community research and technological development actions in the 1990s' on 13 June 1989;

Whereas, in addition, pursuant to Article 4 of Decision 87/516/Euratom, EEC, the Commission has examined and assessed progress in carrying out the second framework programme, in particular through an evaluation report prepared by a group of independent experts;

Whereas, in view of the rapid pace of technological development, new economic challenges which the Community must meet, the increased level of global competition and the need to keep in view the horizon beyond 1992, Community activities in the field of research and technological development must be intensified and augmented; whereas, in the light of these factors, it has been judged appropriate to adopt a new framework programme for the period 1990 to 1994 developing out of the current framework programme 1987 to 1991;

Whereas the Community's activities must be based on the principle of subsidiarity, and whereas the Community's activities in the field of research and technological development must thus provide added value in relation to activities carried out at national and other levels;

Whereas efforts should be focused on a limited number of activities corresponding to the strategic objectives laid down in the framework programme;

(4) OJ NO L 302, 24. 10. 1982, p. 1.
(5) OJ NO L 89, 6. 4. 1988, p. 35.

Whereas it is necessary to promote the overall harmonious development of the Community with a view to strengthening its economic and social cohesion; whereas it is intended that the implementation of common policies of the Community and its strategy for research and technological development shall contribute to this objective; whereas a Community framework programme should play its part, along with other Community instruments, in contributing to strengthening scientific and technological infrastructure and potential throughout all parts of the Community;

Whereas the process of technological progress requires a continuum of interlinked activities, ranging from basic research through to the demonstration of the applications of new technologies; whereas, however, the pre-competitive aspect must remain central and still take priority in Community research and technological development;

Whereas the prenormative dimension referred to in Article 130f of the Treaty could enable Community research and technological development activities to guarantee the scientific and technical basis necessary to establish adequate norms and standards; whereas such an approach will help make it easier for the Community to meet the increased responsibilities linked with completion of the single market, in other areas such as the environment, safety and health;

Whereas the Joint Research Centre is called on to contribute to the implementation of the framework programme particularly in those fields in which it can offer an impartial and independent expert opinion for the benefit of all Community policies;

Whereas the dissemination and exploitation of the results of research and technological development activities are essential elements in the innovative process, in particular for small and medium-sized undertakings; whereas, for this reason, each specific programme must specify the procedures for disseminating results, and provision should be made for centralized action to disseminate and exploit the results of research;

Whereas a new initiative should be launched to improve the mobility and training of young researchers at postgraduate level, particularly relying on networks of laboratories and research teams, both public and private, in Member States, throughout the whole Community;

Whereas the framework programme is to be implemented through specific programmes and may also be implemented through supplementary programmes within the meaning of Article 130l, participation within the meaning of Article 130m and cooperation with third countries or international organizations within the meaning of Article 130n or may take the form of joint undertakings or other structures within the meaning of Article 130o of the EEC Treaty;

Whereas a complementary relationship should be promoted between Community activities and Eureka projects which fit in with the extension of the Community's research and technological development strategy, by the choice of appropriate instruments, in accordance with Articles 130m and n of the EEC Treaty;

Whereas the Community is ready to cooperate, on a mutually advantageous basis, with third countries, particularly those which have concluded framework agreements with the Communities;

Whereas European Cooperation in the field of scientific and technical research (COST) activities are making an increased contribution to the implementation of the framework programme and playing a specific and complementary role by encouraging scientific and technical cooperation between the Community and the members of COST by means of research projects of a multilateral character;

Whereas it is necessary to make an estimate of the Community financial means necessary for the realization of the research and development activities envisaged, in accordance with Article 130i (1) of the EEC Treaty; whereas this amount is compatible with the financial perspective included in the Interinstitutional Agreement of 29 June 1988 for the years 1990 to 1992;

Whereas as regards the implementation of the framework programme in 1993 and 1994 provision should be made for the amount deemed necessary and the continuity of research activities should be ensured;

Whereas the Scientific and Technical Research Committee (Crest) has been consulted;

Whereas the Scientific and Technical Committee referred to in Article 7 of the EAEC Treaty has been consulted by the Commission and has delivered its opinion,

HAS DECIDED AS FOLLOWS:

Article 1

1. This framework programme for Community activities in the field of research and technological development, hereinafter referred to as the 'third framework programme', shall cover the period 1990 to 1994. The Decisions adopted in implementation of Decision 87/516/Euratom, EEC, concerning the framework programme for 1987 to 1991 shall not be affected by this Decision. The remaining Decisions necessary to complete the implementation of Decision 87/516/Euratom, EEC, may be adopted.

2. The third framework programme shall provide for the carrying out of the following activities:

— enabling technologies:

1. information and communications technologies;
2. industrial and materials technologies.

— management of natural resources:

3. environment;

4. life sciences and technologies;

5. energy.

— management of intellectual resources:

6. human capital and mobility.

3. Without prejudice to the amount of ECU 3 125 million deemed necessary in respect of the framework programme for 1987 to 1991, which it will be possible to enter in the budget from 1990 onwards, the amount deemed necessary for Community financial participation in the entire programme shall be ECU 5 700 million, of which ECU 2 500 million are deemed to be necessary during 1990, 1991 and 1992 and ECU 3 200 million during 1993 and 1994.

4. The latter amount shall be intended for the financing in 1993 and 1994 of activities begun in the period 1990 to 1992. If this amount is covered by any financial perspective fixed for 1993 and 1994, it shall be deemed to be confirmed. In any other circumstances, the Council should as soon as possible take, in accordance with Article 130q (1), the decisions deemed necessary to ensure the continuity of the present framework programme.

5. The breakdown of the amount deemed necessary for the period 1990 to 1994 between the six activities referred to in paragraph 2 is set out in Annex I.

6. The activities referred to in paragraph 2 and their scientific and technical objectives are described in Annex II.

7. The selection criteria to be applied in the implementation of the framework programme are laid down in Annex III.

Article 2

1. The third framework programme shall be implemented through specific programmes in accordance with Articles 130k and 130p of the EEC Treaty. For activities covered by the EAEC Treaty, programmes shall be adopted in accordance with Article 7 of the said Treaty. Each programme shall fall within one of the activities referred to in Article 1 (2).

2. This implementation may also give rise, as necessary, to supplementary programmes within the meaning of Article 130l, to participation within the meaning of Article 130m, to cooperation within the meaning of Article 130n and to joint undertakings or any other structure within the meaning of Article 130o of the EEC Treaty. In such cases the decision shall be taken by the Council pursuant to the rules of the Treaty.

3. If a decision is taken in implementation of Article 1 (4), the various specific programmes or other decisions shall be adjusted to take account of such decision.

4. Each specific programme shall determine its precise objectives and make provision for an evaluation of the results achieved as compared with those objectives and with the criteria in Annex III, which include that of contributing to the economic and social cohesion of the Community.

Article 3

The detailed rules for financial participation by the Communities in the third framework programme as a whole shall be those provided for by the Financial Regulation applicable to the general budget of the European Communities.

The rates of financial participation by the Community are set out in Annex IV.

Article 4

Measures to disseminate the knowledge gained from and to exploit the results of the specific programmes and the supplementary programmes, as described in Annex II, shall be implemented, on the one hand, through the specific and supplementary programmes and, on the other, by means of a centralized action.

The amount deemed necessary for the abovementioned centralized action is ECU 57 million, as indicated in Annex I.

The detailed arrangements for the dissemination and exploitation of the knowledge gained, in particular the definition and the implementation of the centralized action, shall be the subject of a Council Decision.

Article 5

During the third year of execution of the third framework programme, the Commission shall assess its progress by reference to the criteria set out in Annex III. It shall examine in particular whether the objectives, priorities and activities envisaged and financial resources are still appropriate to the changing situation. It shall also make an evaluation of all the specific programmes implemented under Decision 87/516/Euratom, EEC. It shall communicate the findings of this examination and evaluation to the Council together with its comments.

After the Council has examined this communication, the Commission shall submit to it the necessary proposals for decisions.

When implementation of the third framework programme has been completed, the Commission shall make a new evaluation of that programme.

Done at Luxembourg, 23 April 1990.

For the Council

The President

A. REYNOLDS

ANNEX I

BREAKDOWN OF THE AMOUNTS DEEMED NECESSARY TO IMPLEMENT THE VARIOUS ACTIVITIES ENVISAGED

(in millions of ecus)

	1990—92	1993—94	Total
I. ENABLING TECHNOLOGIES			
1. Information and communications technologies	**974**	**1 247**	**2 221**
— Information technologies	1 352		
— Communications technologies	489		
— Development of telematics systems of general interest	380		
2. Industrial and materials technologies	**390**	**498**	**888**
— Industrial and materials technologies	748		
— Measurement and testing	140		
II. MANAGEMENT OF NATURAL RESOURCES			
3. Environment	**227**	**291**	**518**
— Environment	414		
— Marine sciences and technologies	104		
4. Life sciences and technologies	**325**	**416**	**741**
— Biotechnology	164		
— Agricultural and agro-industrial research (1)	333		
— Biomedical and health research	133		
— Life sciences and technologies for developing countries	111		
5. Energy	**357**	**457**	**814**
— Non-nuclear energies	157		
— Nuclear fission safety	199		
— Controlled nuclear fusion	458		
III. MANAGEMENT OF INTELLECTUAL RESOURCES			
6. Human capital and mobility	**227**	**291**	**518**
— Human capital and mobility	518		
TOTAL	2 500	3 200	5 700 (2)(3)

(1) Including fisheries.
(2) Including ECU 57 million for the centralized action of dissemination and exploitation provided for in Article 4, drawn proportionally from each activity.
(3) Including ECU 180 million for 1990—92 and ECU 370 million for 1993—94 for the Joint Research Centre.

ANNEX II

THE ACTIVITIES

The third framework programme of research and technological development (1990—94) defines objectives for giving an innovatory thrust to Community action during those five years. The specific programmes of the second framework programme (1987—91) are retained. The third framework programme will be able to bring to them the necessary elements of continuity.

The selection of the broad outlines of the third framework programme meets six major concerns:

— improving industrial competitiveness whilst maintaining the pre-competitive nature of Community activities;

— meeting the challenges linked to the attainment of the large market as regards norms and standards by strengthening prenormative research;

— modifying industrial operators' attitudes in the direction of further transnational initiatives;

— introducing a European dimension into the training of scientific research and technological development staff;

— increasing economic and social cohesion whilst ensuring the scientific and technical excellence of research projects;

— taking into account environmental protection and the quality of life.

The choice of scientific and technical objectives rests *inter alia* on the principle of Community added value and subsidiarity. In this sense, the criteria laid down for the previous framework programme and set out in Annex III take on an added significance; they will be taken into account in the evaluation of the different activities.

There will be greater consultation of representative scientific, technical and industrial bodies in the Community.

In industrial programmes, the emphasis will be on pre-competitive research and technological development. The main objective will be to contribute to strengthening the technological bases for the development of standards in order to encourage the attainment of the single large market, thus making it possible for industry to invest in the design of products on the basis of common standards. Transfer of technology in order to encourage the use of new technologies will assume particular importance and will include certain demonstration projects with particular reference to use of such standards. There will be no financing of product development.

The principal instrument of the specific programmes remains the shared-cost action, without ruling out the possibility of adjusted rates of support. In those cases where coordination of existing research activities at national level is the predominant aspect, concerted action will be used. The other methods of implementation provided for in the Treaty may be used, in particular to establish or strengthen links with long-term Eureka projects meeting the criteria for Community action.

The Joint Research Centre is to participate in the implementation of the framework programme in those fields where it has the necessary competence. These are *inter alia* industrial and materials technologies, research with a prenormative character, nuclear safety (fission and fusion), technological forecasting, the environment and industrial risks.

The research, development and innovative capacities of small and medium-sized undertakings, higher education establishments and research centres will be given sustained attention and their activities in partnership will be encouraged. Particular attention will be given to promoting the access of small and medium-sized undertakings to Community programmes.

Emphasis will also be placed on the various courses of action on fundamental research geared to any area where it might become necessary.

The Council will define the detailed arrangements for the dissemination of knowledge resulting from the specific programmes and other arrangements for implementing the framework programme. Within this legal framework, dissemination activities will be coherent and coordinated, which presupposes on the one hand a central level of management and on the other freedom of action in specific programmes to organize a level of specialized dissemination. In both cases, such activities may be carried out in particular through publications or by computerized means according to common standards and protocols.

The activity of dissemination will also cover information on Community programmes and actions to provide easier access to information for small and medium-sized undertakings and private and public research laboratories. To this end, encouragement will be given to the creation or extension of the activities of national and regional relay centres for the dissemination and exploitation of results.

As far as the exploitation of results is concerned, although it is clear that in the first place it is the responsibility of undertakings and laboratories, in certain cases it requires Community action, coordinated with the operators concerned and the competent public or private organizations in particular at national or regional level (including *inter alia* the above relay centres), in order to protect certain results and facilitate and guarantee the best possible innovation transfer.

Both for the dissemination of knowledge and for the exploitation of results, it is necessary to specify or define the rules concerning intellectual and industrial property and the exploitation of the results within the Community and to observe them.

In addition to the evaluation activities involved in the various programmes, work on the methodology of evaluation, forecasting and strategic analysis will also continue unabated in cooperation with the Member States with a view to improving the effectiveness of Community research.

In strict accordance with the guiding character given to the framework programme by the Treaty, the following paragraphs make reference to the strategic elements of the 1990—94 framework programme.

I. ENABLING TECHNOLOGIES

1. Information and communications technologies

The development of the relationship between information and communications technologies, the increased requirements of users regarding standardized systems and trans-European services networks to assist in unifying the European area and the strengthening of scientific and technological bases lead work on information and communications technologies to be directed in three main ways. An essential aim is to achieve open standards making it possible to improve the integration of advanced systems into the networks. In all the areas concerned, the active participation of users and small and medium-sized undertakings and the transfer of technology to their advantage will be encouraged.

A. *Information technology*

Whilst ensuring that all the work relating to information technologies remains focused in the pre-competitive area, the emphasis will be placed, on the one hand, on demonstration activities for the preparation and validation of standards and for the integration of technologies and, on the other, on basic research, in particular in sectors which have the potential to make a substantial impact on industrial innovation, such as the cognitive sciences. In addition, activities on topics dealt with in the Esprit programme will be oriented towards the new generations of technologies. In a general sense, the balances between the various basic areas of technology defined in Esprit II (including those for microelectronics) will be respected.

The various activities envisaged may be grouped round four large fundamental topics which contain elements of continuity but also exhibit new facets in comparison with earlier research.

(a) Microelectronics

The objective is to contribute, by means of pre-competitive research and technological development work, to the strengthening of the European technological base in respect of semiconductors on which to base a European manufacturing capability for advanced products and the technologies for component processing. This work will also concern application-specific integrated circuits (ASIC), multi-function circuits, very fast circuits, opto-electronics, advanced power circuits (smart power), new equipment and materials for integrated circuits and, in conjunction with other initiatives in the Community such as Jessi, the technologies linked to submicron silicon.

Research into and development of advanced and standardized computer-aided design tools for integrated circuits will also be pursued, particular attention being given to users' needs.

These actions will be organized in such a way as to link users and producers and encourage and ensure broad participation by operators in the Community as a whole, for the benefit of all.

(b) Information processing systems and software

The rapid development of this sector leads research to be directed towards parallel architectures, knowledge-based systems, work stations, hosts and distributed and real time systems. The tools and methods necessary to increase the productivity of the software and the integration of the systems will continue to be developed.

Emphasis will be placed on the portability of the software, re-usability and design of standardized modules and on prenormative research. Attention will also be given to seeing that European industry, in particular small and medium-sized undertakings, can adopt standardized software on a large scale and use the best practices in the area of programming tools, methods and environments, taking account of national activities in this area.

(c) Advanced office technology systems and peripherals

The main objective will be to use European technological competence to construct improved forms of architecture, software packages and other system components capable of adding to the value of devices and systems, in particular those based on standards.

The two main themes are research and development concerning the use of software engineering for the development of selective applications based on open standards and the integration of sophisticated information systems and interfaces. Among the fields concerned may be cited information systems adapted to mobile terminals, cooperation work (groupware), house automation and intelligent buildings and integrated data processing systems for business.

In this context, peripherals take on an added importance. The objective of research and development work is to reinforce the scientific and technological bases for new generations of peripherals which are reliable, cheap and capable of being produced in large quantities, without going as far as product development. This requires the use not only of basic technologies at the best state-of-the-art level, but also of new generic methods of manufacture. The action will have to lead, for instance, to new in-out arrangements and storage systems.

(d) Computer-integrated manufacturing and application of information technology to industrial engineering

The objective is to provide, by means of pre-competitive research and technological development work, the bases for open, multisite and multi-vendor systems. The work will cover planning and scheduling systems, production control, computer-assisted engineering systems, robotics and quality-guarantee technologies. The areas concerned are those of discontinuous, continuous and batch manufacture, flexible assembly and mass production. Technology transfer activities will comprise some demonstration projects in which information technologies occupy an important position and which may be launched in real industrial environments enabling standards to be validated and their use to be promoted. These activities will be carried out in close coordination with those under heading 2.

This action will contribute to better integration in advanced systems of design and computer-assisted production of the needs voiced by industrialists including problems of work integration and organization and job evaluation.

B. *Communications technologies*

The principal objective is to enable the integrated broadband network to take on the emerging new services, constructed on 'open' standards, and to make the use of integrated services both flexible and cheaper.

Parallel to the continued development of the integrated broadband network and the strengthening of the research effort on optical communications and techniques of synchronic/asynchronic switching, the new activities will be directed towards the development of intelligent, reliable and secure networks and new value-added services that are both profitable and adapted to the developing needs of users. These actions include a Community R & D effort of the prenormative type in order to guarantee the interoperability of the systems on the basis of common standards and protocols.

Particular attention will be given to the growing demand for mobile telephony services and the integration of these services into networks.

The following actions are planned:

— **Development of intelligent networks,** using new techniques of information transfer, optical communications and possibly artificial intelligence. The objective is to enable second-generation systems to exploit foreseeable progress in data processing. This requires research and

technological development work in the fields of standardization and interconnection protocols. This work should take into account the development of a new European regulatory environment on open architecture (ONP — Open Network Provision).

— **Mobile communications.** The objective is to contribute to definition of the standards necessary for the third-generation system which should appear on a time-scale of 1996 and beyond and permit the exploitation of new hyperfrequencies in mobile telecommunications services.

— **Image communication:** building on numerical image transfer (including high-definition television — HDTV), research efforts are needed into processing, storage and display to integrate image into multimedia communications and to ensure the development of allied protocols and coders-decoders.

— **Service engineering:** work of a prenormative type on architectures and software, realized on basic teleservices and on improved value-added services, with particular attention to their ease of use by small and medium-sized undertakings and preparing the scientific and technological bases for development of standards both for systems and for telecommunications services.

— **Experiments in advanced communications.** It will be necessary to identify the characteristics and functions of certain advanced model services. These experiments of a generic kind, in real conditions, will contribute to developing interconnection standards and to verifying the feasibility of integrated communication systems so as to limit the dangers when they are introduced later.

— **Security of information.** The objective is to contribute to the development of technologies which can guarantee effective and practical security meeting the requirements of interconnected or integrated communication services used by economic operators and by the general public. Priority research and technological development work is required to contribute to the definition of international standards and verification technologies.

C. *Development of telematic systems in areas of general interest*

The general objective consists, by means of prenormative research and a limited number of experimental development activities concerning the validation of common functional specifications, in ensuring the interoperability of systems, peripherals and telematic networks at trans-European level. Special attention will be given to considerations of quality, reliability, security and ease of use of services, and to economies of scale and the abolition of barriers to information exchange.

The work will be carried out in areas corresponding both to requirements resulting from the implementation of the large European market and the new increased requirements of a social and economic nature which can both benefit from the use of new telematic resources.

The realization of the large internal market is setting new requirements in the field of services and information exchange. In relations between public administrations, new requirements are being expressed, for instance, in the areas of emergency services, justice, the social services, statistics, customs and the environment. Sectors of general concern are dominated by questions of transport, health, problems relating to the handicapped and aged, problems of training, problems of links between libraries and access to rural areas.

To meet these requirements, beyond the efforts being undertaken within regional or national contexts, an additional Community effort is also needed in research and technological development.

More specifically, some of these sectors have already been explored in the course of exploratory activities (AIM, Delta, Drive) or preliminary activities (investigation of needs in rural areas and libraries). The planned research and technological development actions will be based on the experience and results obtained from these exploratory actions. Endeavours will be made to achieve their continuity so as not to lose the advantage of the community of interest created.

It will only be possible to develop such projects fully outside the framework programme: the setting-up and exploitation of networks and services are not covered by this work.

In each of the above two areas, making services easier to use will require a sustained effort in language research and engineering. Following work already done as part of the Eurotra programme, it is now necessary to encourage the development of operational systems linked to information and communications systems.

All these actions will involve information and communications industries, telecommunications operators, providers of telecommunications services and pioneer users of advanced communications. In the case of telematic services, the trans-European dimension will be even more necessary for success than elsewhere.

2. **Industrial and materials technologies**

The objective is to contribute to the rejuvenation of European manufacturing industry by strengthening its scientific base through research and development work. With that in mind it is important to encourage:

— basic technical research;

— integration of new technologies by user industries;

— acquisition of the scientific and technical knowledge needed in order to establish standards and codes of good practice facilitating the transfer of such technologies;

— harmonization of methods of measurement and testing.

The advanced technologies required cover the whole life-cycle of materials and aim at reducing the 'design to product' lead time and improving manufacturing processes. In selecting actions to be implemented, account will be taken of the experience acquired through current programmes and pilot projects (Brite-Euram, Raw Materials, Recycling and BCR).

These technological developments will integrate considerations of future market requirements and more severe constraints as regards the environment and working conditions, while at the same time enabling improvements to be made in the competitiveness of European producers and users.

The more it can be guaranteed that technologies will have a human dimension, the more the quality of work and consequently the quality of production will increase. Work will therefore cover research and development concerning the working environment and continuous adaptation of the skills of workers to technological change. New methods of management and organization will be sought in order to ensure a smooth relationship between technology and the working world.

Work carried out in any of the three areas described below will be linked to the others and consequently not performed in isolation, but under a systematic approach. Research on new materials will be closely linked to research on the design and manufacturing processes needed to make economic use of the materials and prenormative research allowing the incorporation of such materials into products and ensuring environmental acceptability.

The research work proposed will help to consolidate and further technological developments within the Community and make more effective use of resources. A particular effort will be made to help small and medium-sized undertakings become more involved in transnational research, develop links with other undertakings and universities and manage their technical resources better.

Research on measurements and testing is necessary to the application of harmonization of quality standards and testing methods and the acceptance of results throughout the Community. Greater collaboration between laboratories will improve the quality of results and their acceptability, as called for by the completion of the single market.

This approach concerns both the following areas of activity and their interfaces:

A. *Materials — Raw materials*

The objective is to contribute to improving the performances of materials at a cost which permits competitive industrial exploitation over a broad range of applications not restricted to a few high-performance items. The aim will be to promote an integrated approach to the whole life-cycle of materials, including recycling.

The activities in question will concern both research on advanced materials for key applications, such as ceramic composites and metallic matrices, which may have important spin-off effects in other areas, and research on traditional materials of broader application, such as are used in the construction industry where improvements to the materials life-cycle are needed.

Emphasis will be placed on research enabling innovative uses of materials, metals and industrial minerals, and on their production and processing, including exploration, recovery and recycling.

There will also be strong encouragement to undertake basic research and exploit emerging and rapidly-developing technologies.

Particular attention will be paid to research into new materials to improve understanding of their structures and properties, including the production cycle.

B. *Design and manufacturing*

The objective is to reduce the 'design to product' lead time and to improve the means, processes and management of design and manufacturing operations, on the basis of the state of the generic technologies concerned.

Emphasis will be placed, *inter alia,* on quality, reliability, the control of products and processes, and on the research and technological development work needed for the adaptation of computer-aided design and manufacturing techniques, especially for small and medium-sized undertakings. Care will be taken to ensure close coordination of this activity with the generic aspects of such design and manufacturing techniques covered by heading 1.

The development of the technologies necessary for the modernization of European industry requires a basic research effort, in particular in the areas of physics and chemistry. Similarly, recourse will be had at the same time to generic disciplines (such as mathematical modelling, acoustics, fluid dynamics, process engineering, etc.) and new technological developments (concerning, for example, surface treatment, miniaturization, optomatronics, etc.).

C. *Measurement and testing*

The objective is to lead, by means of improved harmonization of methods of testing, measuring and analysis, to the elimination of certain obstacles to trade in the large internal market.

To that end, transnational actions will be undertaken in four main fields: establishing the scientific and technical bases for Community regulations and directives concerning measurements (including exploitation of research results concerning instrumentation), testing and analysis; the resolution of such sectoral testing problems as might arise when an international approach to certification and testing is adopted and implemented; work arising out of a coordinated approach to the provision of measuring standards adopted henceforward in the Community; and support for the development of new methods of measurement.

The drawing up and implementation of standards and codes of good practice, which are necessary to meet the requirements of the market and which require prenormative research and development work, will be guaranteed by means of the research programmes concerned and are covered by other lines of activity.

In carrying out the research outlined above, flexibility of means of action will be particularly important. Two notable means of implementing these proposals will be:

— Technological stimulus and cooperative research action to extend current initiatives, an open arrangement, without any constraints of theme or timetable, will be set up to support particularly innovative technological projects which, at any given time, could not be included in the other actions. This will help in particular to solve technical problems common to groups of small and medium-sized undertakings without research facilities of their own. This activity is defined in relation to the other sections of the programme as meaning that as a general rule only small and medium-sized undertakings can be considered, in conjunction where appropriate with research centres, with a view to increasing their involvement in Community research programmes.

— While maintaining the generic approach followed under this heading, selected integrated projects will be considered in appropriate fields where a range of generic technologies need to be brought together with a view to providing users with a definition of operational specifications. These projects will have specific targeted objectives, bringing suppliers and users together in a systematic approach and at the same time facilitating the participation of small and medium-sized undertakings. Product development and commercialization will be a matter for the competent industries.

  In view of the needs created by the setting up of the large internal market, the fields to be considered here would include, for instance, transport (which may be the subject of integrated activities concerning, for example, the aeronautical industry — after evaluation, the motor industry and the 'clean car'). The logistical aspects of harmonization and standardization of means of transport will also be given special attention in conjunction with the activities under heading 1. Other fields will be likely to benefit from an integrated approach.

In general, all these actions will have to contribute to the emergence of European small and medium-sized undertakings, in particular by encouraging their integration in the technological networks developed at that time.

The Joint Research Centre will contribute to these activities via work on advanced materials which gives priority to the prenormative aspect, the preparation of nuclear and non-nuclear reference materials, the acquisition of reference data and the validation of certain reference techniques.

II. MANAGEMENT OF NATURAL RESOURCES

3. Environment

Here the purpose is to develop the scientific knowledge and technical know-how the Community needs in particular to carry out its role concerning the environment, as spelt out in Title VII of the EEC Treaty.

In this sector, the research activities are directed towards an understanding of the fundamental mechanisms of the environment, identification of pollution sources and assessment of their combined effects on the environment. They will contribute to the preparation of quality standards, safety and technical standards and the working out of methodologies for environmental, health and economic impact assessment, and will also be geared towards the prevention of natural and technological hazards and towards rehabilitation of the environment. In addition to these activities, 'horizontal' aspects of the environment will be taken into account in the various courses of action.

A. *Participation in global change programmes*

The objective is to contribute to understanding of the processes governing environmental change and to assess the impact of human activities. Community participation will be concentrated on problems which will have an impact on environment policy and in areas where the Community is best placed to ensure European coordination in the framework of large international programmes while taking account of national programmes. This participation will contribute to the development of research on natural and human-induced climatic change, the interaction between biogeochemical cycles, atmospheric physics and chemistry, effects on ecosystems, physical, chemical and biological oceanography and climatic processes in general, as well as the depletion of the stratospheric ozone layer.

B. *Technologies and engineering for the environment*

The objective is to promote better environmental quality standards by encouraging technological innovation at the pre-competitive level. The two main lines of research in this field will be environmental monitoring, including remote sensing applications and the development of techniques and systems to protect and rehabilitate the environment (for example recycling, treatment of toxic wastes, of contaminated soil and of waste water, and clean technology).

C. *Marine sciences and technologies*

In the area of marine sciences and technologies, in addition to the MAST pilot programme a special effort will be made on basic know-how (including oceanography), coastal engineering and technologies for the exploration and exploitation of resources whilst respecting the environment.

D. *Research on economic and social aspects*

The objective is to improve understanding of the legal, economic, ethical and health aspects of environmental policy and management, and concerns: natural and technological risk assessment, perception and management, the economic evaluation of environmental impacts, the socioeconomic impact of the implementation of environmental policies, and the effectiveness and consistency of laws and regulations related to environmental matters.

E. *Integrated research projects*

The objective is to cooperate on interdisciplinary research into a limited number of areas of transnational interest. These transnational projects may involve coordinated campaigns, extending from observation and experimentation to integrated operations attaching to all aspects of a regional issue and encompassing general research work on natural and technological risks. Integrated research into modelling will also have to make possible assessment of technological strategies for the environment. There will also be concerted action on the databank.

The Joint Research Centre (JRC) will contribute to activities in the environmental field, in particular by prenormative work on atmospheric chemistry and on modelling, by study of the assessment and management of technological risks and by use of experimental ways of assessing such risks. The JRC will make a specific contribution to the application of remote sensing techniques in cooperation with the European Space Agency; in cooperation with the future Environment Agency of the European Community, it will contribute to the development of new instruments and trial techniques, to the harmonization of methods of measurement and to intercalibration.

4. **Life sciences and technologies**

The long-term strategic objective is to contribute in a selective and integrated way to the development of Europe's potential for understanding and using the properties and structures of living matter.

A. *Biotechnology*

The aim of this research is to reinforce basic biological knowledge as the common and integrated foundation needed for applications in agriculture, industry, health, nutrition and the environment.

All the necessary importance will be attributed to the ethical implications of such work and their relevance to industry.

The goals of the Bridge programme will be expanded. The priority areas will include protein structure and function, molecular modelling, the structure and function of genes, in particular genome analysis in representative species, the conservation of genetic resources, the expression of genes and controls thereon, cellular regeneration and development, and the reproduction and development of living organisms. Work will also cover animal and plant microbe metabolisms and their essential physiology, the ecological implications of biotechnology, with particular reference to microbe ecology and the environmental behaviour of modified genes and organisms. Communication systems within living matter, in particular immunology, neurobiology and the operation of receptors, will also be studied.

The methods and tests making up the requisite scientific prenormative bases for the preparation of Community rules will be developed.

B. *Agricultural and agro-industrial research*

The objective is to contribute to securing a better match between production of land and water-based biological resources and their use by consumers and industry. Within the pre-competitive field, sights should be set on upgrading and diversifying agricultural and sylvicultural products, on enhancing the competitiveness of agricultural and agri-food undertakings in line with other Community policies, while contributing to better rural and forestry management and to ensuring proper protection for the environment.

These will involve interdisciplinary projects which make use in particular of the findings of biotechnology and take account of genetic factors, agricultural and sylvicultural engineering, cultivation or breeding techniques, and environment-plant interaction. In particular, there will be a project to develop effective remedies for desertification and deforestation. Research in the field of aquaculture and fisheries will be pursued.

Work has already started on some topics in the second framework programme, especially under the Eclair programme. Still within the pre-competitive field, they will be supplemented by demonstration projects jointly developed by producers and users to bring the products of research and development closer to their applications.

In the field of industrial uses for agricultural and sylvicultural raw materials, still within the pre-competitive sphere, research must as a matter of priority be directed to innovative processes aimed at industrial exploitability of the by-products of food-oriented applications and at developing new, cleaner industrial and energy applications holding out favourable economic prospects.

Agri-food research already begun under the second framework programme, in particular the Flair programme, will be amplified, particularly as regards: definition and satisfaction of nutritional

needs, toxicology and food hygiene, new technologies for agri-food processing. Further work in these sectors will take account of ongoing programmes (Eclair, Flair, agricultural research and fisheries).

When these projects are being implemented, encouragement will be given to the execution of innovative projects by small and medium-sized undertakings.

C. *Biomedical and health research*

The chief objective is to contribute to improving the effectiveness of research and development in medicine and health in the Member States, in particular through better coordination of their research and development activities, to applying their findings through Community cooperation and to using available resources in common.

The main focus is on new approaches to tackling economically and socially significant diseases (in particular cancer, AIDS, cardiovascular disease and mental illness), ageing, the problems of the handicapped and the problems of health at the workplace, through harmonized methodological and protocol studies in epidemiological, biological and clinical research. Activities will also cover the analysis of the human genome and will be closely coordinated with work done elsewhere on the other genomes. Ethical, social and legal aspects of implementing the findings of research into the human genome will be carefully assessed.

This action will be supplemented by pre-competitive research into ways and forms of administering medicines.

Particular attention will be paid to methods of early screening for risk factors, to the development and assessment of prophylactic and therapeutic methods and to the management of health services.

D. *Life sciences and technologies for developing countries*

The objective of this programme is to increase cooperation in the fields of tropical agriculture (including fisheries), medicine, health and nutrition between European scientists and scientists from developing countries so as to enable the developing countries to benefit from the scientific knowledge and technological developments available in the Community and to encourage the development of their own research capacity and the Member States of the Community to increase their own capacities.

All the problems associated with tropical areas (soil, water, forests, energy, environment, agriculture, population, health, nutrition, etc.) will be taken into account.

In tropical agriculture, emphasis will be placed on integrated management of agricultural resources, including aquaculture and forestry, for reducing food shortages in regions at risk while conserving the environment with due regard for the human factor. Special attention will be paid to crops which are potential substitutes for those used for producing narcotic drugs.

Tropical medicine research will undertake new initiatives on major health problems, particularly as regards transmissible diseases and health care systems.

5. **Energy**

The main aim of Community action in this area is the development of sound, environmentally safe energy technologies designed to improve the Community's energy balance at reasonable expense within the large market. This will be pursued in the following three areas.

A. *Fossil and renewable energy sources, energy utilization and conservation*

The objective is to contribute to the development of new energy options that are both economically viable and more environmentally safe, including energy-saving technologies, by means of joint activities to assist Member States in this direction. In this connection, increased attention must be

paid to work on those energy technologies which, despite their high potential and the fact that they have no adverse effects on the environment, particularly the climate, cannot be used under satisfactory economic conditions at present as this work cannot yet be fully funded by industry.

Activities will be concentrated in three interconnected areas: energy conservation, renewable sources and reduction of the adverse impact on the environment. As regards energy conservation, account will be taken of the leading role of fossil fuels in the Community's energy supplies. This will include work on improving technologies for economizing energy in all its uses, energy production from fossil sources using advanced technologies, in particular combined cycles, and suitable substitutes for conventional fuels in the transport sector. As regards the environmental impact of producing and using energy, in particular electricity, emphasis will be placed on reducing emissions of gases responsible for the greenhouse effect, including CO_2. R & D work in the field of renewable energy sources will be stepped up to bring it rapidly up to the level where it can make an optimal contribution to the Community's energy policy.

Research into modelling should also enable technological strategies relating to energy conservation and energy-environment interaction to be assessed.

B. *Nuclear fission safety*

The aim of this action is to continue the common endeavour to support Member States in the fulfilment of their responsibilities for regulating and protecting the environment.

Community action will foster a harmonized approach to safety by bringing together all the parties involved, thus reinforcing the prenormative dimension of research. A new impulse will be given by concentrating research on reactor safety with greater attention to passive technologies, radioactive waste management, decommissioning operations, intervention in a hostile environment, fuel elements, actinides and control of fissile materials. Radiation protection research will cover radiation from natural and medical sources, a better definition of the risks of low radiation doses and new technologies to assess quickly the radiological consequences of nuclear accidents.

The Joint Research Centre will participate in this action through work in the field of reactor safety, radioactive waste safety and management, the management and safety of fissile materials, nuclear fuel and actinides.

C. *Controlled nuclear fusion*

The long-term objective of the Community fusion programme is the joint creation of safe, environmentally sound prototype reactors. The immediate objective is the establishment of the scientific and technological base for the construction of an installation designed to achieve and study the ignition and prolonged combustion of plasma and related technological problems (Next Step). Accordingly, in order to achieve control of plasma in conditions close to those of the Next Step, the Council could decide, in the light of the evaluation, to prolong the JET Joint Undertaking beyond the date currently planned. Work relating to the Next Step and the new systems will be continued taking into account developments in ITER cooperation. Following assessment of ongoing actions, work may include the building of specialized equipment necessary for attaining the objectives of the programme. Some existing fusion devices will be phased out, having completed their experimental programmes. The present keep-in-touch activity with other approaches to controlled thermonuclear fusion, and particularly with inertial confinement, will be continued.

The Joint Research Centre will make its contribution by means of work on installation safety, support for NET and some basic work on materials. This work will be closely coordinated with that undertaken in the same fields in associations.

III. MANAGEMENT OF INTELLECTUAL RESOURCES

6. Human capital and mobility

The objective is to help increase the human capital in terms of research and technological development which the Member States will be needing in the next 10 years and to make optimum use of their scientific and technical infrastructure, paving the way for a genuinely European scientific and technical community. This action should provide Community added value of benefit to all Member States.

Unlike the preceding headings, which are to be organized in a thematic or sectoral manner, this action will be organized across the board, following a bottom-up approach, around two main strands: training and mobility of research staff, and the building-up of networks.

Increased mobility of research staff will enable more of them to spend a significant amount of time during their careers working in high-level scientific and technical establishments in other Member States.

Actions will be aimed chiefly at training young people embarking on careers in research and technological development (especially at postgraduate level) and may also cover other staff, at times when they need to acquire new specializations, particularly during retraining required to adapt to rapid scientific and technological change, and in exchanges and cooperation schemes which are to be maintained on a permanent basis.

The building-up of an infrastructure of networks under this action is of crucial importance for the achievement of the objectives of the Community's research and technological development policy in consolidating and complementing the structuring effects of thematic programmes.

The networks will bring together both public and private sector laboratories and research teams from the Member States, so that they can all benefit from the experience acquired by the best amongst them. They will particularly encourage interchange between different disciplines, the grouping together of several techniques and the extension of applications from one area to another.

The networks should extend to all the regions of the countries of the Community, particularly bearing in mind the special needs of peripheral regions and regions that are currently lagging behind. Highly-qualified scientific and technical potential will thus be built up in these regions.

The activities being carried out under the Science plan will be taken further. In addition to twinning between laboratories, encouragement will also be given to projects of the same type involving both applied and industrial fundamental research, grouping together institutions from several countries or bringing together national and Community initiatives.

The effects of such action will be increased by developing cooperation between laboratories and teams of research establishments (including the Joint Research Centre), undertakings and higher education establishments.

Account must be taken of demographic factors and of the research and training structures peculiar to the various States, to help each of them to acquire the best possible capabilities.

This will also involve encouraging special access to existing major scientific facilities and fostering consultations when future facilities are being planned.

All these schemes will cover the various branches of technology, the exact and natural sciences, including mathematics and the human and social sciences, which help to strengthen the scientific and technical base of European industry and make it internationally competitive. Interfaces between basic science and technological applications will be taken into account.

Care will be taken to see that these activities have due regard to the existing bilateral and multinational cooperation to which the Member States are party, including cooperation in the COST framework.

Care will also be taken to see that they are in keeping with other Community training and research activities.

The scientific, technical and industrial community will be involved in implementing this project, particularly in identifying networks and choosing beneficiaries, with due regard for the guiding principles of the projects and for Community added value.

ANNEX III

SELECTION CRITERIA

In general, Community research and technological development (R & TD) actions should be selected on the basis of scientific and technical objectives, their scientific and technical quality and their contribution to the definition or implementation of Community policies.

A particular aim of Community R & TD shall be to strengthen the scientific and technological basis of European industry — including that of small and medium-sized undertakings — especially in strategic areas of high technology, and to encourage it to become more competitive at international level.

Community action can be justified where it presents advantages (added value) in the short, medium or long term from the point of view of efficiency and financing or from the scientific and technical point of view as compared with national and other international activities (public or private).

The following criteria in particular justify Community action:

— research which contributes to the strengthening of the economic and social cohesion of the Community and the promotion of its overall harmonious development, while being consistent with the pursuit of scientific and technical quality;

— research on a very large scale for which the individual Member States could not, or could only with difficulty, provide the necessary finance and personnel;

— research, the joint execution of which would offer obvious financial benefits, even after taking account of the extra costs inherent in all international cooperation;

— research which, because of the complementary nature of work being done nationally in part of a given field, enables significant results to be obtained in the Community as a whole in the case of problems whose solution requires research on a large scale, particularly geographical;

— research which contributes to the achievement of the common market and to the unification of the European scientific and technical area, and research leading, where the need is felt, to the establishment of uniform rules and standards.

ANNEX IV

RATES OF COMMUNITY FINANCIAL PARTICIPATION

The rates of financial participation by the Community are as follows:

— direct action will in principle be fully funded;

— concerted action may receive a contribution of up to 100 % of the costs of concertation;

— for shared-cost projects, the contribution will not normally be more than 50 %. Universities and other research centres participating in shared-cost projects will have the option of requesting, for each project, either 50 % funding of total expenditure or 100 % funding of the additional marginal costs;

— for the implementation of the activities provided for in Article 2 (2), the Council will decide for each individual case the details of the Community's financial contribution.

There may be no derogation from these general rules, except under the conditions set out in each specific programme.