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Research and technological development for Europe



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Research and technological development occupy an increasingly significant and central place in our lives. By extending the scope of our activities on a scale which would have been unimaginable a hundred years ago, science and technology play a key role in the process of economic development. Judiciously employed, they can make an enormous contribution to increasing our general well-being and to improving the quality of life, for both the individual and society.¹

European scientific and technological cooperation: virtue and necessity

Europe is the cradle of science and technology as we know them today: until a short while ago, it was there that all the major breakthroughs in knowledge occurred. At present, Europe can no longer claim to be in first place in most of the major fields of research and technological development. In some sectors (such as research on controlled thermonuclear fusion or particle physics), European research remains in the forefront at world level. Overall, however, its relative decline is clear – and all the more regrettable in that it shows itself in areas of exceptional economic importance: electronics and information technology, biotechnology, materials technology, etc.

The real difficulty which Europe faces is neither an absence of scientific and technological ability nor a lack of financial resources. Of course the overall outlay on research in Europe is less than that of the United States or (relative to the size of the population) of Japan. However, the essential weakness is the fragmentation of this outlay.

Now enlarged to 12 Member States, the European Community represents an immense economic and intellectual potential: a market of 322 million people, with more than a million scientists and technicians, including 450 000 research workers. However, optimal use is not being made of this potential: the scope of the efforts undertaken is still too often reduced by dispersion of resources for research, isolation of research teams and lack of coordination of research work, poor diffusion of information and duplication in the different national programmes.

European cooperation in research and technology is therefore an imperative one which has become more and more evident over the years. The European Community offers a natural and obvious framework for such cooperation. Community action in the field of research and technology dates from the very foundation of the Community and has continued to diversify and grow over the years.

Community research: history, structures, means

The history of Community research, like that of the Community itself, is one of a continual process of growth and maturation: the conquest of new fields, and increasing interpenetration of activities.

¹ This file replaces our No 15/85.

In 1955 a system of financial assistance was established for research in the 'historic' areas of European cooperation: coal and steel. This system continues to function today. In 1957, the Community equipped itself with its own research centre, the Joint Research Centre (JRC). At the beginning of the 1970s, the Community launched its first major multiannual thematic programmes in the energy, environment and raw materials sectors. These have now been succeeded by new programmes. The 1980s saw the birth of a whole series of 'second generation', highly integrated programmes, in the major technological fields: information technologies, biotechnology, materials technology, etc.

The increasing importance accorded by the Community to its activities in the research and technology fields has been given clear legal and institutional expression over the last few years. In 1984, the Community decided to coordinate all such activities within large integrated structures, the framework programmes of research and technological development, and launched the first framework programme (1984-87).

The most recent (and important) development in this process was the 'Single European Act', which in 1987 explicitly legitimized the Community dimension of scientific and technological cooperation by making research and technology an area of formal competence for the Community.

The 'Single Act' modifies very significantly the Treaty of Rome which founded the European Community. It contains a number of provisions which are intended to put new emphasis on European integration through the establishment of a single large market, the development of social policy, increased economic and financial cohesion, etc. For research and technology the Single Act provides a two-stage approach: the adoption by unanimity of multiannual framework programmes and decision by qualified majority on specific programmes. The present (and second) framework programme of research and technological development (1987-91) is based on the Single Act.

Community action in the field of research and technology, as currently exercised within this framework programme, essentially takes three different forms.

- First of all, there is the Community's 'own' research carried out at the Joint Research Centre, which is largely financed by the Community. The JRC comprises four establishments, located at Ispra (Italy), Karlsruhe (Germany), Petten (The Netherlands) and Geel (Belgium). It employs 2 260 people, of whom 700 are research workers. In the beginning, JRC activities were exclusively concentrated on research into nuclear fission. These activities gradually diversified and today cover several other areas for which the existence of an independent research centre can prove invaluable: for example, research on environmental protection, remote sensing, or preliminary research for the setting of standards (for materials, appliances using solar energy, etc.). At the same time, in the nuclear field, the JRC has specialized in nuclear safety.
- The second form of Community research, the major one in terms of scale, is research on the basis of 'shared costs': the European Commission defrays 50% of

the cost of work carried out by research centres, universities or industrial companies. The majority of specific programmes (Esprit, RACE, Brite, Euram, etc.) are carried out on a 'shared-cost' basis.

- Finally, certain Community activities (such as the medical research programme) take the form of 'coordinated action': the Community does not actually finance the research work as such, but looks after the coordination and meets the costs it entails.

Whichever of the last two forms they take, Community programmes are 'programmes' in the full sense of the word: they implement a strategic and coordinated approach and they involve a plentiful exchange of information and considerable publication activity.

The framework programme (1987-91)

The framework programme is an instrument for medium-term programming in the research and technology field: it sets general objectives and priorities, as well as the overall financial allocation and the breakdown of this allocation between the different major activity areas. The framework programme serves as a 'guide' for decisions to be taken during the five years covered by the programme: the extension of programmes which have ended and the adoption of new programmes. It therefore makes clearly visible to scientific institutions, companies and Member States, the medium-term research possibilities offered by the Community.

In the view of the European Community authorities, the framework programme (1987-91) constitutes the Community's answer to the twin challenge it currently faces:

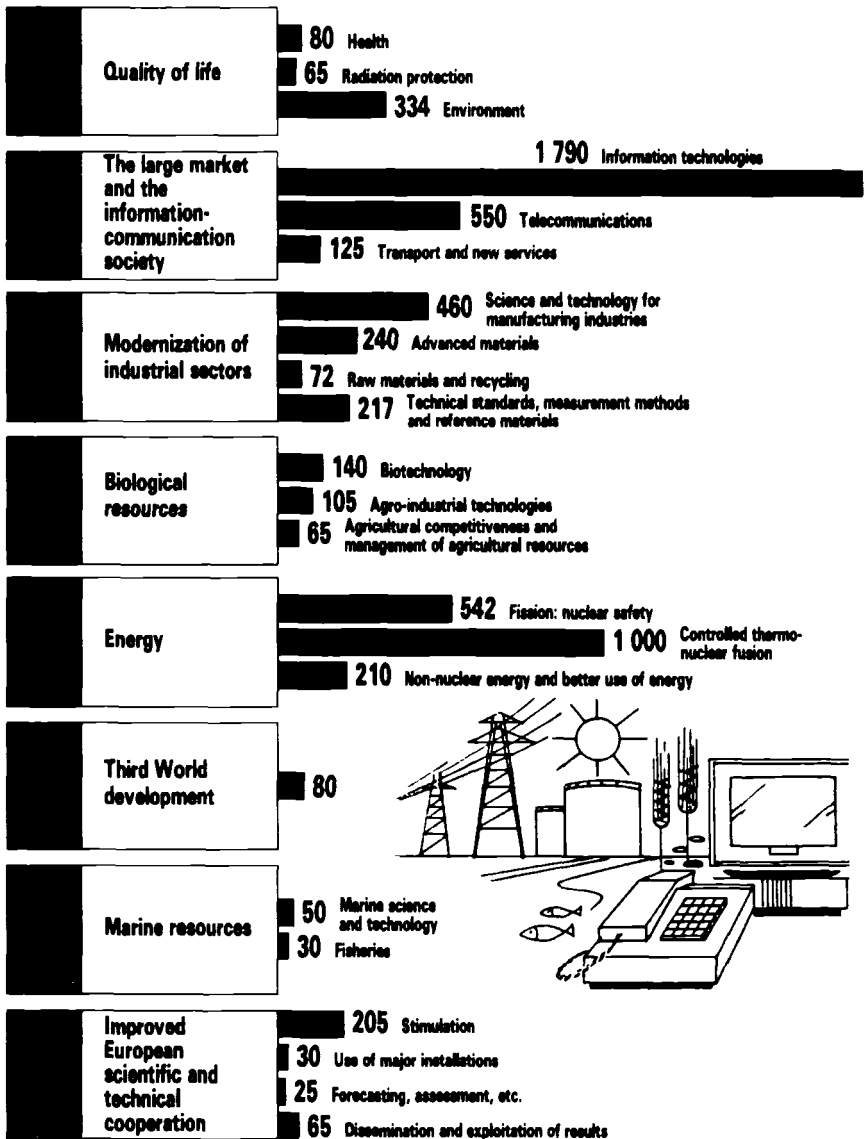
- The challenge to maintain and strengthen its competitiveness, *vis-à-vis* the United States and Japan, in the high-value-added technology sectors;
- The challenge to improve the cohesion of European economic development: such an improvement requires that disparities between Member States in the scientific field be reduced. This is possible only by ensuring the participation of all countries in high-level research.

The task of the framework programme (1987-91) is clear: it must accelerate the establishment of a true European 'scientific and technical area', an authentic European Community of research and technology, an indispensable ingredient of the 'large market without frontiers' which the Community aims to establish between now and 1992.

The philosophy of the framework programme is a simple one: not to transfer to the Community level most of the research work carried out in Europe (this would make no sense), but certainly to effect at this level all research which, for one reason or another, is more appropriately, more economically and more efficiently conducted

European Community framework programme of research and technological development (1987-91)

Breakdown of the amounts provided (in millions of ECU)



6 480 TOTAL

there. This would include research in areas, such as environmental protection or health, where the problems present themselves 'naturally' at European level; research which exceeds the financial or manpower resources of one single Member State, such as controlled thermonuclear fusion; research – and this is usually the case – in sectors where it is essential to make full use of the complementary knowledge and skills available in Europe: it is clear that no Member State, not even the largest, is entirely competent in every field.

One aspect of the framework programme (1987-91) which is of particular importance for all sectors is 'pre-standardization' research: it is through research carried out at Community level that European norms and standards will more easily be established. For this reason especially, the framework programme is an essential element in the process of completing the internal market by 1992.

The framework programme (1987-91) was adopted on 28 September 1987 and was allocated 6 480 million ECU.¹ It singles out for Community action in the research and technology field eight major lines of activity.

1. Quality of life

Under this heading comes Community research in the areas of health and the environment.

- Community action in the health field includes above all a programme to coordinate *medical research*. The two principal aspects of this programme of 'coordinated activities' are research on cancer and on AIDS (epidemiology, prevention, treatment). The medical research programme will soon be supplemented by a programme specializing in the field of *predictive medicine and novel therapy* (the application of genetics to the prevention and treatment of illnesses of the immune system, congenital illnesses, etc.). It has already been supplemented by a programme on *radiation protection* (studying the effects on the body of natural, medical or industrial radiation) and activities concerning *occupational medicine* in the coal and steel industries.

- Community activities in the environmental field are concerned with actual environmental protection (the build-up of pollutants in the environment, 'acid rain', the protection of historic monuments, etc.), climatology (the effects of an

¹ 1 ECU (European currency unit) = about £ 0.69, Ir£ 0.77 or US\$ 1.23 (at exchange rates current on 6 November 1987).

accumulation of carbon dioxide in the atmosphere, the problem of deterioration of the ozone layer, etc.) and the study of major technological risks. The environment constitutes an important area of the JRC's activities.

2. Information and telecommunications technologies

- [] Community research in the *information technologies* field is centred on the Esprit programme. Launched in 1984, Esprit was designed to run for 10 years: 1984-93. The first phase of the programme, successfully completed in 1987, represented the real beginning of European cooperation in information technology. For this first phase, 225 projects were selected, involving more than 450 different participating entities and nearly 3 000 research workers. The second phase of Esprit, which has been provided with an increased budget, should enable the results obtained in the different programme sectors (microelectronics, knowledge engineering, advanced information processing, office automation, robotics, etc.) to be extended and broadened.
- In the related field of *telecommunications*, Community action has given rise to another programme of wide scope: RACE. Drawn up in liaison with the national post office and telecommunications authorities, RACE is part of an overall strategy, the aim of which is to ensure the coherence of the different telecommunications systems and services being developed in Europe. Its specific objective is to enable a progressive development towards a Community system of integrated broadband communications (IBC), beginning with the integrated services digital network (ISDN).

Esprit and RACE are intended to be supplemented by a series of specialized programmes on the application of information and telecommunications technologies: Delta (teaching through computers), DIME (new technology in banking and finance), AIM (medical information) and Drive (the use of informatics in road traffic).

3. Industrial technologies

- [] The application of *new technologies in industry* is the aim of a particular programme: Brite. Its specific field is the application of advanced technologies (laser, computerized design, mathematical modelling, etc.) in manufacturing industry: automobiles, aeronautics, textiles, chemistry, etc. The first phase of Brite financed some 200 projects in which Community firms and universities were associated in an often unprecedented manner. The second, and more ambitious, phase will continue to develop the programme.
- [] The Euram programme is devoted to the expanding technology of *materials* and aims to give Europe the capability to perfect and produce 'new materials' for automobiles, construction, aeronautics, etc. It covers almost the whole vast field of materials technology: new alloys, engineering ceramics, composite materials, etc. It also supplements the long-standing activities of the JRC establishment at Petten in the area of high-temperature materials.

- It is equally appropriate to include under the heading of industrial technologies Community research in the area of *raw materials* (exploration and mining technology, the recycling of waste, the use of wood, etc.). Also to be included here is preliminary research for the establishment of norms and standards, carried out as part of the programme of the Community Bureau of References (CBR) and, as regards nuclear norms and standards, by the JRC establishment at Geel.

4. Energy

Three principal forms of energy are still the subject of research at Community level.

- *Nuclear fission energy*: Community research has specialized in the vital area of safety: the safety of reactors (light-water and fast-breeder types); the management and disposal of radioactive waste (treatment, conditioning, long-term storage in safe geological sites, etc.); the decommissioning of nuclear power plants at the end of their useful lives. Nuclear safety accounts for 60% of the activities of the JRC, which has acquired considerable experience in this area.
- *Nuclear fusion energy*: Europe is a world leader in this field due to the research carried out on the JET. The JET is the essential element of the European research programme on controlled thermonuclear fusion, a potential form of energy for the next century. It is a 'tokamak' type machine which uses the principle of 'magnetic confinement' of plasma at high temperature in a torus-shaped enclosure. The work carried out on JET aims to demonstrate the 'scientific feasibility' of fusion. Concurrent with this research work, the period 1987-91 should see progress on the planning of the next stage, NET. NET is intended to demonstrate the 'technological feasibility' of fusion. The fusion programme also involves work conducted in external laboratories linked to the Community and the JRC by association agreements.
- *Non-nuclear energy*: This is an overall heading for the technologies for production, transport and exploitation of energy in non-nuclear form: solar energy (passive solar technology and photovoltaic conversion), wind energy, biomass, geothermal energy, fossil fuels (liquefaction and gasification of coal), sensible use of energy, etc. The Community is active in these different areas through a shared-costs programme and – as regards solar energy – through the JRC establishment at Ispra.

5. Biological resources

The 1987-91 framework programme includes a whole group of closely linked research activities on the sensible use of living resources. The Community research programme in the *biotechnology* field covers sectors associated with the application of biotechnology to agriculture and agro-industry: the identification and transfer of plant genes, the study of protein architecture, the genetics of livestock disease

viruses, etc. This programme supplements Community activities in *agricultural research* and will itself be supplemented by a programme on the *application of biotechnology to agro-industry* (agri-foodstuffs, agro-chemistry, agro-energy, etc.).

6. Development aid

Under the heading 'science and technology for development', the Community carries out a research programme which specializes in the application of science and technology to the problems of the Third World. Covering the fields of agriculture and tropical medicine, this programme explicitly aims to strengthen the internal scientific capabilities of developing countries by associating laboratories from the North and the South in common projects.

7. Marine resources

Community action in this field is intended to cover both research aimed at increasing knowledge of the oceanic environment (models of the behaviour of marine waters etc.) and work in the areas of exploration of the sea bottom, fishing, aquaculture, etc.

8. European scientific and technical cooperation

This last heading includes several activities with the common characteristic of contributing to accelerate the establishment of the 'Europe of science and technology'.

- '*Stimulation activity*' embraces advanced research projects in the fertile areas which occur at the meeting point of different disciplines (for example, the Brain project in the area of neuro-informatics); these will be supplemented by a plan for *optimal exploitation of the major European scientific installations*.
- The FAST programme of forecasting and assessment is a tool for reflecting on the future development of science and technology, their impact and their social uses.
- The Eurotra research programme in the field of *automatic translation* may also be included under this heading, as may the different activities for *dissemination* of the results of Community research: publications, data banks, etc.

The framework programme in context

Thus constituted, the 1987-91 framework programme of research and technological development takes its place among other Community cooperation activities, with which it will be integrated.

- In the overall context of Community activities, it fits into a wider system of training/research/demonstration/innovation, which includes, upstream and

downstream of the actual research work, a certain number of other programmes: Erasmus (student mobility), Comett (university-industry cooperation), Sprint (innovation and transfer of technology), NETT, STAR and Valoren (the transfer of technology in the fields of environmental protection, telecommunications and energy, respectively), demonstration projects in the energy field, etc.

- [] In the general context of scientific and technical cooperation, the framework programme occupies a central place between research of the most basic kind and applied research. Broadly covering the areas of finalized basic research and pre-competitive technological development, it lies between European cooperative activities in pure basic research (CERN, the European Space Observatory, etc.) and more advanced activities for either the development of goods and services demanded by the market (Eureka) or commercial development (Airbus).

As exercised through the framework programme, Community action in the research and technology sphere plays a specific role in European scientific and technological cooperation. That this role is indispensable is demonstrated by the recent achievements of Community research. Results of major scientific value and incontestable economic interest have been recorded; a tradition of cross-border collaboration between laboratories and companies has established itself: something which would not have occurred without Community programmes. The results achieved on these two levels provide much encouragement to pursue a task far from completion: the construction of a true European Community of research and technology ■

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