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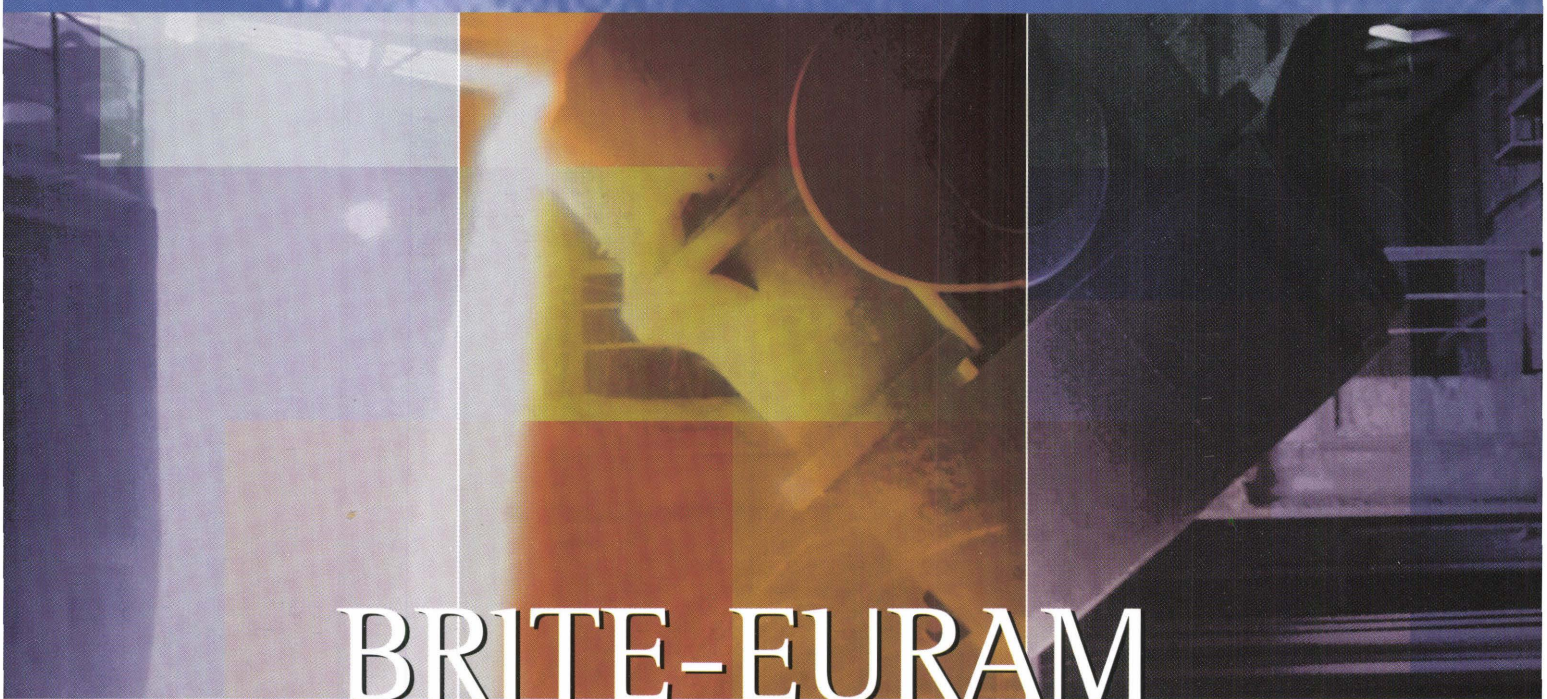
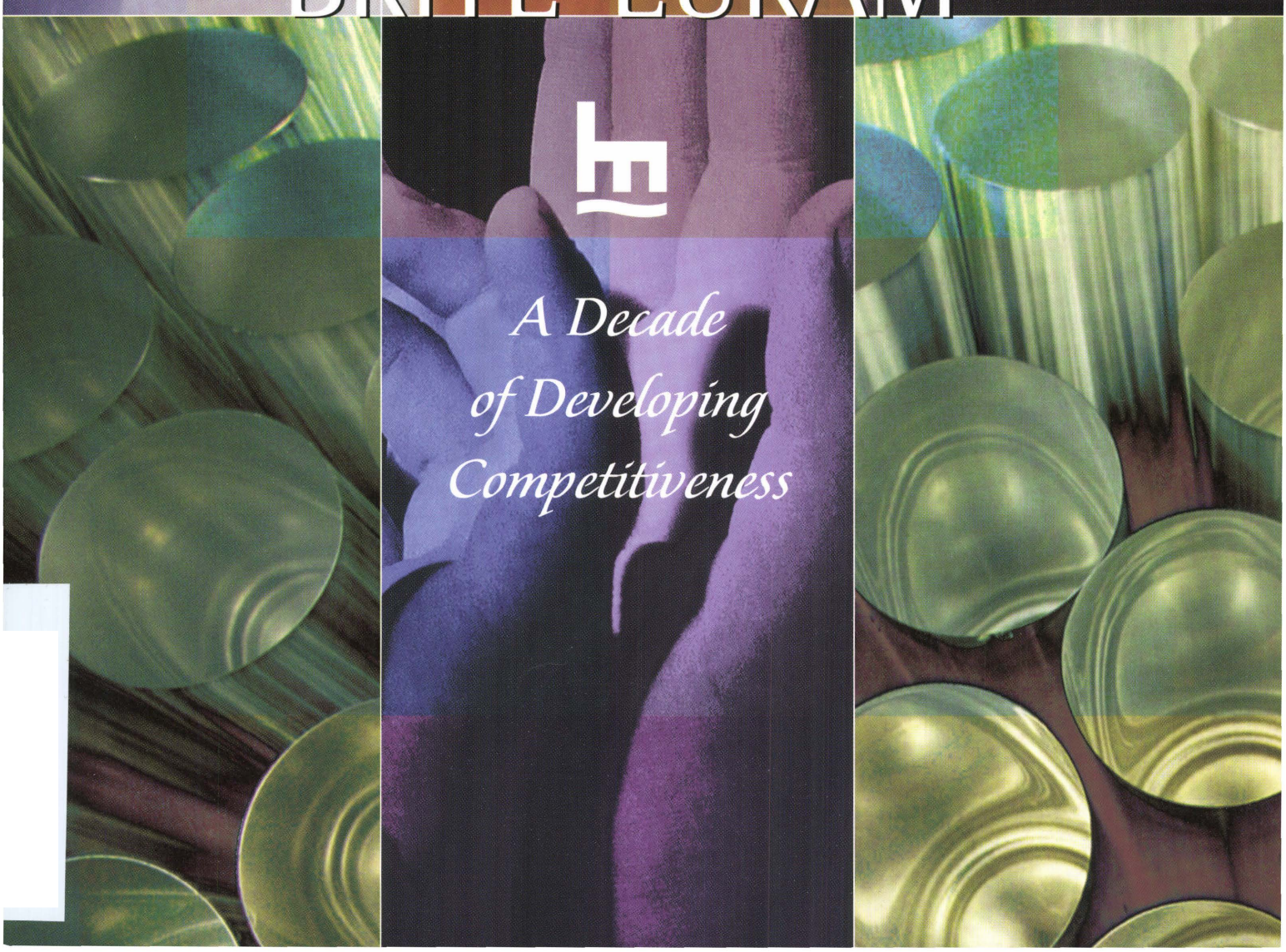


BRITE-EURAM



A Decade of Developing Competitiveness

BRITE-EURAM

A Decade of Developing Competitiveness

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Preface

"The Community shall have the objective of strengthening the scientific and technological base of Community industry and encouraging it to become more competitive at international level" ... (Article 130F of the Treaty of the European Community).

European industrial R&D has been part of the post-war European scene from the beginning - the very earliest treaties underpinning today's European Union provided for research in the coal, steel and nuclear fields.

These early initiatives were a recognition that Europe could ill afford to lock its various national research programmes into a set of airtight boxes. As in so many areas, Europe had a great deal to gain from sharing knowledge, experience and resources.

It still does. The original logic was correct, but the increasing ferocity of competition in today's global economy required Europe to expand scientific and technological cooperation to every field of industry.

Research was first put onto a broader footing in the mid 1980s, when the European Community launched the first Framework Programme for research and technological development. The Frameworks became a central part of the "European project" - one aspect of a multi-faceted approach to tackling Europe's economic and social problems which includes the Single Market, the European Environment Agency, trans-European transport and energy networks, and much more.

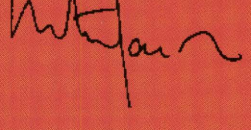
Industrial research - in the form of the Brite and Euram projects - played a crucial role in this strategy from the start. Today we can see how these two programmes' descendants have evolved with the times. While their focus was mainly science and technology, today's Brite-Euram III programme takes proper account of the needs of industry and society.

It features a range of activities - projects, networks, training activities and more - encourages vertically integrated, multidisciplinary projects and focuses on socio-economic and environmental problems. It has also evolved towards user-friendliness, with a range of SME-oriented actions, a clearer administrative structure, simplified contracts and other initiatives making the programme more accessible to European industry.

This process will continue during the Fifth Framework Programme, under which we can look forward to a range of industrial research activities targeted, through a small number of integrated Key Actions, to Europe's most pressing industrial, economic, social and environmental objectives.

The Key Action concept embodies everything the European Union has learnt in the promotion of pan-European, multidisciplinary, multi-sectoral projects involving the entire technology supply chain - universities, research institutes, testing laboratories, large and small companies, user groups, and society at large. The Fifth Framework Programme will also support generic, long-term research, and will ensure that Europe makes full use of its outstanding research facilities and human resources.

We all stand to benefit from these activities. The scientific knowledge and technological applications that they will help develop will empower our industries to compete with their competitors and help European society develop a sustainable future.

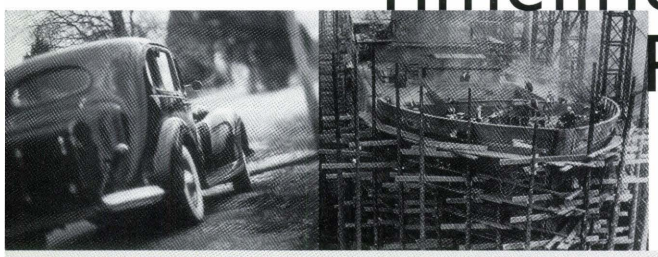


A. Garcia Arroyo
Director

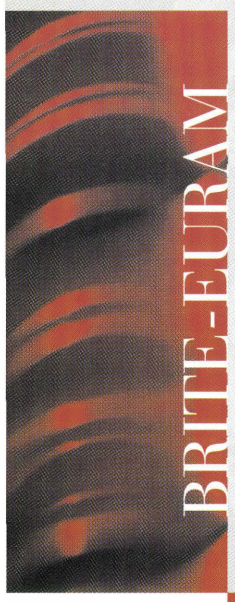
I. The Research Imperative

Building an internationally competitive position in advanced technology is central to the development of the European Union and plays a central role in its policy to improve the quality of life of its citizens. Research is not an option, it is a sine qua non of economic progress and survival. The European Union is committed to building that position through coordinated, cooperative research and development. The strategy, launched in the early 1980s, has evolved into a cornerstone of EU policy.

Timeline: Post-War to Union

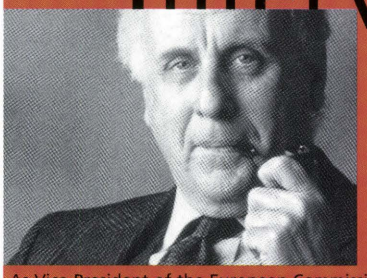


Time	Politics	Research
1952	The European Coal and Steel Community (ECSC) created, pooling the coal and steel resources of the Benelux countries, France, Germany and Italy.	
1955		ECSC research programme created.
1957		Joint Research Centre for nuclear research created.
1958	The Treaties of Rome create the European Economic Community (EEC) and the European Atomic Energy Community (Euratom).	
1971		Cooperation for Science and Technology in Europe (COST) established.
1973	Denmark, Ireland and the United Kingdom join the Community.	First Community research programmes in environment, new technologies; Community Bureau of References established.
1975		European Space Agency established.
1981	Greece joins the Community.	
1984		First Framework Programme (1984-87) launched.
1985		EUREKA established by 17 European countries.
1986	Spain and Portugal join the Community.	
1987	Single European Act	R&D now a "Community Policy". Second Framework Programme (1987-91) adopted.
1991		Third Framework Programme (1990-94) adopted.
1992	Treaty on European Union	
1993	Single European Market	
1994		Fourth Framework Programme (1994-98) adopted, reinforcing the links between Research and Industry.
1995	Austria, Finland and Sweden become members of the European Union.	
1997		Amsterdam: European research to be decided by majority voting in the European Council, rather than unanimity.
1998		Negotiation and adoption of the Fifth Framework Programme (1998-2002)



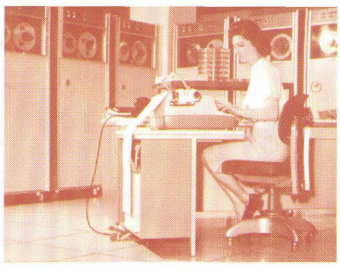
Interview

Looking back .... to move forward



"How does Viscount Etienne Davignon, the "father" of Europe's original common research policy during the early to mid 1980s, view the progress made over the past fifteen years, and what changes does he see as necessary for further progress?

As Vice-President of the European Commission from 1977 to 1985, Etienne Davignon introduced the First Framework Programme for research and technological development. Since then he has been Chairman of *Société Générale de Belgique*, the influential Belgian holding company. Chairman of the group behind a recent five-year evaluation of the Framework Programmes, he has provided vital input for the Fifth Framework Programme (1998-2002). He has also chaired an expert group on EUREKA's medium-term plan, and is currently chair of the "Association for Monetary Union in Europe"..



War and Recovery

From the Industrial Revolution onwards, Europe was consistently in the vanguard of research and innovation.

World War II was the watershed. In its aftermath, the immediate and overriding priority for Europe was to rebuild its industrial base and restore output to pre-war levels: to recover rather than to innovate. Elsewhere, however, countries and companies were investing more heavily in research and innovation.

By the 1960s this had resulted in an alarmingly wide technological gap between Europe and North America. Nowhere was this more evident than in high-tech, strategically important sectors such as aeronautics, microelectronics and information technology. European industry haemorrhaged as scientists and researchers joined a mass exodus to the USA. American multinational corporations dominated the global marketplace - underwriting the expansion of their European operations in part via the new Eurodollar capital markets.

Meanwhile, other new and aggressive global competitors were beginning to appear on the horizon - Japan, Korea and the tiger economies of Southeast Asia.

Closing the Gap

Throughout the 1970s, Europe struggled to close the technology gap. Modest progress was made as Europe and the European Community integrated and modernised. But this progress was largely offset by two factors - successive energy crises and increasing demands made on Europe's governments to improve living and working conditions and safeguard employment.

By the early 1980s, European industry was still losing ground to its principal competitors in North America and in Southeast Asia. Traditional industrial sectors such as steel, shipbuilding and textiles had gone into seemingly irreversible decline, no longer able to compete with low-wage economies in what had come to be known as the developing world. Even more ominously, Europe also seemed to be falling behind in the "sunrise industries" of information and communications technologies.

And all of this was despite the enviable record of scientific excellence enjoyed by many individual European countries. This excellence, however, was not being exploited - there were too many barriers between Europe's universities, research institutes and companies, preventing them from pooling their resources to compete with the giant, single-market economies of the USA and Japan. It was clear that Europe was applying the tried and tested rule of "divide and conquer" - but it was applying it to itself.

A fresh approach was vital for the 1980s and 1990s if post-industrial Europe was to survive - let alone prosper - into the next millennium. The prospect of a genuinely Single Europe represented a unique window of opportunity.

The launch of the First Framework Programme at the beginning of the 1980s was an important milestone in the development of the powers of the European Union. What were the main reasons and expectations which prompted Europeans to establish a common RTD policy?

At the end of the 1970s and beginning of the 1980s, entire sections of European industry - textiles, steel, the car industry and part of the chemical industry - were suddenly confronted with recession. The initial knee-jerk reaction was to take measures to guarantee their survival. Restructuring processes were vital but had rather harsh consequences.

Such a purely defensive approach was far from exhilarating. For European industry to be able to pick itself up, its future also had to be redefined. Consequently, attitudes suddenly became much more receptive to the idea that the vital key to this future lay in strengthening research and technological development.

But how did this new awareness come to be coupled with consensus for the establishment of a new European RTD policy?

This need was stressed by those immediately concerned, namely the scientific community and the industrial world, which had assessed the gaps in the European scientific and technological environment in comparison to American and Japanese research efforts. Researchers and industrialists were widely consulted ...

The Big Picture

The Framework Programmes are one part of a larger European effort to improve competitiveness, employment and the quality of life.

The most visible initiative today is undoubtedly economic and monetary union (EMU), the next step in the development of the Single Market. Behind that, however, lie many far-reaching achievements in providing a better environment for European business.

The free movement of persons, goods, services and capital throughout the Single Market is now taken for granted. The right to set up shop throughout the Union, the progressive harmonisation of company law, the progress made towards fiscal and customs harmonisation - these are only some elements of an enterprise policy that is allowing European businesses to grow unimpeded in a market of several hundred million people.

Fulfilling the Potential

This is fine in theory, but in practice national borders still remain. The Framework Programmes are one activity designed to break down these barriers and help unleash the full potential of the Single Market. Similar initiatives cover education, the audiovisual market and the environment, among many others.

Innovation, in particular, is gathering more attention at the European level, as it is here - where research is translated into market share - that Europe is falling behind. There are many reasons, including high administrative burdens and taxes, a lack of venture capital and gaps in Europe's "innovation fabric".

This decade has seen a wide range of initiatives in response. The innovation process has been studied in depth, breaking the "linear view" of research and technological development. The research programmes have been adapted accordingly, and the First Innovation Action Plan for Europe established, setting out what can and should be done at both European and national level.

The drive towards a Community Patent has been revitalised. Regional development offices have already been networked together, with national research databases to follow, further accelerating the flow of ideas, technologies and expertise. Trans-European transport, energy and information networks are being established, European satellite networks are being planned, and national business environments are being "benchmarked" against the world's best.

Like EMU, the idea behind all these activities is simple. Europe must compete with the world. Only by linking together Europe's best - whether they be scientists, research policies, businessmen or currencies - can Europe compete on equal terms.

BRITE-EURAM

...Interview

Viscount Etienne Davignon

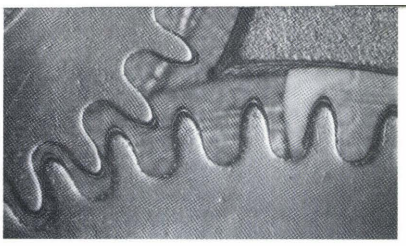
and, through the Members States, were the strongest advocates of the Commission's proposals. That said, before consensus was reached at political level, there were serious battles that I could only describe as epic.

ESPRIT and BRITE, the first two programmes established by the Commission at the time, reflected the wish to link the common research policy to key cutting-edge industries in order to strengthen Europe's competitiveness. How would you assess the impact of this strategy today?

There is no doubt that these programmes had a positive impact. However, there is no point in trying to quantify this in a measurable way. Attempts to compare what would have happened had they not existed with what actually happened because of their existence are somewhat artificial.

However, the initial observation, which is very significant, is that European research policy has helped to create a genuinely transnational relationship between companies, universities and government bodies, which was never the case before.

More than ten years after your term of office in the Commission, you are still a "sage", listened to and frequently consulted on all matters relating to European research. Given



Framework: A Single Market for Ideas

The basic idea of the Single Market is to help Europe compete on equal terms with its competitors. The full benefits of the Single Market, however, will only be reaped if Europe's ideas, innovations and businesses can cross national borders as easily as its goods and people.

The answer was launched in 1984 - the first in a series of overlapping Framework Programmes. The First Framework Programme (1984-1987) introduced the concept of coordinated European Community research within an established time frame and infrastructure.

From the beginning, the guiding principle was to only support research which benefited from the "added value" of Europe - research which could be carried out at national level should remain there.

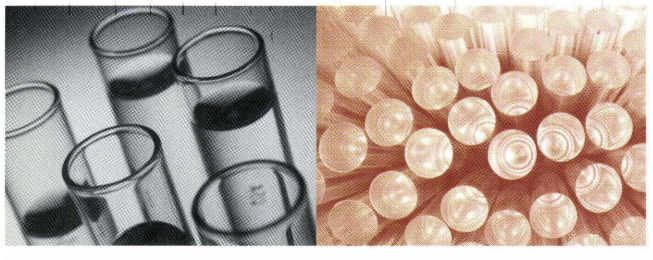
The Framework approach was "institutionalised" by the Single European Act of 1987. Under the Second Framework Programme (1987-1991), research and technological development was accorded equal status with other areas of Community concern, such as economic and social policy. The Community was now empowered to act. By this time the Framework Programmes were becoming one part of a multi-pronged approach to improving European industrial competitiveness which involved activities in training and education, the environment, telecommunications, and industrial and enterprise policy.
The Framework model is simple. The actual Framework Programme is quite a small document - it simply sets out the overall budget, timescale, priorities and rules. Within the Framework, however, are a number of Specific Research Programmes, each focusing on a particular technological area. Both the First and Second Framework Programmes focused research on areas like information technology, advanced materials and environmental science.

It may be a simple model, but the implications are profound. The Framework approach provides continuity while simultaneously allowing Europe to reconfigure its research priorities and refine its working methods every few years. This is essential in the world of science and technology, where yesterday's impassable technical barriers become tomorrow's market opportunities within the timespan of a university education.

The value and flexibility of this approach has been amply demonstrated since then, with subsequent Frameworks introducing new areas and priorities, fine-tuning their operations and developing new ways of involving smaller companies and disseminating the results.

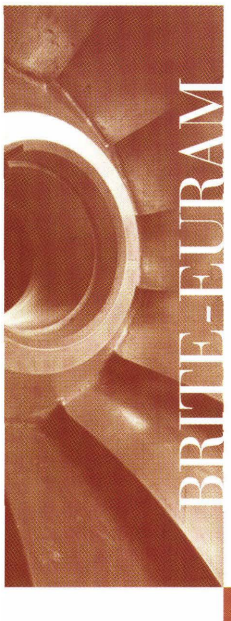
Thus, while broadly following the lines of its immediate predecessor, the Third Framework Programme (1990-1994), while actually reducing the number of programmes from over 20 to 15, introduced new activities in reinforcing Europe's innovation infrastructure and developed a programme focusing on Europe's

the many world-wide challenges and upheavals in terms of both technology and the economy, the Fifth Framework Programme should constitute a turning point for Community research policy. How do you see this change of direction?
If we wish to learn from the first 15 years of European research policy, basically we must admit that it needs to be adapted. The priority in the past was to establish a scientific and technological community from scratch. Now that it exists, it must be preserved. However, it is necessary to move beyond what we have already achieved, and this requires quite considerable change. First of all, we must aim to be more selective regarding the areas of research that we decide to support. We should then ensure that the entire effort is fitted into the economic and social environment.
In other words, European research should not limit itself to meeting the needs of the current technological reality, above all it should be concerned with the relationship between that technological reality and the environment which it could adapt and improve. In my view, this point is crucial.
Another important question - but this was resolved in the recent Treaty of Amsterdam - was that of decision-making procedures. Unanimous voting was perhaps acceptable for the first 15 years, but is no longer. It had become counter-productive to attempt to endow European research with a strategic vision for society, ...



human potential in science and technology. It also piloted the first research activities aimed specifically at small and medium-sized enterprises, or SMEs. These were widely adopted under the current Fourth Framework Programme (1994-1998).

This was the first time all of the EU's research efforts, ranging from the 40+ year old steel research programme (funded under the European Coal and Steel Community) to the SPRINT Programme, which focused on technology transfer, had been brought together under one roof.



The Fourth Framework Programme is the most ambitious to date. It aims to help create high-level, pan-European infrastructures in information technology, communications, transport and energy, foster industrial competitiveness, improve the quality of life, further develop scientific cooperation with Central and Eastern Europe, broaden and deepen its efforts in improving technology transfer across Europe, and emphasises training and researcher mobility, particularly for the EU's peripheral and disadvantaged regions.

Apart from putting SMEs firmly at the top of its agenda, it emphasises the social implications of research as never before, introducing the first European programme of socio-economic research to identify technology policy options and assess their impact on European society. Perhaps most importantly, it saw the various strands of European policy - industrial, social, regional, environmental, education, science and more - become more tightly integrated.

Tomorrow's Fifth Framework Programme (1998-2002), builds on all the lessons learnt over the past decade. It is discussed in the final section, The Way Ahead.

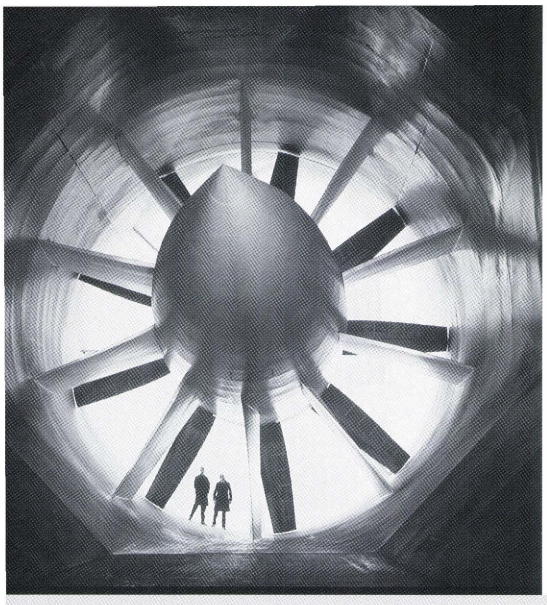
...Interview

Viscount Etienne Davignon

while it remained dependent on negotiating procedures in which individual Member State's priorities were discussed. I think that the decision to move to majority voting is very significant.

There is a third important point: the purpose of a "Framework Programme" is to set strategic goals. Otherwise, why have a programme over five years? You may as well decide upon specific actions on a yearly basis. On the other hand, it is necessary to be able to adapt the objectives along the way.

Nowadays a five-year forecast for research is an extremely long time-span. In practice, when you prepare a Framework Programme, there is a great deal of reflection for a year and



The Case for Industrial Research

Why is a European-level industrial research programme necessary?

Economic globalisation has changed the world for good. For companies competing with the developing world's lower labour costs there are only two answers - relocate to the developing world, or somehow optimise costs and improve product and service value. As if that was not enough, industry and society must become sustainable - the greenhouse problem will not disappear, but natural resources and parking spaces just might.

Advanced technologies and innovation are therefore crucial to revolutionising European industry and safeguarding European society. The materials used in tomorrow's products can be made cheaper, lighter, stronger and more recyclable. The products themselves can be better designed, increasing reusability and reducing maintenance costs. Manufacturing processes can be made more flexible, allowing companies to respond better to changing demand. Energy use can be reduced and waste streams recycled.

Information and communication technologies can also play a significant part, tying companies together in more effective partnerships, embedding intelligence into products and allowing employees to work from home.

Spiralling Costs

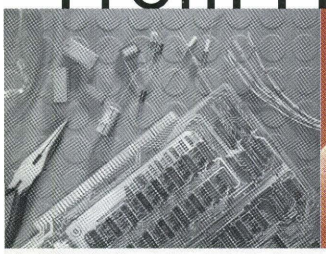
All of this stems from research. The cost of this research is spiralling as competition grows more intense, increasing the risks individual companies face as they develop new products. Moreover, research is becoming increasingly multidisciplinary - materials scientists need to talk to designers, software authors to telecommunication engineers, robotics specialists to ergonomists.

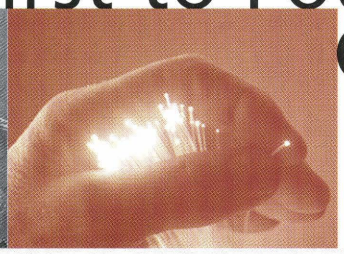
Companies around the world have responded by joining forces, both to avoid having to develop in-house expertise in every discipline and to reduce costs and risks. In America and Japan this is relatively simple - there is one legal and tax environment, one language, one currency and one market. Not so in Europe.

Europe therefore needs industrial research programmes to share the risks with industry and help companies across the continent pool their resources and benefit from a multidisciplinary, multicultural approach. In this way a "critical mass" of research resources, spanning national markets and scientific disciplines, can be created in each field. While the past decade has shown just how difficult and complex this is, it has also shown that it can be done.

a half before it is even approved, with the result that the intellectual process spans over six and a half years instead of five years. How can you guarantee that the main elements relating to the strategic objectives are not forgotten?
I will give you a recent example encountered by Commissioner Bangemann and myself. Along with industrialists and the Commission, we had produced a document on the information society - this was three and a half years ago now - in which the Internet was not mentioned ... the Internet existed, but no one had realised that the Web was to become Number One in on-line communication within such an amazingly short time. I hasten to add that we were not alone in our lack of perceptiveness: Mr Gates, whose merits are vaunted world-wide, did not see the Internet coming either....
In other words, if we wish European research policy to meet vital strategic objectives and if we wish to prevent its added value from becoming bogged down in bureaucracy, technocracy or disputes over sharing out the benefits, it must have built-in flexibility. Incidentally, such a feature would have been unthinkable in the context of unanimous voting mentioned earlier...

From First to Fourth: Changing Priorities

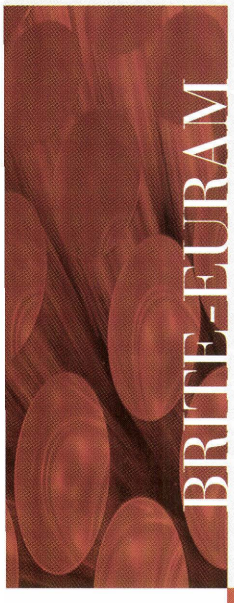




Comparisons between the First and Fourth Framework Programmes illustrate how research priorities have changed from the early 1980s to the early 1990s.

The story is more complex than a simple tale of changing funding levels, however. When the First Framework Programme was launched the primary focus was technology, pure and simple. Today, it is clear that a multidisciplinary approach, stretching from university lab to community groups, is needed to ensure that the gap between science and society is bridged and science's potential to improve our quality of life and industrial competitiveness is fully exploited.

In essence, Europe's approach to R&D has become more holistic. The overall scientific and technological objectives have shifted towards meeting Europe's social needs: boosting employment, improving working conditions, promoting quality of life and health, and preserving the environment.



Systems Approach

The environment, in fact, provides a good example of this "systems approach". Problems such as polluted waterways and acid rain do not respect national boundaries, so the benefits of coordinating research across Europe are obvious, as are the benefits to our quality of life. Environmental R&D was therefore one of the priorities of the Second Framework Programme, launched in 1987.

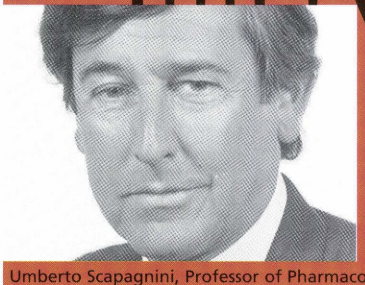
More recently, however, the link between the environment and employment has strengthened as public appreciation of environmental problems has deepened. With environmental legislation, regulation and standards increasingly being formulated at European level, a Single Market in environmental services began to appear.

The industrial research programmes under the Third and Fourth Framework Programmes recognised this trend, and encouraged projects with environmental benefits. Life cycle analyses, clean production technologies, recycling and reuse all became more common in Europe's research portfolio of the 1990s.

This was part of an overall approach, with the Commission also encouraging the sector in other ways, through for example its Ecolabel and Eco-Management and Audit schemes. The overall picture is of a social priority being reflected across all European policies, helping the birth of a new industry which creates new jobs and improves the quality of life.

Interview

European Research and Society

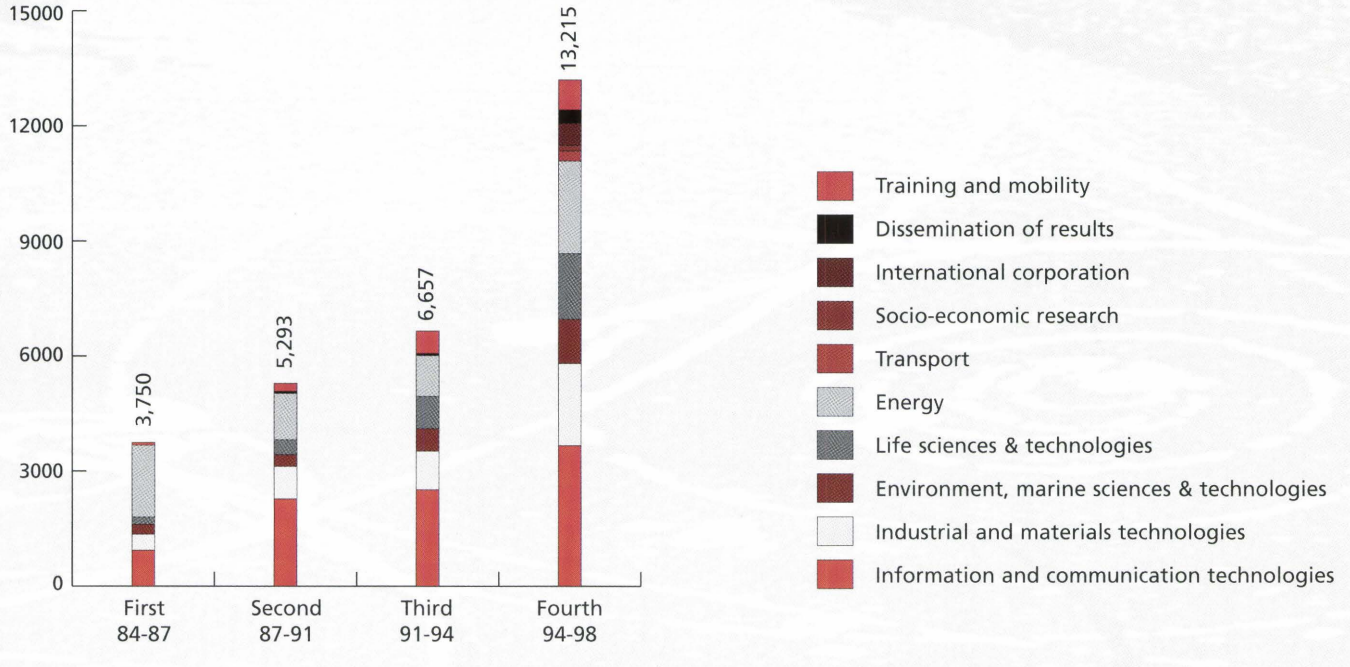


Umberto Scapagnini, Professor of Pharmacology at the University of Catania (Italy), is President of the European Parliament's Committee for Energy, Research and Technology (CERT).

How should European research reflect Europe's needs?

What is the Parliament's and CERT's role in shaping the Framework Programmes?

While the Commission proposes the Framework Programme, it is the Parliament, acting jointly with the European Council of Ministers, which modifies and legally adopts it, setting out the final budgets, priorities and rules of participation. CERT is



The Framework approach provides the EU with short term research funding continuity, while allowing it to change funding priorities in the medium term. Industrial research funding remained steady from the Second to Third Framework Programmes, for example, while environmental research grew in importance.

the body which prepares the Parliament's report and exercises parliamentary scrutiny and follow-up. These responsibilities will grow once the Treaty of Amsterdam is ratified.

Do you think the Framework Programmes have been effective?
To some degree. They have helped many industries integrate throughout the Single Market, and have brought people and resources together to start up hi-tech companies in an international environment from the very beginning.
Nevertheless, we still have borders and barriers within Europe that we cannot afford. There is a lot of work to be done. We must improve the operational environment for business, particularly with regard to competition, intellectual property rights and the internal market. The development of technical standards and harmonisation carried out within the Industrial Technologies programmes is therefore very valuable and should continue.

How should European research - particularly industrial research - affect European society?
I would prefer to ask the reverse: "how should society affect European research?"
In a market-oriented world, any company's position is built on a deep understanding of its clients' needs and its ability to meet them. Likewise, the direction of European research should stem from the needs of European society.
These needs are not difficult to spot. We have to do something about ever growing traffic congestion and the degradation of the infrastructures upon which our cities and towns survive. We need better methods for the life-cycle assessment of products ...

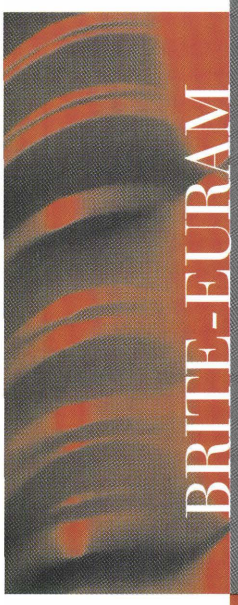
Programmes, Projects and

The Programmes

Most of the Fourth Framework Programme's 13.215 billion ECU budget is devoted to 15 research and demonstration programmes and the EC's Joint Research Centre. There are also three more programmes dealing with international scientific cooperation, improving the environment for innovation and developing Europe's human resources in science and technology.

One of the guiding principles is subsidiarity, which rules out EU support for projects best dealt with at national level. Hence the programmes generally fund pre-competitive research into technologies which could benefit a number of industrial sectors and require massive investment.

Research Programmes:	MECU
Telematics applications	913
Advanced communication technologies and services	671
Information technologies	2,082
Industrial and materials technologies (Brite-Euram III)	1,833
Standards, measurements and testing	307
Environment and climate	914
Marine sciences and technologies	243
Biotechnology	595.5
Biomedicine and health	374
Agriculture and Fisheries	729.5
Non-nuclear energy	1,076
Nuclear fission safety	441
Controlled thermonuclear fusion	895
Transport	263
Targeted socio-economic research	147
Other Activities:	
Cooperation with third countries and international organisations	575
Dissemination and exploitation of results	352
Stimulation of the training and mobility of researchers	792



Research Projects

Around 80% of the research programmes' funds are devoted to collaborative research projects.

These are officially termed "shared cost research actions", because the EC supplies up to 50% of the research costs.

All projects:

- involve partners from at least two EU Member States;
- are innovative and pre-competitive in nature;
- benefit from working on the European level;
- are compatible with the EU's social, economic and environmental objectives.

Details vary from one programme to the next. Brite-Euram III projects, for example, should all involve at least 10 man-years work and run for 2-4 years. Moreover, the

Networking Research

The European Commission also helps different research teams link up across Europe.

While all Commission research funding involves networking researchers and companies across Europe, Concerted Actions and Thematic Networks focus their funding solely on networking. By helping research teams across Europe share their facilities, experience, research results and staff, the EC obtains a significant "added value" at European level for a relatively small amount of funding.

Concerted Actions were developed under the First Framework Programme. They link nationally and privately funded research teams together, paying up to 100% of the costs involved in running workshops and conferences, transferring scientists between laboratories and information-based activities such as newsletters and databases (see page 25).

...Interview

Professor Umberto Scapagnini

and production systems, and must base our economies on genuine knowledge generation.

And then, of course, there's unemployment. Across the EU the figure is around 10%, while unemployment in the USA and Japan is 6% and 3%, respectively. In the last three decades, jobs in the manufacturing industry have declined. This cannot be allowed to continue. Europe cannot compete with other parts of the world by using cheap labour, so developing advanced industrial technologies is really the only answer.

But we have to bear in mind that research alone cannot solve all our problems. Bringing together the different policy areas remains a significant challenge.

What should we learn from the past decade of European research?

One of the biggest problems, seen from the Parliament's perspective, is that national interests have dominated the debate for too long. Although everyone agrees on the need for subsidiarity, the word means different things to different people. I believe subsidiarity should serve to define common European interests.

I think also that the present system faces a dilemma: society wants positive results from research almost immediately, but it may take 20 or 30 years before a research result is turned into a product. This is a long time to look ahead - it is not easy

Networks

programme recognises two types of projects: industrial research projects and basic research projects of industrial relevance.

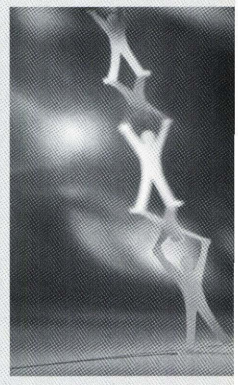
70% of Brite-Euram III's budget is devoted to the industrial research projects. These must cost 1-7 MECU in total (larger projects are possible if they can produce a significant EU impact) and involve an investment by the industrial participants worth at least 60% of the EC's contribution. Basic research projects, which account for 10% of Brite-Euram III's budget, cost 0.5-1.5 MECU in total, but still require some funding from private industry (at least 10% of the EC's contribution).

Thematic Networks, however, only appeared under the Fourth Framework Programme, and network the research carried out across Europe into common socio-economic goals. The aim is to strengthen Europe's R&D infrastructure through the transfer of technologies and know-how, and to ensure that industry's needs are widely understood and addressed.
Under Brite-Euram III, for example, 119 "exploratory phase" networks have been launched since 1995. By 1997, 60 of these had become fully fledged networks in fields as diverse as electronics manufacturing, advanced propulsion systems, nanotechnology, computer-aided process engineering, noise control materials, medical materials and maritime technology.

Just for SMEs

Special projects and procedures have been developed for small businesses.

The EU specifically encourages the involvement of small and medium-sized enterprises (SMEs) in European research (see "Why Target SMEs?", page 26). Most Programmes, for example, fund "Exploratory Actions" to help SMEs develop their ideas into research project proposals. Brite-Euram III provides up to 45,000 ECU in this way for feasibility studies, finding partners, market studies, and so on.
For the many SMEs without their own research resources, Brite-Euram II (1990-1994) piloted cooperative research ("CRAFT") projects. They have been widely adopted by most programmes under the Fourth Framework Programme. 15% of Brite-Euram III's budget, for example, is dedicated to these projects.
The idea is simple - a number of SMEs with similar needs join forces and, with the help of the research programme, sub-contract the research to a university, research organisation or company. The advantages are clear - the projects enable SMEs to share risks and investment, develop innovative technologies specific to their own needs and forge cross-frontier links with other SMEs and research organisations.



Accompanying Measures

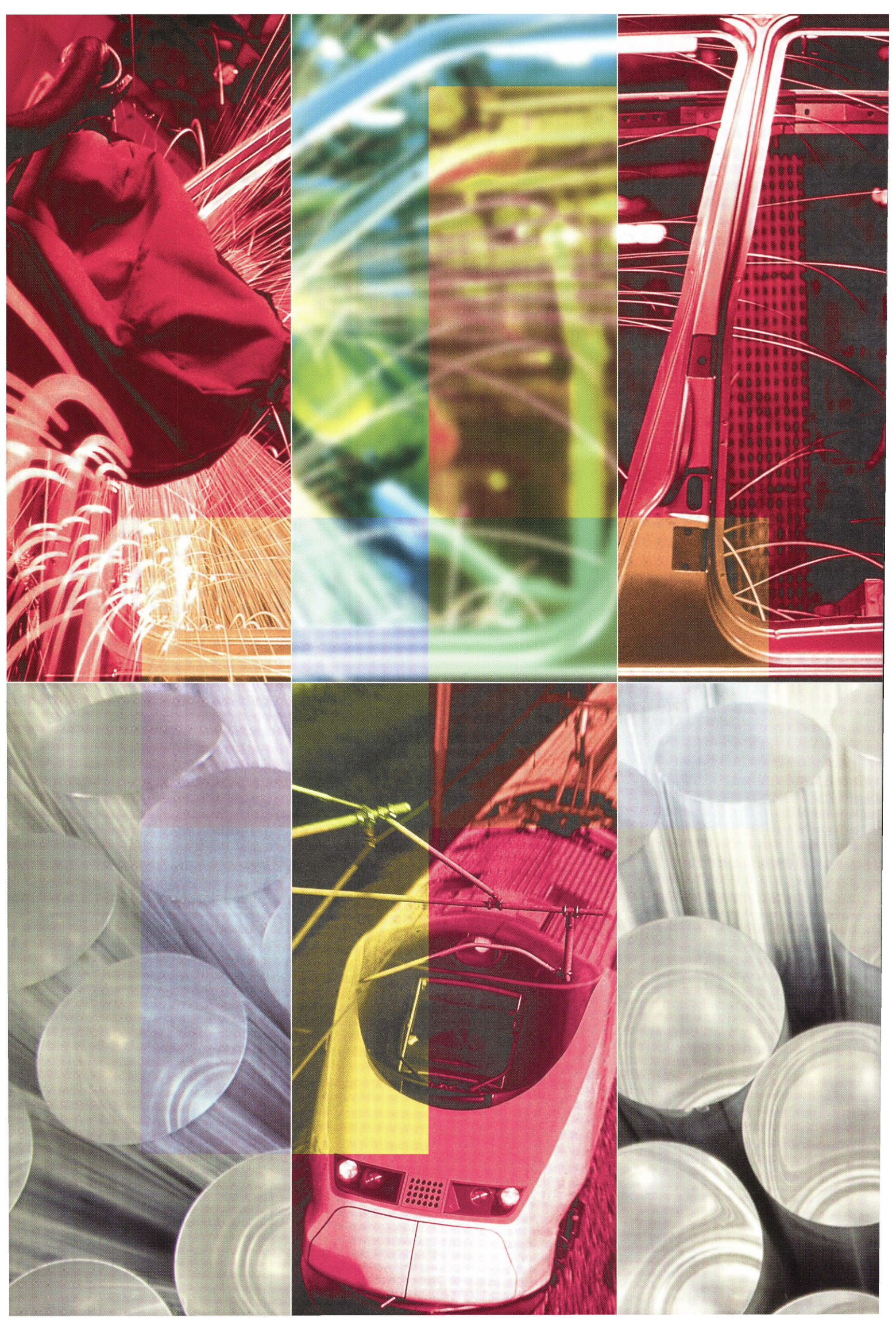
Each programme also carries out a range of other measures.

The basic idea of all accompanying measures is to make the programme more effective by making it more accessible and enhancing its impact. Activities include training initiatives, support for workshops and conferences, and measures to improve the exploitation of the research results. Preparations for future R&D activities are also funded.

to define exactly what we want after 30 years in product terms. Sometimes, in fact, it is easier to know what we *don't* want. However, we all share common values, such as the well being of the individual and saving the planet for future generations. These should be our guiding lights.

Another factor is the SME issue. We often hear that more SMEs should participate in the Framework Programmes. However, there have been many more good proposals than the EC could fund. The time and money that these SMEs have invested in writing the proposals should not exceed the money available. It may be that measures other than research may be more effective in meeting SMEs' needs in the innovation process.
I believe more demonstration projects would be useful, although they should not grow into an institution. Finally, while it is right to orient the research oriented towards the market, we also perhaps need more "blue sky"projects - research that can show us the new and unexpected. They often yield startling results.

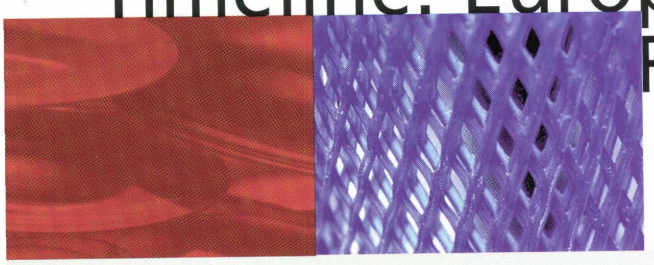
What about the proposals for the Fifth Framework Programme?
It's still a bit early to say, but one thing is clear - the projects funded under the Fourth Framework Programme have not interacted enough with each other. The Commission's efforts to improve the lines of communication between projects and focus the research more sharply therefore look extremely positive.

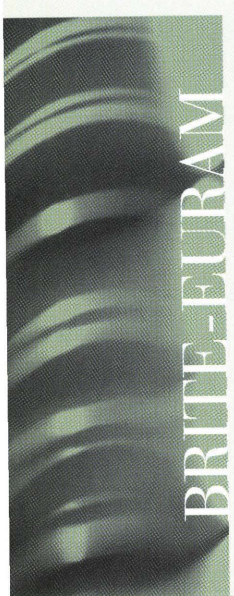


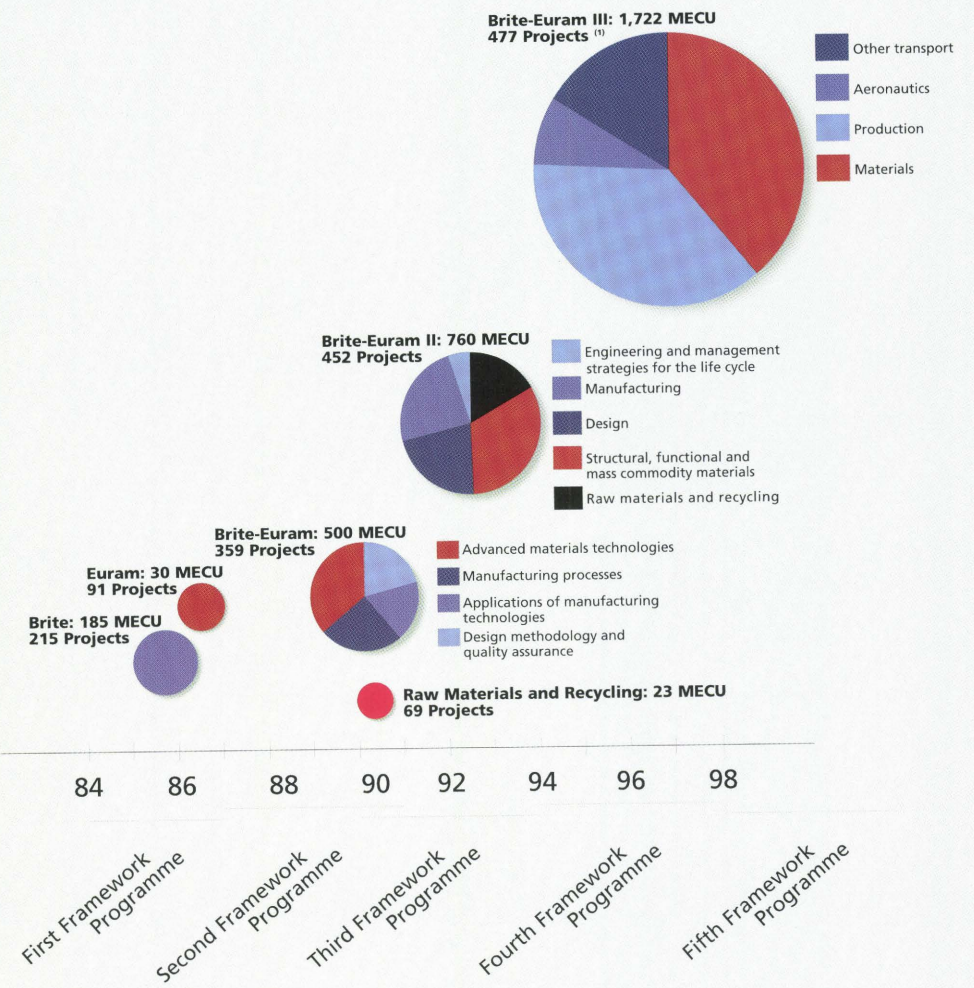
II. Brite-Euram: Meeting the Challenge

The Brite-Euram "programme family" has been a cornerstone of Europe's efforts to reinvigorate its industrial base for over a decade, and exemplifies the European approach to cooperative R&D.

Timeline: European Industrial Research (1985-2002)

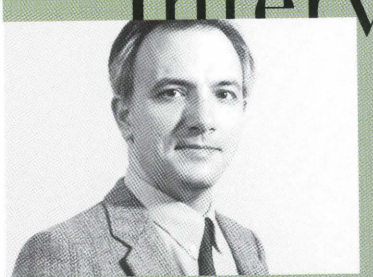






(1) A total of around 1,000 projects are expected for 1994-1998.

Interview *Aérospatiale*



Serge Catoire is vice-President of Research, Technology and Industrial Policy at Aérospatiale. With a 1996 turnover of 7.7 billion ECU and employing some 38,000 people, the French company is the second largest aerospace company in Europe and exports three quarters of its products outside of the EU.

What role does Aérospatiale play in Europe's aerospace industry?
A principal one. We are major partners in Airbus, Arianespace and Eurocopter, Europe's largest aerospace producers. In fact, Aérospatiale has been involved in pan-European collaboration as long as practically anyone, as Airbus and Arianespace pioneered European integration several decades ago.

How successful has this strategy been?
More than anyone dared hope. Airbus has a third of the world market for civilian aircraft, while Arianespace has half of the open satellite launcher market. These market shares

Origins and Evolution

From Day One, Europe's industrial technologies research programmes have had one basic aim: to boost the global competitiveness of Europe's manufacturing industry through supporting cooperative, cross-border research and development.

The methods for achieving this, however, have evolved since the original **B**asic **R**esearch in **I**ndustrial **T**echnology (**BRITE**) and **E**uropean **R**esearch in **A**dvanced **M**aterials (**EURAM**) Programmes were launched in 1985 and 1986, respectively. Between them they funded around 300 projects.

The degree of overlap between them led to their merger in 1989 under the second Framework Programme, creating **Brite-Euram I**. The next year, reflecting the growing concern for the environment in the late 1980s, the EC launched the **Raw Materials and Recycling Programme**. A 35 MECU aeronautics research action line was also launched.

The new programmes were not simply a continuation of the old, however - while the pursuit of scientific excellence remained, Brite-Euram I placed greater emphasis on developing technologies for clearly defined market needs. The research was still "precompetitive", but it was oriented so that it reduced the risks companies faced in developing and introducing new technologies.

Evaluating Impact

In the beginning of the 1990s the Commission began assessing the impact of this research on European industry and society. This process continues to this day, making the Brite-Euram family of programmes one of Europe's best documented.

Each Evaluation is carried out by independent external specialists, who ask project leaders to answer a set of questions using a set of indicators - such as a number between 1 and 5 or a percentage figure. This allows issues such as the project's scientific and commercial results, its impact on the company's technical capacity and employment, the quality of the collaboration and so on to be quantified statistically.

This, in turn, allows a largely complete comparison between Evaluations, both helping the EC to fine-tune the Programmes and demonstrating the "key factors" of project management to future participants.

could never have been won by purely national companies. Even given the benefits of pooling the resources of companies like Aérospatiale, DASA, British Aerospace and CASA, it's still an extraordinary achievement when you compare the levels of government support we receive with that of Boeing and McDonnell Douglas. Now, of course, these two competitors have merged, upping the stakes even further.

Is lower public funding in Europe the main problem, then?

It's one of them, certainly - aerospace is at the heart of US government policy, unlike here. Another significant problem is that our American competitors cover the entire spectrum of the aerospace industry - they produce civilian and military aircraft, rockets, missiles, helicopters, the lot. They can therefore exploit a huge number of synergies. There is no European equivalent. Perhaps there should be. Certainly, in my view, simply creating one company out of Airbus is not the complete solution - it will still concentrate on one market segment.

A third problem is that we are constantly having to protect ourselves against movements in the US dollar. This is expensive. It's difficult enough to organise a multi-national industrial and technological organisation - having to deal with a multitude of currencies, all constantly changing values, doesn't help. The euro, hopefully, will mitigate this.

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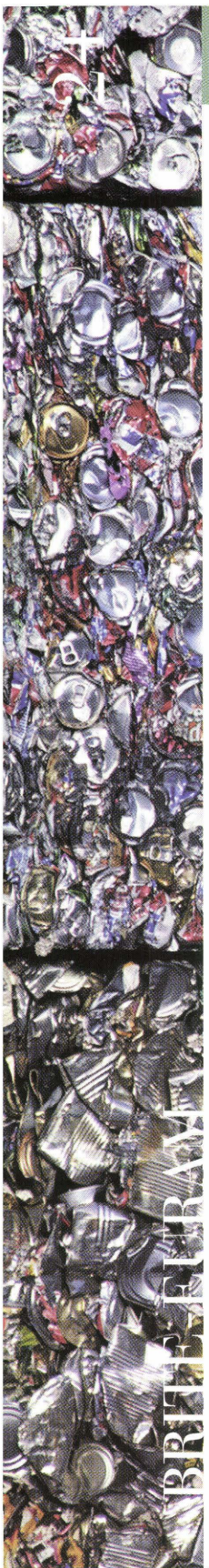


II. Brite-Euram: Meeting the Challenge

Programme Rationalisation: Brite-Euram II

The Industrial and Materials research programmes under the Second Framework Programme featured nine different "action lines", each divided into a number of sub-sectors. Under the Third Framework Programme (1991-1994), some rationalisation took place.

The resulting **Brite-Euram II** Programme focused on just three principal technical areas:

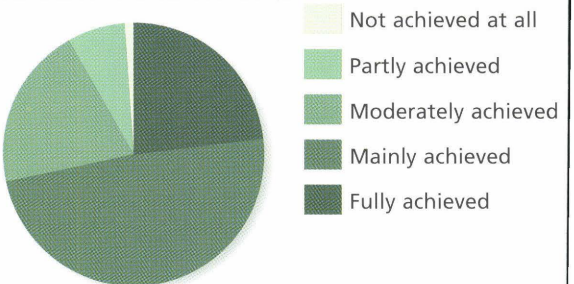
- **materials:** from raw materials to recycling, from mass commodities to structural materials;
- **design and manufacturing:** from product design to engineering and management strategies;
- **aeronautics:** environment-related technologies, aerodynamics and aircraft technologies.

Research projects with a positive impact on Europe's social or physical environment were given priority. The Programme also reflected the findings of the previous half decade of European research, encouraging multidisciplinary project teams which integrated suppliers, producers and users.

The Programme therefore emphasised projects - or groups of projects - that improved technologies throughout the lifecycle of a wide range of materials and products. Projects in the manufacturing sector increasingly dealt with human and organisational factors as well as assembly and production systems, and helped their participants achieve strateg aims such as reducing design-to-product lead tim and linking improved design techniques to the man facturing process.

It was also under Brite-Euram II that cooperati research projects (CRAFT) and SME feasibility awar were piloted (see pages 18-19), reflecting t Programme's strategic aim of encouraging SM to adopt advanced technologies and become mo involved in research and development at Europe level. The programme's accompanying measur meanwhile, covered training - research fellowshi funding for training within projects and specialis courses - and supported a range of seminars a conferences.

Scientific Achievements



Almost three quarters of the participants surveyed in the Third Evaluation, which studied 84 BRITE and BRITE-EURAM projects which finished in 1992, stated that they had mainly or full achieved their scientific or technological objectives. Almost all rated these results as level with (28%), beyond (45%) or strongly beyond (18%) the state of the art.

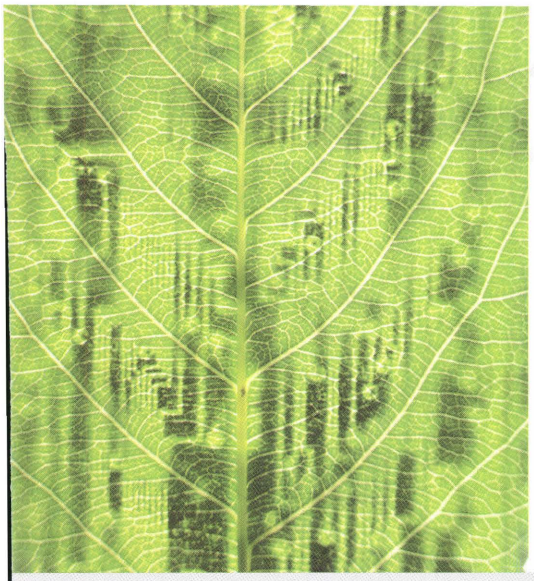
...Interview

Serge Catoire

What are your main R&D challenges?

Research and development, of course, is our lifeblood. The aerospace industry's main technical challenge is to integrate the best industrially feasible technologies together. We don't push ceramic materials to the absolute limits of physical performance, for example - we're interested in what can be achieved in an industrial environment, not in specialised labs.

Our R&D structure illustrates this perfectly. It's structured like a matrix, allowing our different product centres to access all new developments. And there are nineteen themes, ranging from materials and processes to documentation and infor-



Creating European Research Communities

In 1983, as it was becoming clear that Europe had to pool its scientific resources to compete with America and Japan, researchers from those countries independently discovered $Nd_2Fe_{14}B$ - the first high performance, iron-based, "rare earth" magnet.

The potential was immediately obvious - the new material promised cheaper, better and, in some instances, entirely new products in industries as diverse as consumer electronics and aeronautics.

According to Professor Michael Coey, Head of the Physics Department at Trinity College, Dublin, there were many excellent European research groups in the field, "but while different countries were strong in particular areas, the spectrum of interlocking activities was not properly coordinated. Hence the early US and Japanese lead."

In 1985, one of Europe's first Concerted Actions was launched in response. It was to convincingly demonstrate the power of networking European research, and foreshadowed the thematic networks pioneered in subsequent years.

Patents and Processes

CEAM (Concerted European Action on Magnets) spent its 2.7 MECU budget for the decade on workshops, staff exchanges, a newsletter, and a bibliography and database. Academic and industrial scientists and engineers were networked together, promoting understanding between experts in basic magnetism, processing technologies, product development, international competition and more.

After ten years, the network encompassed over 150 laboratories in 13 countries. Europe had surpassed America and caught up with Japan, notching up successes such as the second generation material "Nitromag" and hydrogen-based processing technologies along the way. Over a dozen patents had been filed and several European companies were on the market. Over a third of the 1000 papers published by the partners involved at least two CEAM laboratories.

"Much of this would never have happened without CEAM," Professor Coey concludes. "My group's exposure to industry's priorities helped lead to our discovery of Nitromag, for example, and CEAM was instrumental in transmitting our results throughout industry. Most significant, perhaps, is that European researchers now collaborate more with each other than with American scientists, as they did before."

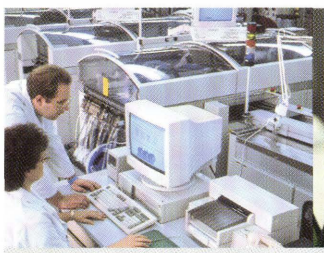
mation treatment. Most large, research-intensive companies would have no more than five themes.
Being industrial system integrators, rather than basic researchers, a constant flow of new technologies from industrial research organisations is therefore crucial.

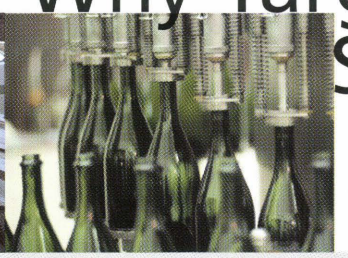
What is your experience of the European research programmes?
We've been involved since Brite-Euram launched an aerospace-oriented action line. This industry is special, as I've said, so it has and still requires a specially oriented programme. Again, my main criticism is that there is not enough money at European level - too many good projects cannot be funded.

Looking beyond this problem, however, we are very satisfied with the Programme. Overall, the EC focuses the limited resources where they do the most good - on research, which costs much less than development. These programmes allow us to work with universities and non-partner companies at the research level, where this makes perfect sense.
The achievements in materials, CAD/CAM systems and parallel computing have been significant and valuable. But I must repeat that the Americans get much more support at this level.

...

Why Target SMEs?

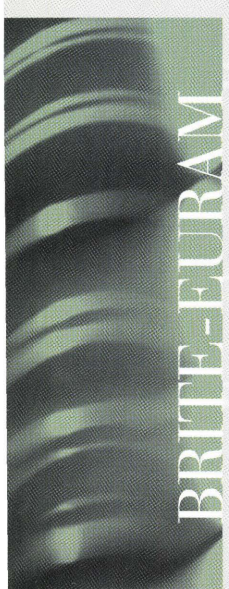




BRITE-EURAM II pioneered the SME-oriented CRAFT projects and Exploratory Awards, while almost 40% of the participants in today's Programme are SMEs.

Under the Framework Programmes an SME is defined as any undertaking with a workforce of fewer than 500 employees, annual turnover of less than 38 MECU and with no more than 33% of its capital owned by a non-SME. Their size and structure renders them more creative, innovative and flexible than large organisations, allowing them to react quickly and effectively to new developments and changing marketplace conditions. They account for more than two thirds of turnover and jobs in the European Union, and play a proactive role in building economic growth and generating employment.

The Single Market is working in their favour by reducing the business costs - trade barriers, customs formalities, transport and telecommunications services - which have kept expansion out of their reach for so long. There is, however, another side to this coin - increasing competition. This comes partly from other SMEs in the EU, but mostly from large transnationals, which are benefiting from the economies of scale inherent in producing for a Single Market.



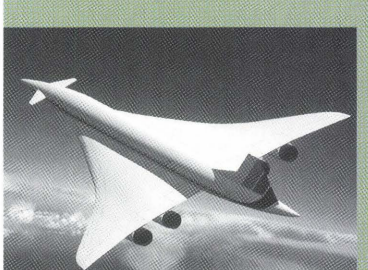
The Size Barrier

In this environment, therefore, innovation is crucial to continued success. And it is here that SMEs suffer from a number of disadvantages. Even if they have their own research capacity - and very few do - SMEs find it extremely difficult to spare the resources to cu through the red tape of a research programme manage a research project. Most SMEs, moreover, d not have research facilities - but their need f research results is just as great.

Hence the EC's CRAFT projects and explorato actions (see pages 18-19). But the story does not sto there, as there is a wide range of SME-oriente initiatives under way to strengthen Europe's innov tion infrastructure. Activities include developing lin between companies, research institutes and gover ment at regional level, promoting the spread of "be practices" in adopting new technologies, encouragi the investment of private finance in small compani and research, and developing a "Community paten to reduce the costs of protecting research results, name just a few.

...Interview

Serge Catoire



Is coordinating national programmes a solution?

They are already coordinated - at least in the aerospac industry. The national programmes focus more on development and this is coordinated quite effectively by industry throug Airbus and Arianespace.

This demonstrates the effectiveness of coordinating nationa research programmes, in fact - but only if industry is intimatel involved.

What do you think of the Fifth Framework Programme?

I like the English phrase - "if it works, don't fix it." Brite-Eurar works for us, although I'm not saying it couldn't be improved.

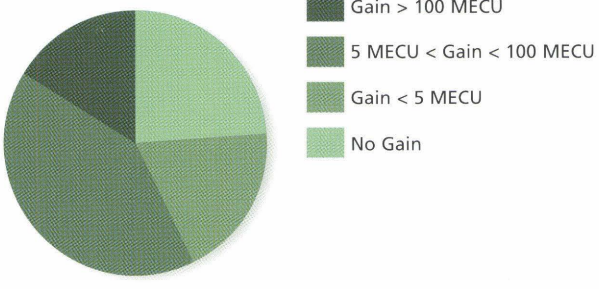
Brite-Euram Today

These objectives and methods were further refined in Brite-Euram III (1994-1998).

In many ways Brite-Euram III reflects the priorities of the Maastricht Treaty of 1992, integrating objectives such as industrial competitiveness, economic growth, quality of life, respect for the environment, industrial safety and so on.

This is best achieved through the systems approach developed successfully under the previous Programme - multidisciplinary projects run by consortia of suppliers, manufacturers, universities and users, preferably from different industrial sectors. This multi-sectoral approach, coupled with a commitment to testing and demonstrating the technologies in industrial environments, helps ensure that the projects' results are adopted in as many different industries and countries as possible.

Economic Impact



The Third Evaluation also studied the direct economic impact of the projects foreseen over the subsequent five years, and concluded, after accounting for risk factors and inflation, that every ECU invested in these projects generated around 7 ECU of economic gain.

Targeting Research ...

Another feature is the Targeted Research Actions (TRA). Each TRA focuses on a research topic of strategic importance to Europe, and contains a number of project clusters focusing on one specific aspect of this research. The key point is that TRAs do not involve any new research per se - each cluster is simply a network of already running projects.

The Total Quality Textiles TRA, for example, aims to improve the competitiveness of Europe's textile industry. It features four clusters, one of which focuses on advanced textile processing machinery. This groups together seven individual projects into technologies as diverse as carded yarn processes and the magnetic bearings used in any machine with high speed spinning parts.

While most of the networking is between the individual projects in a cluster, each TRA also promotes information exchanges between its clusters. Each project participant therefore gains a better appreciation of the state of the art both in their particular field (e.g., advanced textile processing machinery) and in the wider industrial context (e.g., improving textile quality).

The Commission does *not* dictate what the clusters should be and then approve research projects accordingly. It is only after projects have been

There is a Key Action focusing on aeronautics in the Fifth Framework Programme. If Key Actions are used to complement the main research activities, creating multi-disciplinary project clusters and helping launch strategic projects, then I am in favour. My only concern is that Key Actions could replace the main activity of funding research projects. This, I believe, would be unnecessarily risky.

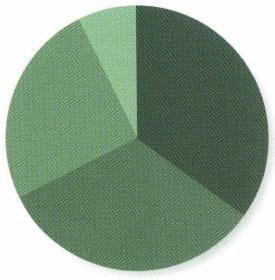
What else needs to be done in Europe?

I'm optimistic. A lot of small improvements could be made across a very wide front, but then the same can be said for the American scene. The very fact that we're still here, competing with them despite the problems I mentioned, means we must be getting quite a bit right.

Obviously, my view is that of a large company which works with other large companies. We don't face the same problems as small companies, and we can afford to invest heavily in research and patent the results when it suits us. What we need is a healthy basic research structure. Any improvements to the flow of knowledge across Europe at that level has to be a good thing. The EC's efforts have made a significant difference here.

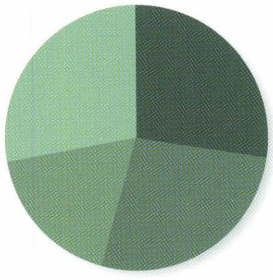
Health and Society

Environmental Impact
168 positive effects



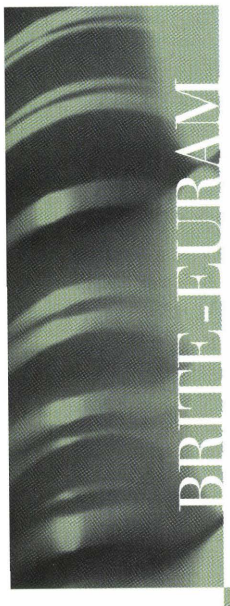
- Other
- Lowered release of dangerous products
- Material saving
- Energy saving

Health and Working Conditions
109 positive influences



- Other (predominantly stress reduction)
- Biocompatibility or less dangerous products
- Quality of working environment
- Safety of use

The Fifth Evaluation analysed 131 BRITE-EURAM projects launched in 1990. It identified 177 individual impacts on the environment, and another 120 impacts on health and working conditions. Nearly all (95% and 89%, respectively) were positive.



approved for funding that "critical masses" of projects in important areas are identified, leading to TRAs and clusters. Participation is always voluntary, and extra funding to cover the coordination costs can be made available through thematic networks.

So far, Brite-Euram III has established a wide variety of TRAs, focusing on subjects as varied environmentally-friendly construction technologies, materials and technologies for the electronic industry, advanced machine tools, waste minimisation and recycling and environmentally friendly vehicles (see page 33). Between them they are improving information flow between around several 100 individual research projects.

... and Setting Targets

Like its predecessor, Brite-Euram III focuses on three technical areas: production systems, product innovation and technologies for transport. For each area it sets strategic goals for the short, medium and long term.

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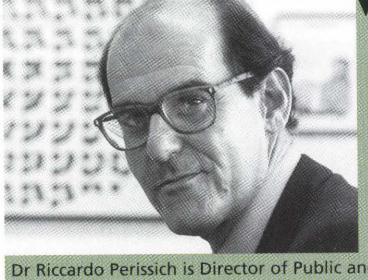
Interview

Pirelli



Dr Riccardo Perissich is Director of Public and Economic Affairs at Pirelli. The Italian-based multinational employs some 36,000 people world wide, and runs 72 factories in 15 countries. It invests 3% of its annual turnover into research, and employs around 2,000 researchers in six research centres in Europe, the US and Brazil.

"The Pirelli Group is involved in dozens of materials-oriented EC research projects, focusing on applications as diverse as truck tyres and fibre-optic cables.

Making Nickel "Skin-Friendly"

Nickel is very widespread in jewellery, watches and so on. Unfortunately, it helps trigger a number of allergic reactions. Current treatments for these contact allergies are, for the most part, ineffective.

What is more, nickel is typically allergenic in salt form, which can be formed when the metal is in contact with human sweat. Several countries, as well as the EU, have therefore restricted or even banned the use of nickel in products likely to come into contact with skin.

Jewellery and watch manufacturers will have to adapt rapidly. In addition, 40% of the electroplating industry's output involves the application of nickel undercoatings. The new regulations could mean a loss of up to 1 billion ECU every year for this industry, which is worth around twice that figure.

Cooperative Research

A CRAFT project[1] was launched in November 1993 to tackle the problem. Bringing together 15 SMEs and six research organisations and technical centres in France, Italy and Spain, the 0.7 MECU project pursued two main lines of research:

- limiting nickel's negative affects by reducing its diffusion through the metal towards the surface. The work aims to seal the nickel in an undercoat or in the substrate through a new combination of coating layers;
- replacing nickel with non-allergenic alloys.

The 15 SMEs first put forward over 20 different production "baths", each of which produced different layers of metal. The research institutes analysed each layer and chose the most promising baths. The technical centres then tested these layers for adhesion, corrosion, porosity and nickel release.

The 14 different baths that were identified were tested in a pilot plant set up in one of the research centres. The three baths which passed this industrialisation phase were then subjected to further tests, including brightness, ductility and colour. All three met the standards, and between them provide an array of layers which will allow the SMEs to continue production.

The project, therefore, allowed 15 SMEs to share the risk of financing and managing a multinational research effort, and resulted in technologies vital to reconciling the companies' future with society's demand for healthy products.

(1) CR-1076-91

According to Riccardo Perissich, the completion of the Single Market and the introduction of the euro will substantially alter the framework of global competition.

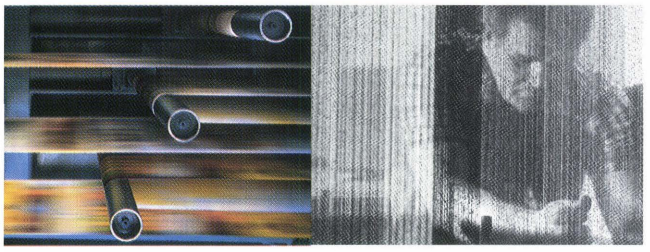
"Monetary union will make Europe the leading economic force in the world, with 21 per cent of the global market and vast potential for consumption and investment," he argues. "It will also create the largest bond market in the world, with all the benefits that implies for European firms. The development and consolidation of Europe is essential for Pirelli's competitiveness, so developing a Europe-wide research presence has been an integral part of the company's strategy for years."

The Pirelli Group has been involved in Europe's Brite-Euram, Information Technology and Communication Technology research programmes since 1987. They are involved in a total of 17 projects under the current Framework Programme.

"We focus on new production methods and materials research in these projects," Perissich continues. "For mature products such as tyres, our attention is directed at improving process efficiency and bringing production into line with environmental regulations and performance standards. For advanced products, such as optoelectronics and superconductors - both areas in which Pirelli Cavi is active - materials research is the priority. Brite-Euram covers all these fields, which makes life easier when it comes to approaching Brussels."

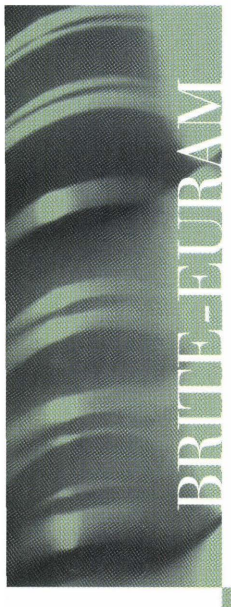
Universities and research centres play an important role within the ...

II. Brite-Euram: Meeting the Challenge



The short term (less than 5 years) priority is to adapt existing technologies and develop new ones to increase competitiveness, particularly in low-tech sectors. Medium term (4-10 years) research focuses more on the research-intensive industries, and aims to help them reinforce competitiveness, make better use of human resources and reduce environmental impact.

The long term (8+ years) research, by nature more fundamental and high-risk in nature, focuses on new technologies for the production and design of tomorrow's products. Success will create new and sustainable industries and markets.



I - Production Systems

Managers and scientists have to somehow develop production lines combining the economies of mass production and the flexibility of human-based assembly. They need to increase speed, improve quality, respond to rapidly changing demand, reduce waste and improve the environmental impact of everything they do. Simultaneously , if possible.

The Programme's short term goals in this area include adapting cutting edge technologies and management techniques - such as CAD/CAM, quality control and the "extended enterprise" model - to more traditional sectors. Medium term research focuses on intelligent production systems, closed loop processing and the man-machine interface, among other topics.

Long-term research, finally, deals with technologies capable of reducing pollution levels by up to 80%, developing machinery capable of self-diagnosis and maintenance, identifying new ways of re-engineering production cycles, and so on.

II - Product Innovation

The ability to produce things as well as possible, however, is not enough - you must have something to produce. And global competition means that it had better be world class. Making such a product means adding value to every aspect of it: making it less expensive, lighter, stronger, smarter, better looking, more versatile, more rugged and more recyclable.

Over half of the cost of manufactured products stems from buying and processing the materials. Short-term research should reduce these costs by 20-30%, while longer term projects, covering areas such as thermodynamics, nano-engineering and superconductivity, should halve them.

• • • p. 32

...Interview

Doctor Riccardo Perissich

early, basic research phases of these projects, with the Pirelli Group focusing on development and pre-production. The projects have produced major benefits, mainly through spreading the risks of financing the research and sharing access to research institutes around Europe.

"The research centres are important, but the real key to our success is the cooperation with other firms", notes Perissich. "This enables us to complement the output of the academic world and develop technologies that can actually be used in an industrial environment".

Pirelli works with all types of firms, from industrial giants such as Siemens and Bayer to a large number of SMEs. "The small companies usually come from our Group's own networks of suppliers and customers," Perissich adds. "This provides better focus for the project, reinforces the links between the companies and allows us to better coordinate the technical development of the entire industrial supply chain. Brite-Euram, quite rightly in my opinion, encourages this sort of consortium."

Looking to the Future

While Perissich thinks that their projects' overall impact has been positive, he agrees with some of the criticisms levelled by the "Five Year Assessment Panel", chaired by Etienne Davignon. "Most of the difficulties we see are caused by inadequate identification of

Concrete: Getting a Greener Mix

Sprayed concrete, or shotcrete, is an integral part of tunnelling systems around the world. It is sprayed onto the bare rock surface immediately after excavation, rapidly hardening to protect the tunnelling crew until a final lining can be installed.

It hardens quickly because alkalines are added at the spraying nozzle. However, the method has drawbacks - up to 30% of the concrete fails to stick and has to be removed and disposed of, caustic dust from the additives creates a health hazard, and the alkalines leach out to pollute aquifers and rivers.

The last reason, particularly, led the German authorities to reject a 1991 plan for using shotcrete in a high-speed Stuttgart-Ulm rail link. The rail companies turned to Heidelberger Zement, the world's fifth largest cement producer, for help. With both Austria and Italy facing similar problems, a Brite-Euram II [1] consortium naturally followed.

The project brought together cement producers Heidelberger Zement, Cementi Buzzi (Italy) and Wietersdorfer und Peggauer (Austria), shotcrete additives manufacturer Heidelberger Baustofftechnik (Germany), and the materials research institute of the University of Innsbruck (Austria). Together they set out to remove shotcrete's problems and improve it to the point where it could serve as a permanent tunnel lining.

Patented Worldwide

Meanwhile, Heidelberger Zement's competitors were developing concrete free of gypsum, the standard setting regulator. This also removes the need for alkalines, but the cement sets immediately on contact with water, making oven-dried aggregates necessary.

The partners took a more technically demanding approach, and successfully developed a new, non-alkaline additive which retards setting for the few minutes required for easy spraying and improved adhesion.

Crucially, wet aggregates do not trigger the setting reaction, so expensive oven-drying of the aggregates is unnecessary. The resulting shotcrete is denser and stronger, and less is wasted. The partners also developed a new application technique which brings additional logistical and cost benefits.

All three of the cement manufacturers now produce the cement, which won 15% of the German market in its first year. Heidelberger Zement has patented both the formulation and the application technique.

(1) BE-5189: Eco-friendly sprayed concrete.

priorities and over-complex procedures. It is vital that we quickly determine the real needs of the European industrial system and establish priorities accordingly: advanced technologies for telecommunications, for example, or automobiles. These are sectors in which Europe can play a leading role over the next 5 or 10 years."
The first four Framework Programmes have successfully created a European-level structure through which the R&D efforts of European firms and research centres can be channelled. The next programme, he says, "should take a more active stance in generating proposals and leading European research towards well-defined strategic objectives, with special attention being paid to sustainable development. The need to solve industrial research problems over the medium term, however, should not prevent the development of basic research aimed at long-term objectives. The balance between basic and applied research is crucial for the future."
Regarding procedural issues, Perissich focuses on the time factor. "Today, it takes a year to go from proposal to the actual start of a research project," he points out. "It will be difficult to go on like this, especially for work carried out in the most advanced sectors, which are in continuous evolution and have seen product life cycles shorten drastically. It would be useful, I think, to introduce two-stage assessment or compulsory proposal pre-screening systems to speed up the approval process."

Similarly, over half of all quality problems stem from product design. Research into product design and manufacturing should reduce these problems by 20% in the short term. In the longer term, technologies such as multi-user virtual design environments and fundamental work in thinking processes should reduce quality problems by up to 50%.

Other research into manufacturing processes, spanning artificial intelligence, new sensors, materials testing and joining techniques, should reduce materials and product defects by as much as 70%.

Finally, research is being carried out into "end of life" technologies, needed to recover materials for recycling and develop closed-loop materials cycles. Short to medium term research into product design and disassembly, materials separation and recycling and more should enable up to 50% of all products and packaging to be reused or recycled. Long-term research should push this figure up to 80%.

III - Technologies for Transport

Society's demand for more mobility is only matched by its demand for cleaner, safer transport systems. Both must be reconciled if neither the economy nor the environment is to be stifled.

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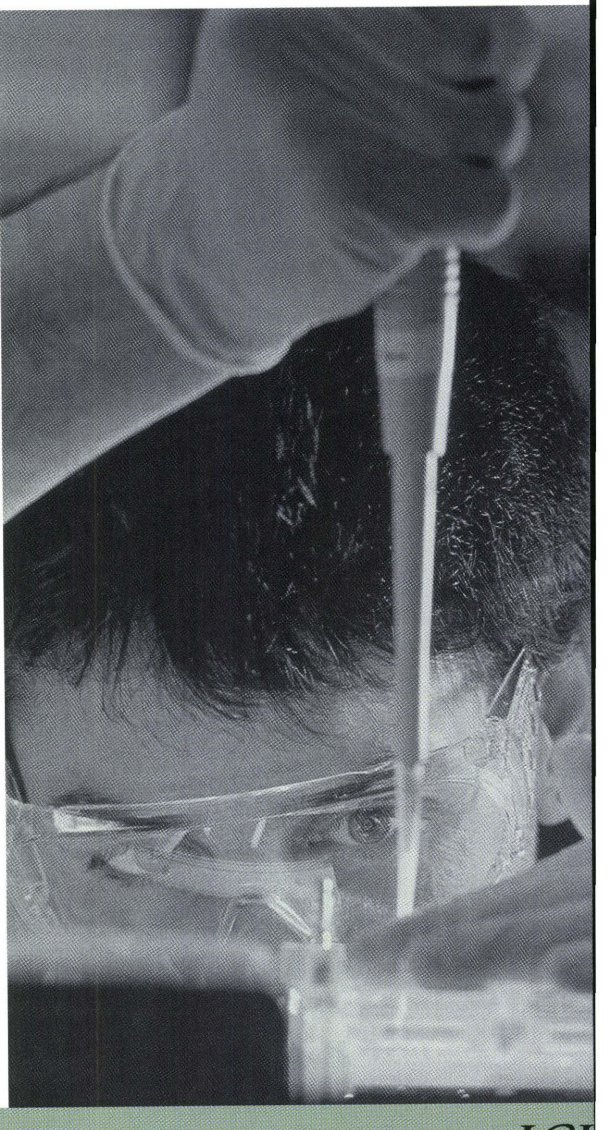
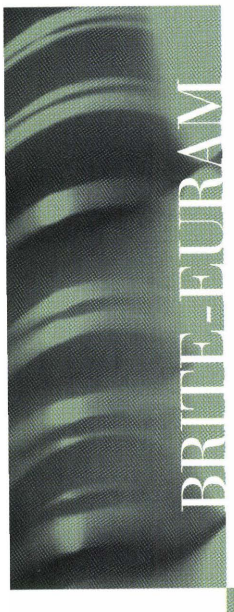




Interview

ICI

Since 1985 ICI has been a partner in more than 80 EU-supported collaborative research projects.

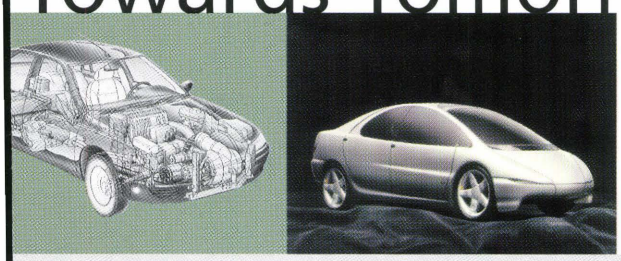
Interview with Dale Laidler, External Collaborations Manager, ICI.

How does one of the world's chemical giants view EC R&D?

Europe's chemical companies are a success story - they account for a third of the world's chemical production, employ nearly two million people and remain one of the few profitable sectors in Europe's traditional manufacturing industries.

"We talk about the chemical industry in Europe, rather than the European chemical industry," explains Dale Laidler,

Towards Tomorrow's Greener Vehicles



Europe's major car manufacturers and their thousands of specialised suppliers employ around 1.8 million people, of which around 30,000 are scientists and engineers. If these numbers are to hold firm or grow, the industry must face challenges ranging from overcapacity in Europe to increasing competition from Asia.

Reinventing the wheel in each country is an expensive option, which is why Brite-Euram III formed a Targeted Research Action grouping together 46 of its projects into seven clusters. Reflecting the emphasis of orienting European research towards social as well as economic goals, the TRA focuses on environmentally friendly vehicle technologies.

Seven Clusters

The seven different clusters within the TRA reflect the staggering number of technical challenges involved in reducing the environmental impact of motor vehicles. They focus on structural aluminium alloys; material processing technologies for high strength steels, aluminium and fibre-reinforced thermoplastics; innovative manufacturing concepts; reducing emissions; suppressing noise and vibration; electric and hybrid vehicles; and composite materials for vehicles. All seven clusters meet once a year, providing a unique overview of European research into environmentally friendly vehicles.

Each cluster sets a number of targets. The cluster on structural aluminium alloys, for example, aims to reduce a typical aluminium car's body weight by 40%, cutting fuel consumption by around 7.5%. It is composed of nine different research projects which between them involve companies as diverse as Ferrari, Alcatel Espace and Hydro Aluminium, and more than a dozen universities and research institutes.

Together, the projects cover aluminium alloys and metal matrix composites, design and fatigue life prediction, direct powder forging, spaceframe design and manufacturing processes, and ultrasonic quality assurance.

This last project illustrates the networking benefits that project participants reap from being involved in a cluster. The partners are developing ultrasonic quality assurance for a number of materials, and their project involves not a single car manufacturer. The cluster will help them better understand the car industries' needs, and industry understand the technologies' potential.

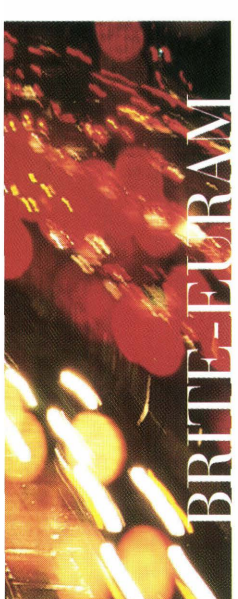
External Collaborations Manager for ICI Technology. "The sheer size, maturity and international outlook of the industry has meant that Europe's chemical companies have little history of R&D co-operation."

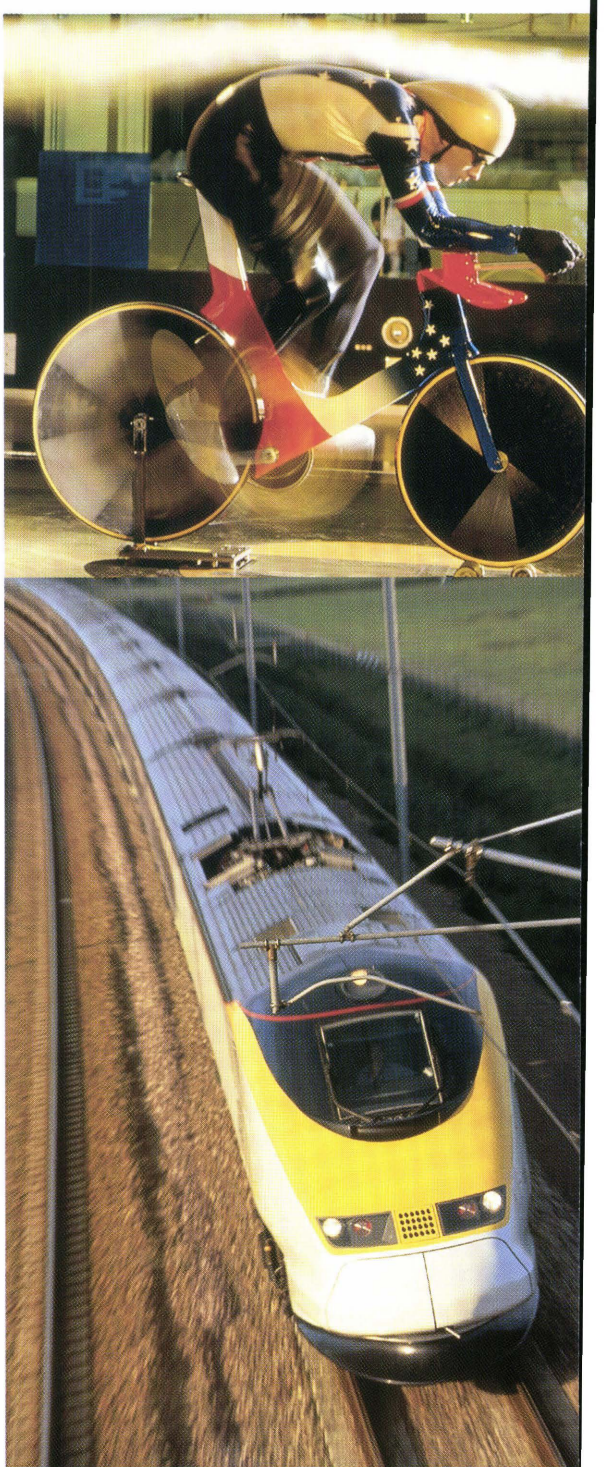
This changed in the 1980s. Recognising the many threats on the horizon - competitors from the USA, Japan and South-East Asia, high wages, overcapacity and environmental pressures at home, a boom-bust cycle - European chemical companies started exploring cooperative R&D as never before.

"We started to work together, and programmes such as Brite-Euram formed a central plank of this platform from the beginning," says Laidler. "Since 1985, in fact, ICI has been involved in over 80 EC research projects, most funded by Brite-Euram or Esprit (Information Technology)."

Learning from experience ...

In the five years he has been in the job Laidler has seen changes in the way projects are tackled, both within ICI and at the Commission. The main thing to remember when planning a project, he says, is that it should be relevant to your core business - your company should still be interested in the results several years down the line. "Don't rely on funding of this kind to start a new business," he warns. "The chemical industry is cyclical, and cycles can be bad for seeding new businesses." ...





This sector is divided into two areas - aeronautics and surface transport technologies. The aeronautical research has a number of specific targets: reducing aerodynamic drag by 10% and nitrogen oxide emissions by 90%, for example, as well as improving time-to-market by 30% and maintenance costs by 40%. Projects range from fluid flow research to advanced logistics development, from the study of advanced turbine blade materials to human effectiveness in the cockpit.

While the surface transport industries - trains, cars and ships - may appear different, they do share common challenges, such as integrating the work of many small and large manufacturers, improving design methods, reducing fuel consumption and developing telematics systems.

The research therefore focuses, wherever possible, on technologies that can be applied to all three. Topics include integrated vehicle design, rapid prototyping, flexible assembly, virtual production modelling, electric vehicle technologies and vehicle safety.

...Interview

Dale Laidler, ICI

The second important lesson is that collaborative projects are not a source of money. "You need to invest in projects of this kind, so the money you get from the EU is not the most important thing - the work done by your partners is."

The opportunity to work with customers in these research projects should not be missed, either. "The chemical industry is near the head of the supply chain, maybe three or four links away from the final users, whose views we rarely hear," explains Laidler. "Programmes such as BRITE-EURAM have allowed us to do that, so they can make us more responsive to customers' needs."

Project management, finally, is crucial. "Put in good people, and give them continuity," he emphasises. "It's good for them, too. The manager of one of the projects we did with Unilever said he thought that, in terms of experience, one year on an EC projec is worth two years in your own company."

... and from Brussels

Anyone expecting nothing but red tape from Brussels might b pleasantly surprised, according to Laidler. "Commission staff ca give you lots of good ideas if you let them. Identify contacts at th Commission who are interested and knowledgeable about you industry, take your ideas to them, and be guided by what the suggest. If your ideas fit theirs, you have a potentially successfu project. If not, don't be tempted to bend your objectives just t get a project going, because it probably won't work."

The process of applying for project approval can be protracted however. Laidler feels that the heavy workload can sto

Learning Lessons

Apart from convincingly demonstrating the scientific, economic and social impact of the Brite-Euram programmes, the Evaluations have helped identify "factors for success" in setting up, running and exploiting Brite-Euram projects.

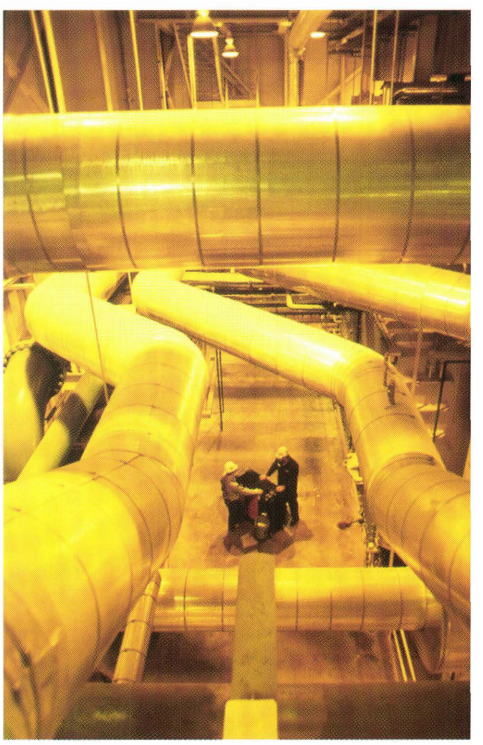
The Evaluation process was enhanced in 1997 by a new survey of organisations which participated in projects which had finished five years previously. Over 400 organisations provided a unique view of the long-term effects of industrial research under the Second and Third Framework Programmes.

The survey showed just how important the projects were for the participants. Three quarters of the SMEs surveyed, for example, stated that the project itself was an important factor in exploiting their research results, with post-project development being an important factor for 68%. The figures were even higher for large companies, although for them the post-project development was more important than the projects themselves.

Factors for Success

The Evaluations, meanwhile, stress the importance of having at least one senior partner with a vital economic interest in the project's outcome if it is to at least be technologically successful. Other factors include setting technical objectives to meet clearly-defined user needs, and strong project leadership and management.

Successful commercial exploitation, even if the results are competitive with existing products or processes, is never guaranteed. Partners can improve their chances by setting up vertically integrated projects involving suppliers, developers, users and manufacturers. They should assess the market potential throughout the project, not just at the start, and ensure that they have both access to the relevant markets and the necessary distribution and marketing expertise.



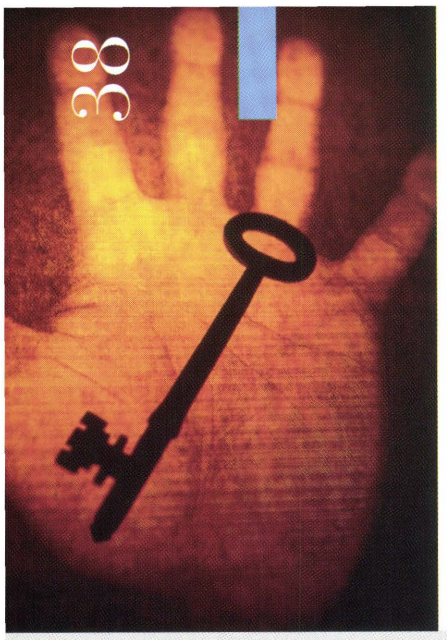
Commission staff from contributing where they are most useful, generating ideas rather than filling in forms.

What about the Fifth Framework Programme? "The new thematic programmes are more oriented towards objectives, rather than being organised along technological lines, which is good," he points out. "For example, it looks likely that there'll be a Key Action which will focus both on the sorts of industrial technologies we saw funded under Brite-Euram information and environmental technologies, which were often previously funded by other programmes. The Key Actions should make it easier to get multidisciplinary projects together, which is increasingly important to manufacturers like ICI."

According to Laidler, the Key Action approach could also avoid a problem he saw with the current programme's Targeted Research Actions (TRAs), where projects are encouraged to exchange information. "I would recommend that private companies think carefully before getting involved in a TRA - it's always interesting to know what other people are doing, but you can get real conflicts of interest when you are asked to exchange information with projects which include your competitors," he maintains. "Key Actions should avoid this - they should focus on networking before projects get under way, not afterwards." He is, however, an enthusiastic supporter of the EC's thematic networks, where research teams across Europe propose to network themselves together. Like research projects, thematic networks are "bottom-up" - the initiative comes from the participants. "It all comes down to doing what you want to do, and only teaming up with others when your interests converge," Laidler concludes. "Get the conditions right, however, and the benefits can be very important."

III. The Way Forward

The Fifth Framework Programme, designed to take European research into the next millennium, marks a break with the past.



The Fifth Framework Programme

The Fifth Framework Programme selectively concentrates on a limited number of priority areas.

These areas were identified because they all meet a set of criteria which the European Commission formulated after wide-ranging consultations with Member State governments, trade and industry associations, research organisations and so on. The criteria specify that Fifth Framework Programme research should:

- correspond to areas where expansion and growth are likely and European firms must become more competitive;
- improve European employment, quality of life, health and the environment;
- benefit from "European added value" - a "critical mass" in human and financial resources must be necessary, and/or the research will make a significant contribution to other European policies (e.g., the development of the Single Market through standards, etc.).

These guidelines capture the essence of European research into the next millennium. They have already been used to formulate the Fifth Framework Programme's general outline, and will be used again for each specific research programme and, eventually, in the selection of individual research projects.

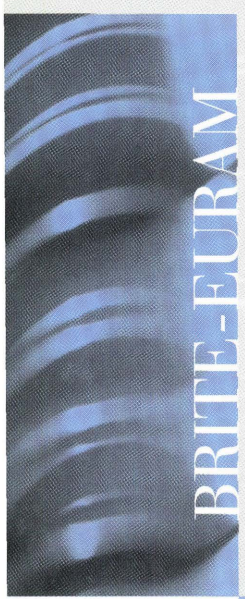
Key Actions

The Fifth Framework Programme streamlines its pre decessor's eighteen areas into a handful of specifi programmes. Of these, three are "horizontal" instead of actually funding research, they focu on other Framework objectives such as encoura ging SME involvement and international R&D cooperation, developing the EU's "innovatio infrastructure" and human resources, and so on.

The actual research is carried out in a number o "thematic" programmes. Each features strategi "Key Actions", each corresponding to an importan agreed social and economic objective, and trad tional research into generic technologies.

Drawing on the experience learnt by the Task Force during the previous Framework Programme, th Key Actions are designed to "clear the bottlenecks currently blocking achievement of the Programme social and economic objectives, and to improve th use of public funds.

Their aim is to mobilise and coordinate researc at European, national and private level, and involv user groups wherever possible. Each thematic pro gramme will also support the development o Europe's research infrastructure.



Industrial Technologies: 1998-2002

One of the Fifth Framework Programme's main objectives is to help European industries develop approaches which are simultaneously competitive and sustainable. These are not mutually exclusive goals, as the products and processes needed to succeed on tomorrow's markets will be as environmentally sound as they are of high quality and added value.

The annual EU market for industrial goods and associate services is estimated at 4,500 billion ECU. The 2 millio enterprises involved employ 40 million people betwee them.

There are two strands running through the Fift Framework research aimed at helping these companies:

- they will need new design, manufacturing, control an production technologies to maintain and increase marke share against the increasingly harsh competition unleashe by globalisation. These technologies include micr engineering and micro-systems, intelligent manufacturin and new methods of organising production and work.
- with the market for environmental protection produc forecast to grow by 50-100% in the second half of th

The Fifth RTD Framework Programme:
Five questions for Edith Cresson

Edith Cresson
Member of the European Commission responsible
for Research, Innovation, Education, Training and Youth

1. How does the Fifth Framework Programme differ from earlier Framework Programmes?

The Fifth Framework Programme has been conceived as a break with the past. It differs from its predecessors in at least two aspects. The first major difference is its general orientation. Far from being established to tackle purely scientific and technological problems, it has been defined to respond to the Union's economic and social needs and to the expectations of Europe's citizens. So our research efforts are resolutely directed towards anything which can contribute to improving Europe's situation in terms of employment, industrial competitiveness and quality of life.

The second major difference revolves around how this new Framework Programme is organised. In order to maximise its impact, it will focus on a more limited number of themes than its predecessors. A major effort has been made to concentrate resources on a certain number of clear priorities. In addition, these subjects are treated within a deliberately tight framework of three major, integrated programmes. This allows us to both approach problems with a global perspective and introduce greater flexibility into the implementation of the actual research, improving our ability to adapt to unforeseen developments.

2. What guided the choice of research subjects?

Making choices is always difficult, and there are certainly many subjects which justify research. But for the reasons I have just outlined above, it was vital to be selective. The fact is that financial resources are not infinite, and that below a certain 'critical mass' the efficiency of the action tends to suffer.

Selection criteria were therefore defined, grouped into three 'families'. Number one is the social repercussions with, first of all, the impact on employment. Secondly, there is the potential for technological and economic development, in terms of their impact on competitiveness and the opening of new markets. Finally, the existence of a clear 'European added value' is fundamental: all of the proposed actions are those which must be carried out at the European level.

* * *

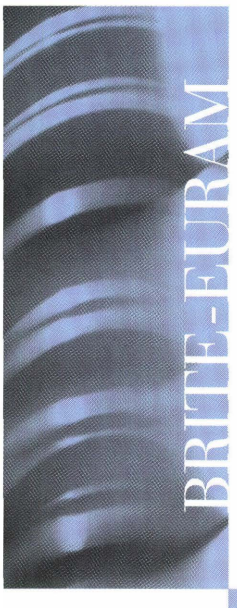
1990s, they will need these new production technologies to be clean, both in terms of using less raw materials and producing less pollution. Research will therefore also focus on reducing material use, promoting waste reuse and recycling, clean processes and products, and so on.

Demand for internal transport of goods within the Union doubled between 1975-1996, and will probably double again before 2025. Road congestion costs 120 billion ECU every year.
The Fifth Framework Programme aims to help develop a safe, intelligent, efficient, environmentally friendly, interoperable and intermodal European transport system. Research will include transport management systems, including satellite navigation and positioning; improving infrastructure and integrating regional planning and transport policies; and socio-economic studies.

Around 15,000 new aircraft will have to be built before the year 2000. Europe's aeronautics industry, which exports two thirds of its production, will soon face a single giant US competitor controlling more than 70% of the global market. Again, Fifth Framework research focuses both on developing key manufacturing technologies and making them more sustainable. Research will integrate design and production systems; reduce aircraft energy consumption, emissions and noise; study the feasibility of new-generation aircraft concepts and improve operational safety.

3. The Fifth Framework Programme contains a new category of activities, the 'Key Actions'. What do these consist of?

The Key Actions are an exemplary illustration of the new approach which has been formulated for the Fifth Framework Programme. Conceived from the experience gained with the 'Research/Industry Task Forces', these Key Actions are designed to address clearly defined needs and problems. An effort has been made to identify the concrete results which one should expect from them, and precise objectives have been established.



To achieve these, the Key Actions will cover a vast spectrum, from fundamental research right through to demonstration projects. Among the topics which have been selected I would mention, by way of example, the relationship between health and food, the interaction between health and the environment, multimedia content for the Information Society, the 'city of tomorrow', and aeronautics.

It is important to stress that these Key Actions address 'real life' problems in all their complexity and with all their interactions with the rest of the world. For example, in an area such as urban development, industrial aspects cannot be separated from issues such as the environment, energy and transport. For this reason, the approach taken is simultaneously global and interdisciplinary, with emphasis placed on the social sciences. The Key Actions will be carried out in close cooperation with the scientific community, industry and users' representatives, meeting in informal and temporary 'Advisory Groups' associated with each Key Action.

4. The Framework Programme represents just 4% of all public research in Europe. How can its impact be optimised?

The Union's research programmes have a far from negligible impact on national research efforts because they are based on the principles of cooperation and of networks creation, and because their resources consist of 'new money', which goes directly to the projects.

The Fifth Framework Programme should make it possible to strengthen this impact and, in particular to extend it to the economic and social level. The Key Actions, which have been designed to have a pan-European dimension, are dedicated to creating convergence between the efforts made by business enterprises and research bodies at the national level.

EUREKA's involvement with projects of a certain size developed within the context of the Key Actions, wil

Almost half of all Europeans live within 50 km of the sea, which carries 90% of the EU's foreign trade. Between 3-5% of EU GNP relates directly to marine industries and services, which employ over 2.5 million people.
A range of technologies is required to ensure that the EU can fully and sustainably exploit its immense marine resources. The Fifth Framework Programme will develop design technologies for safe, efficient and environmentally friendly ships; increase the efficiency of sea transport systems (ports, regional systems); and develop offshore and subsea technologies for the rational and sustainable exploitation of maritime energy and mineral resources.

Total energy consumption is forecast to grow by 20% by 2020, raising CO_2 production by 14% unless specific measures are adopted. The world market for energy technologies should soon reach 800 billion ECU.
Non-nuclear energy research under the Fifth Framework Programme will help improve the efficiency and reduce the emissions of energy production by focusing on new and renewable energy sources and integrating them into decentralised systems; technologies for energy storage and distribution; clean fossil fuel production and use; and reducing energy use.

also provide a certain multiplier effect. Finally, the emphasis being placed on the exploitation of research results, on technology transfer and on innovation will help in translating these efforts into concrete achievements, boosting our competitiveness and generating jobs.

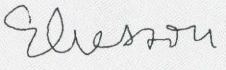
5. Why do Europeans appear to be so weak at innovation compared, in particular, with the Americans? What can be done to improve the Union's position here?

It is obvious that, when it comes to innovation, particularly in technology, Europe's performance is unsatisfactory. Innovation is our Achilles' heel. We could draw up a long list of major scientific and technological breakthroughs made in Europe only to be exploited in Japan or the United States. These include liquid crystal displays and the World Wide Web, which was invented at CERN, to quote just two obvious examples.

This European weakness is very deep-rooted. It is due, among other factors, to the inadequacies of our patent systems and to the weight of our regulations, as much as their lack of homogeneity. But there are also more deeply cultural reasons: unlike what happens in the United States, failure here is punished hard, really stigmatised. This often dissuades our researchers and entrepreneurs from taking the same risks as North Americans.

To remedy this situation, the Commission has adopted a 'First Action Plan for Innovation in Europe', which will be implemented notably through one of the specific programmes in the Fifth Framework Programme.

Among the measures envisaged, I will mention those which address two of the most severe problems. To begin with, networks will be established to provide assistance and advice in the areas of Intellectual Property Rights and access to risk capital, particularly for SMEs. Secondly, at the European Council of Amsterdam last June, it was decided that the Commission would jointly study ways of financing high technology projects within SMEs with the European Investment Bank and the European Investment Fund.



80% of all Europeans live in towns and cities. The decay of Europe's cultural heritage costs an estimated 14 billion ECU each year.
The harmonious development of the urban environment requires a holistic, innovative approach based on advanced models of urban organisation. Fifth Framework Programme research will focus integrated transport management and urban vehicles (e.g. zero-emission vehicles), economic and sustainable construction technologies, energy efficiency (particularly in buildings), and the preservation and utilisation of cultural heritage

Generic Technologies
New and improved materials and manufacturing processes • materials resistant to high temperature and pressure (e.g., energy generation and engines); light materials (e.g., transport and construction); functional materials (opto-electronics, biomaterials, sensors) designed for recycling • new coal and steel materials and production technologies • measurements and tests to support standardisation, combat fraud and assure product and service quality

Improving Europe's research infrastructure
Optimum utilisation of research facilities • virtual institutes • European metrological infrastructure • reference databases

Annex - Further Information

The Commission operates a variety of networks and services dedicated to helping European companies and businesses both get involved in the research programmes and profit from the results.

DG XII (Science, Research and Development)

DG XII administers most of the EC's Specific Research Programmes under the Fourth Framework Programme, and will remain a central information point under the Fifth.

Contact:

- **The Brite-Euram Help Line**

for information on R&D into industrial technologies;
Tel: +32 2 295 23 45
Fax: +32 2 296 67 57; +32 2 295 80 46
E-mail: imt-helpdesk@dg12.cec.be

- **SME Help Desk**

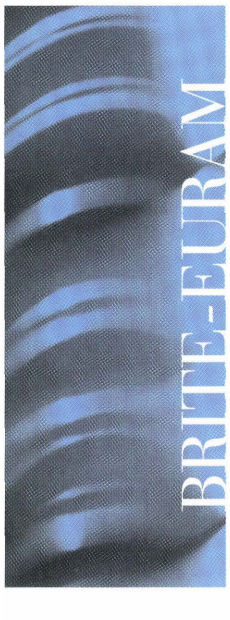
for information on SME-oriented R&D;
Tel: +32 2 295 71 75
Fax: +32 2 295 71 10

- **DG XII Communication Unit**

for general information on the Specific Research Programmes run by DG XII, including press releases, brochures, booklets and the quarterly magazine RTD Info (see Journals, below).
Tel: +32 2 299 18 65
Fax: +32 2 295 82 20
E-mail. info-dg12@dg12.cec.be

- **DG XII WWW site**

(http://europa.eu.int/en/comm/dg12/index.html) for further, up-to-date information on the DG XII research programmes, contact details, summaries of publications and an electronic document ordering service.



Innovation Relay Centres

There are over 50 Innovation Relay Centres (IRCs) located throughout the European Union and in Norway and Iceland. Each IRC is an independent business and technology consulting office, and is staffed by professionals with in-depth knowledge of the technology needs of businesses in their region.
Their focus is to bring European research, development and innovation closer to the companies, especially SMEs, in their respective regions. Activities range from on-site consulting to seminars and workshops on topics relevant to the region's industry. And because each IRC is part of a Europe-wide network, they can help companies forge research partnerships and technology transfer agreements with organisations across Europe.

Contact:

- **IRC Coordination Unit**

Tel: +352 34 20 21 600
Fax: +352 34 80 30
http://www.cordis.lu/irc/home.html

Other Offices

• **RTD Help Desk**

The RTD Help Desk can assist in locating sources of information on EC research (e.g. publications and contact persons).

Contact:

Tel: +352 4301 33161

Fax: +352 4301 32084

• **Euro Info Centre Network**

The 250 EICs across Europe are responsible for informing local companies, especially SMEs, about EU activities and initiatives, including RTD and technology transfer programmes.

Contact:

Fax: +32 2 295 7335

E-m. eichdt@belgium.eu.net

Http://europa.eu.int/en/comm/dg23/eoleweb/en/e-eole.htm

• **EUR-OP**

The Office for Official Publications of the European Communities (EUR-OP) is the official publisher of the EU institutions, and therefore produces a great deal of information on EC research programmes and projects. Its WWW site contains additional information, an on-line catalogue system and the text of EUR-OP News, its newsletter.

Contact:

Fx. +352 29 29 427 63

Http://europa.eu.int/en/comm/opoce/wel.html

Joint Research Centre

The Joint Research Centre (JRC) is the EU's own scientific and technical research centre. The five research sites in Belgium, Germany, Italy, the Netherlands and Spain house the Institutes for the Environment; Advanced Materials; Reference Materials and Measurements; Systems, Informatics and Safety; Transuranium Elements; Space Applications; and Prospective Technological Studies.

Each Institute focuses on research which can best be done by pooling the EU's resources. The result is a set of world-class facilities staffed by international, independent and results-oriented research teams.

The Institute for Advanced Materials (IAM), for example, runs the High Flux Reactor, one of the most powerful multi-purpose research and test reactors in Europe, a 40 MeV Cyclotron and a number of reference and testing laboratories. The IAM is, unsurprisingly, a significant contributor to many Brite-Euram and standards research projects, participating in 12 EC research projects in 1996 alone, and helps companies with problems ranging from aero-engine turbine materials to non-destructive testing.

Contact:

• **JRC Public Relations**

Tl. +39 332 78 91 80

Fx. +39 332 78 58 18

E-m. prp@jrc.it

Http://www.jrc.org

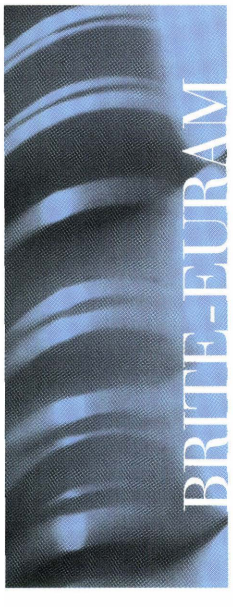
Online - Community R&D Information Service

On-line information systems have rapidly become a major platform for disseminating information on European Commission activities. Information on research and development, naturally, has been at the forefront of this revolution.

The Commission runs a number of servers on the World Wide Web (WWW). Of these, the Community Research and Development Information Service (CORDIS), as its name indicates, is dedicated to providing free-of-charge information on EC R&D, and registers around 800,000 connections every month.

The core of the "CORDIS Information Space" is a set of nine databases documenting all aspects of EU-funded research, including a daily news service and detailed databases of research projects and their results, organisations seeking project partners, research-oriented EC publications and more. Both detailed searches on each database and a less detailed "global search" across all databases are possible, via both the WWW and "dial up" services. The databases can also be accessed through a quarterly CD-ROM and a range of paper-based publications (see "In Addition").

In addition, the WWW site provides a number of dedicated information services covering the development of the Fifth Framework Programme, the research aspects of each EU Presidency, and so on. Users can also use the site to submit information to the the partner search and research results databases, download documents ranging from the Innovation Action Plan to an individual research programme's Calls for Proposals and Workprogramme, and access the "Home Pages" of most EC research programmes.



Finally, CORDIS information is also disseminated through a number of publications:

- **CORDIS focus**, a fortnightly printed digest of the latest items from the CORDIS News Service. In English, French and German.

- **CORDIS focus Results supplement**, a quarterly selection of items extracted from the CORDIS Results Service.

- **Euroabstracts**, published six times a year, provides abstracts of about 300 R&D-oriented publications from the EU per issue, using the CORDIS Publications Service as source material. It also includes reviews and feature articles on EU RTD programmes. 63 ECU/year.

Contact:

- **WWW**: http://cordis.lu

"dial-up services": contact CORDIS Help Desk (below) for details;

- **CD-ROM**: all nine CORDIS databases are available on a CD-ROM, published quarterly on a subscription basis (annual subscription 250 ECU, single edition 100 ECU).

Contact: EUR-OP, OP4C-OFL
Tel: +352 2929 420 17
Fax: +352 2929 420 27
E-mail: offline@opoce.cec.be

- **CORDIS Help Desk**

Tel: +352 40116 2240
Fax: +352 40116 2248
E-mail: helpdesk@cordis.lu

- **Submitting information to CORDIS**

CORDIS Information Collection Unit
Tel: +32 2 280 17 44
Fax: +32 2 280 17 49
E-mail. cordis-icu@cordis.lu

Other Web Resources

In addition to CORDIS, there are a number of other WWW sites carrying useful information on EU RTD activities:

• **EUROPA (http://europa.eu.int/)**: The central WWW server of the European Union contains information on the EU's goals, policies and activities. DG XII (Science, Research and Development), EUR-OP and the Euro Information Centres all have sites on EUROPA.

• **I'M Europe (http://www.echo.lu/)**: The various EC programmes and activities designed to stimulate the European electronic information services market and multimedia content industry.

• **European Commission Host Organisation (ECHO - http://www.echo.lu/echo/en/menuecho.html)**: ECHO offers telnet access to around 20 databases covering research and development, the electronic information market, industry and economy, language technology and more.

• **Information Society Project Office (ISPO http://www.ispo.cec.be/)**: ISPO is the Commission's "one stop shop" for everything concerning the Information Society.

Other Publications

• **RTD INFO**

A 32-page quarterly in English, French and German covering the Community research programmes (calls for proposals, project results, events, publications, etc.), profiling research projects and other aspects of EC research. Free from DG XII, with an on-line version on DG XII's WWW site (see above).

• **Innovation & Technology Transfer**

A 24-page bimonthly in English, French and German of particular interest to the technology transfer community in industry, research institutions, universities and professional organisations. Each issue includes an in-depth Dossier on one subject, articles on innovation policy and practice, case studies of successful projects and so on. Free from the RTD Help Desk, with an on-line version on the CORDIS WWW server.

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