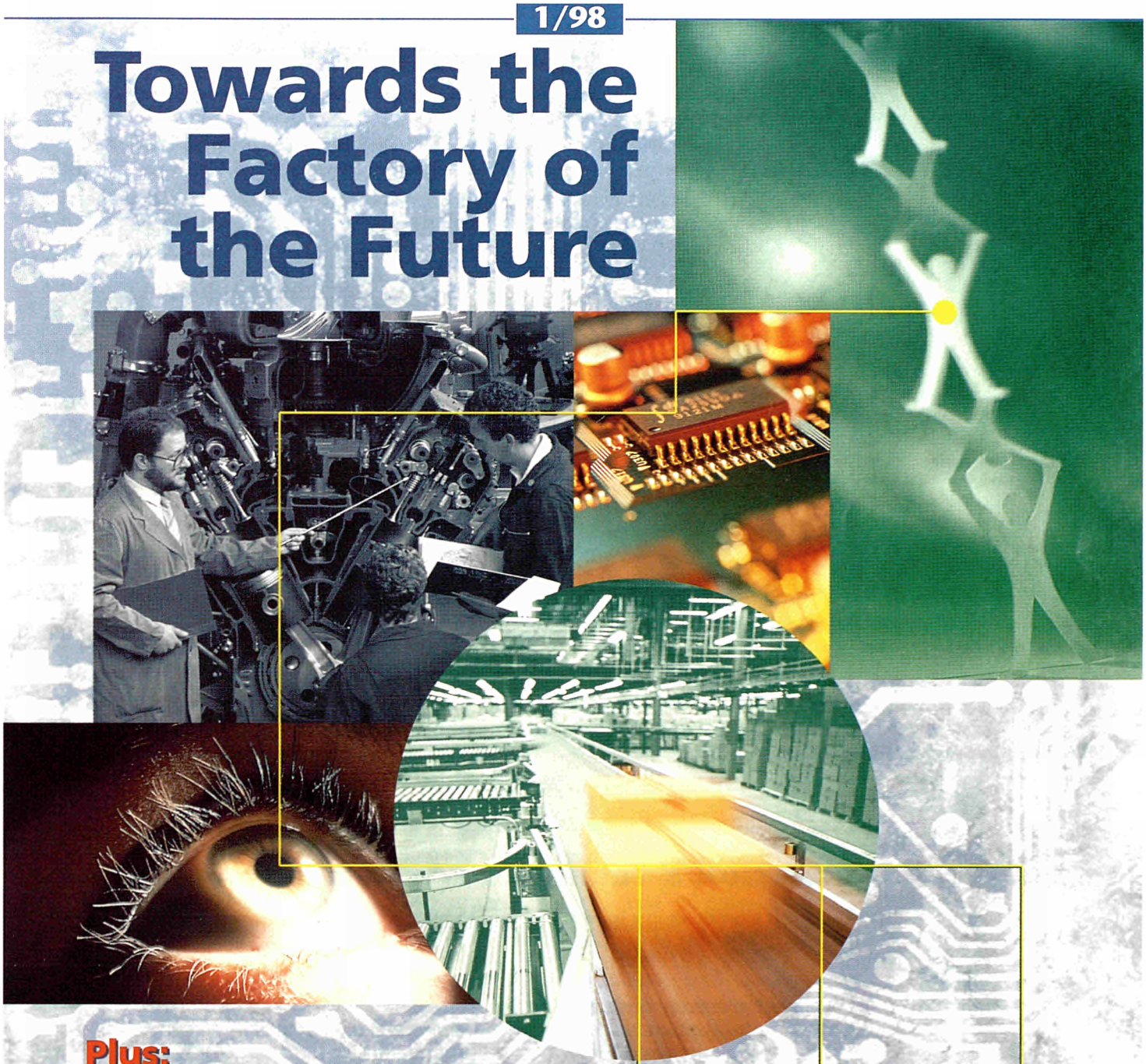
Innovation & Technology Transfer

1/98

ISSN 1013-6452

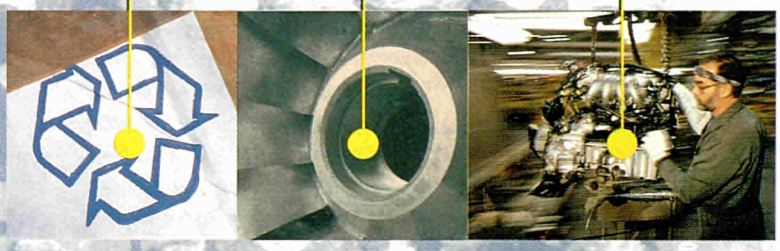
Towards the Factory of the Future



Plus:

- Innovation projects: safer, greener agriculture
- Taking pole position: IRC Automotive Group
- Financing innovation: first I-TEC funds

and more...



PUBLISHED BY THE EUROPEAN COMMISSION

INNOVATION PROGRAMME • JANUARY 1998

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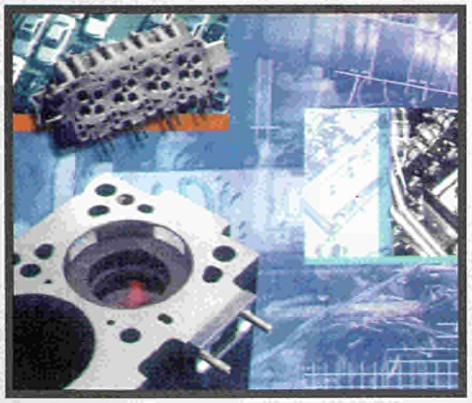

Factory of the Future, page 16.

Cover: European Service Network.

Employment in Europe

The Extraordinary European Council Meeting on Employment, held in Luxembourg last November, underlined Europe's commitment to tackle unemployment, with the Council deciding that the relevant provisions of the Treaty of Amsterdam should be put into effect immediately. The coordination of employment policy across Europe is no longer on the horizon - it is here.

Employment guidelines will be elaborated and specific targets set. These will be monitored with the same vigour as the economic convergence criteria for Monetary Union. Education and training feature prominently in these guidelines, as does risk capital. A number of Commission Programmes are active in these fields, all focusing on creating a knowledge-based Europe - the best guarantor of employment that we have.

The SOCRATES and LEONARDO programmes, for example, are already improving competitiveness and combating unemployment and social exclusion by raising skill levels throughout society. Similarly, the Innovation Programme's I-TEC scheme, carried out in collaboration with the European Investment Bank, is helping improve access to risk capital for innovative SMEs.

Finally, the Fifth Framework Programme for R&D, to be launched this year, will focus Europe's scientific, technological and human resources on raising competitiveness, employment and sustainable growth.

INNOVATION & TECHNOLOGY TRANSFER

The European Commission's Innovation Programme is under the responsibility of Edith Cresson, Member of the Commission responsible for Research, Innovation, Education, Training and Youth.

Innovation & Technology Transfer is published six times a year in English, French and German by the Innovation Programme. The Programme aims to strengthen Europe's innovation infrastructure and foster the application of research results to industry.

PUBLISHED BY:
European Commission, Directorate-General XIII
Telecommunications, Information Market and Exploitation of Research
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WRITTEN AND PRODUCED BY:
ESN, Brussels

Printed in Belgium

WWW ADDRESS:
Http://www.cordis.lu/itt/itt-en/home.html

Subscription to *Innovation & Technology Transfer* is free - please fill out the request form on the back page and fax or post it back to DG XIII/D-2.

► CONFERENCE

A Tighter Focus on Strategic Goals

"Scientific excellence is Europe's trump card. Now we must convert it into competitiveness and new jobs, by strengthening the links between research and new products and services. Research must focus on the needs and expectations of the public, so that industry is better able to meet them."

With these words, Commissioner Edith Cresson set out the theme of the 1997 Conference on Industrial Technologies, held in Toulouse at the end of October — *'Europe's research at the service of its people'*.

The conference itself addressed three technological areas:
- Towards a better living and working urban environment;
- The factory of the future (see Dossier, page 16);
- New perspectives in aeronautics and aerospace.

Contributors to these sessions, and to plenary debates at the beginning and end of the four-day event, were drawn from the European industrial community, from the European Commission, the European Council and the European Parliament, and from the French government. The conference was inaugurated by Mr Lionel Jospin, Prime Minister of France, and the opening session was addressed by Mme Cresson.

> *"The global European research effort has declined over the past years, reaching 1.9% of EU GNP. The figure is 2.7% for the USA and almost 3% for Japan."*
>
> *Edith Cresson*

A Powerful Vision

Mme Cresson's opening address presented a powerful personal vision of the urgency, mechanisms and potential achievements of future technological research at European level.

Industrial research is the key to the international competitiveness of European companies, she said. Historically, the European countries and sectors which spend most on R&D have achieved the highest productivity. More recently, industries with the fastest growing research spending have been most successful in creating new jobs.

European spending on research, public spending in particular, is continuing to fall behind that of the US and Japan as a proportion of GDP. In the US, massive public intervention supports large and small companies in key areas, and employment growth in high technology industries is nearly 2.5 times greater than in the economy as a whole. US government spending on industrial R&D in 1995, in fact, exceeded that of the 15 EU Member States by $16 billion. Several SE Asian countries also devote a greater proportion of GDP to R&D than do the majority of EU Member States.

The EU's trade deficit in high tech products is currently between 10 and 15 billion ECU per year. Investment in R&D, and in particular support for the creation and development of innovative firms, is essential if Europe is to reduce unemployment.

Skill cannot compensate for lack of resources. Governments and companies must increase investment in R&D to the levels of their competitors. Europe must exploit its scientific potential more effectively. Regulatory and cultural obstacles must be removed, so that the full economic benefits of research can be secured. And Europe's efforts must be better co-ordinated. Today, Europe's six civil aircraft manufacturers face a single US competitor with a 70% share of the world market. Closer partnership between manufacturers, researchers and end-users will be needed.

The European Union itself has a key role, and has committed itself to increase spending on research. But the Fifth Framework Programme will focus tightly on a few selected themes and objectives, in order to achieve 'critical mass' in areas of strategic importance. On its own, the Fifth Framework Programme cannot resolve Europe's serious problems of growth, competitiveness and employment. But it can help industrial research to play its part, and to maximise the positive impacts of scientific and technological progress. □

INDUSTRIAL POLICY

Lowering the Price Barrier

Full liberalisation of the European Union telecommunications market took place on 1 January 1998. The lowered costs should have a direct impact on European industrial competitiveness, as well as promoting the growth of new industries.

Last October the European Commission agreed a Recommendation from Commissioner Martin Bangemann (Telecommunications) on the prices which telecommunications operators charge each other for the delivery of calls, to apply after the opening of the liberalised EU telecommunications market on 1 January.

These 'interconnection charges' constitute one of the biggest cost items faced by new market entrants in the telecommunications sector, some of whom find that up to 40% of their costs go in payments to established operators. The Recommendation sets out 'best current practice' prices based on the three Member States with the lowest interconnection prices, typically 2-3 times lower than some operators had originally proposed.

The biggest impact will be to reduce the cost of market entry for new operators, but the Recommendation also points the way to reductions in the cost of calls from mobile phones to fixed networks, and in the cost of long distance calls between Member States in the EU.

The price guidelines are non-binding, but are recommended as an adjunct to the binding principle that fixed network operators must provide interconnection to their networks at cost-oriented prices. They are designed to alert national regulatory authorities to the need for further investigation when operators propose prices outside the suggested ranges.

Telecommunications competition will improve service, in some Member States lowering prices by up to 40%. The impact on European competitiveness will be significant.

"For a new entrant in Europe's liberalised telecommunications market, interconnection is essential," said Mr Bangemann. "It is the only way to reach customers connected to existing telephone networks. The price of interconnection will be a critical factor affecting the speed with which competition and choice develop in the EU. With this Recommendation the Commission is sending a strong signal to the market that we expect interconnection prices in Europe to be very competitive."

With telecommunications costing consumers and industry more in Europe than in the USA, and considering the growing importance of the Information Society as a source of growth and jobs in its own right, the new telecommunications regime in Europe should have a significant impact on all levels of industry. □

> *"According to a study carried out in nine European countries, 86% of European business leaders eagerly await the benefits of telecoms liberalisation, and a similar number say that liberalisation will benefit their business."*

Progress Report

Although by last October Commissioners Bangemann and Karel van Miert (Competition) were generally pleased with the progress being made towards liberalisation, in some Member States Community law was not yet properly applied in practice, even though it was exactly transposed into the national measures.

The Commission had received reports of long delays before licences are granted, of prohibitive licence fees, and of interconnection charges which involved anti-competitive price reductions. It announced that it was instituting legal proceedings against Belgium, Denmark, Germany, Greece, Italy, Luxembourg and Portugal.

Nine out of the ten Member States which had been required to withdraw special and exclusive rights over the provision of voice telephony by 1 January 1998 had adopted the necessary measures. In Belgium, draft measures were in hand. Greece, Spain, Ireland, Portugal and Luxembourg had been granted a derogation regarding the date, while four Member States had abolished special and exclusive rights in advance of the deadline.

The Commission will present an updated status report early in 1998, on the basis of its next bilateral contacts with Member States.

Capital: A Growth Medium for Biotechnology

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Poor access to start-up finance has constrained Europe's conversion of scientific research into marketable 'bioproducts'. The new Biotechnology and Finance forum will help break the deadlock. The first conference will be held this May.

In comparison with the USA, Europe has a poor record for financing technologically innovative SMEs in all fields, particularly in the early stages of product or process development. The problem is particularly acute in the area of biotechnology, where small, dynamic, and innovative companies, many created by university researchers, have found great difficulties in accessing the financial resources, assistance and advice needed during the first phase of their development.

This is despite the rapid growth of demand for biotechnology-based products and processes. It is estimated that by the year 2000 the sector will create 200,000 new jobs worldwide, mostly in the areas of health and environment, and will achieve annual sales worth 100,000 MECU.

Today, however, European industrial biotechnology lags far behind its US competitors. Employment in the sector is 23% of that in the US, even lower (16%) relative to total population, while the value of America's bioproduct sales is ten times greater than Europe's.

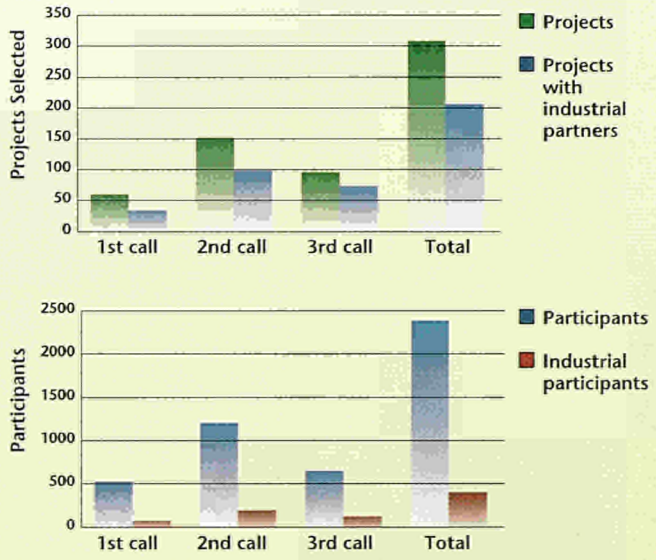
An Entrepreneurial Approach

Launched by the European Commission in collaboration with the European Association of Security Dealers (EASD), the Biotechnology and Finance forum is a first step by the EU towards facilitating the development of the bioproducts sector. It will bring industrialists, researchers, and the financial community closer together by organising studies, European conferences, and the presentation of individual companies and projects to institutional investors.

The main aim is to encourage closer links between investors and the scientific and industrial community of researchers and 'campus companies'. This should lead to better capitalisation and the adoption of a more entrepreneurial approach. Both are essential if the European biotechnology industry is to fulfil its potential.

Announcing the forum's creation, Commissioner Edith Cresson underlined the fact that, in Europe, the gap between the financial community and those involved in research and technological development is still too wide. "To develop new technologies is one thing," she said. "Ensuring their dissemination and application is another. It is essential that our companies are enabled to reach this second stage if Europe is to enjoy the anticipated benefits of economic growth and job creation. We hope that this forum will improve the links between European biotechnology research and potential investors, in particular venture capital funds."

Biotech R&D: Rising Industrial Participation



The third Call for Proposals for the Biotechnology research programme produced 391 proposals, of which 96 were selected in April 1997, representing a total funding of 113.6 MECU. 41% of these new projects include an SME.
While around one in six of all participants in the programme is from industry, the industrial penetration - the proportion of projects involving at least one company - has now reached two thirds, with this figure rising significantly (from 57% to 77%) between the first and third Calls.
The programme's fourth and final Call, which closed last October, received 572 proposals.

First Conference

The forum's first major conference will take place in Brussels on May 12-14.

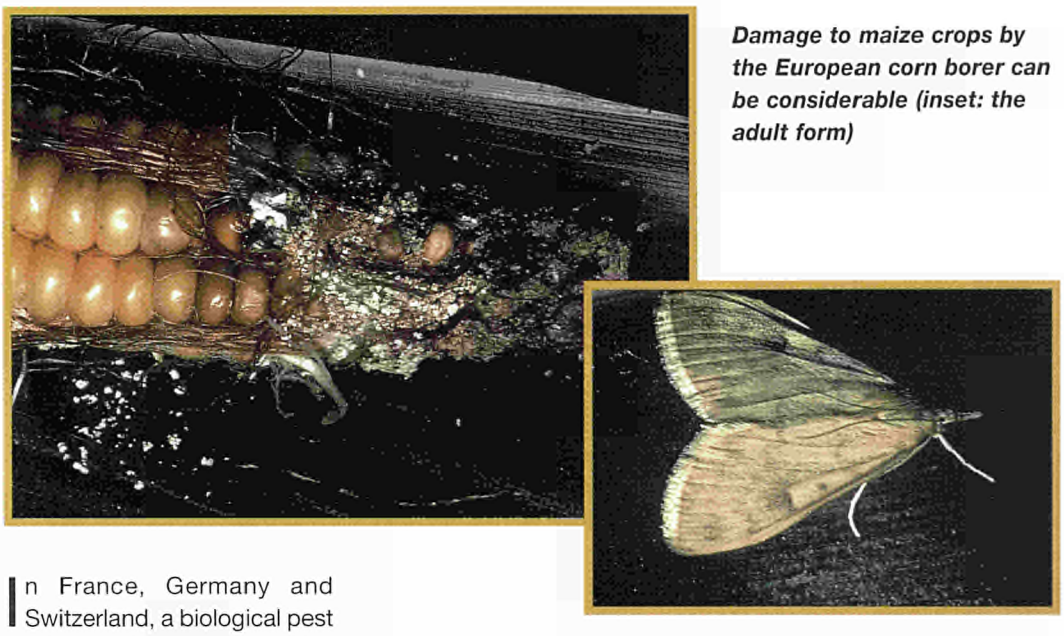
It will cover the state of biotechnology in Europe, a report on the financial needs of the European biotechnology sector, emerging research trends, training and educational needs, financing tools, 'biotech entrepreneurship', presentations of twelve companies, and more.

EASD's Chairman, Mr Didier Duhem, believes that the sector has a great future. "Europe now has pan-European financial markets like NASDAQ, which allow biotechnology firms to be financed properly. The markets have shown that they can raise new funds for companies and provide venture capital investors with the necessary returns, which can in turn be invested in new companies. Nothing now prevents Europe's biotechnology industry from enjoying the same levels of funding as its US counterpart." □

INNOVATION PROJECT

Biological Pest Control

The European corn borer is a major agricultural pest. A recent technology transfer project set out to adapt a successful French method of biological control to the more difficult conditions faced by Europe's biggest maize producers, Spain and Italy.



Damage to maize crops by the European corn borer can be considerable (inset: the adult form)

In France, Germany and Switzerland, a biological pest control method developed by the French SME Biotop and INRA, the French national agricultural research institute, has been a huge success. First introduced in 1986, the method has won a steadily increasing share of the market. In 1997, 30,000 hectares of French maize, out of a total of 300,000 treated against the corn borer, were protected using the Biotop method.

"The European corn borer *Ostrinia nubilalis* is a moth which lays its eggs on the leaves of the maize plant," explains Jacques Frandon of Biotop, the project's technical co-ordinator. "As soon as the caterpillar emerges from the eggs it starts to feed on the stem, hair and grains of the seed head. Yields of all varieties are reduced, and affected heads of sweet corn intended for human consumption cannot be sold at all."

Health Worries

But there is growing concern about the environmental and health impacts of conventional chemical pesticide sprays, particularly among consumer groups. This has created economic pressure to adopt biological treatments, since producers are now able to charge a premium price for sweet corn grown without chemicals.

Biotop's method of control employs a natural parasite, *Trichogramma brassicae*. This tiny wasp, less than a millimetre in length, deposits its own eggs inside those of the corn borer. Its eggs hatch first, feeding on and completely destroying those of the corn borer as they emerge.

Treatment involves the carefully timed release of Trichogrammes, mass-produced by Biotop and delivered in bags of small cardboard capsules. In France, where fields are fairly small, this is easily and cheaply accomplished by hand. The farmer walks through the field, dropping two capsules every five metres, for example, according to a defined spreading scheme. "The method is at least as effective as the competing chemical treatment, which only acts on the caterpillars after they emerge," says Frandon. "But unlike a chemical spray, it is also completely safe for the environment, for the farmer, and for the consumer."

Native Strain

The challenge addressed by the four-year SPRINT technology transfer project(1) was to meet growing demand for a

The Innovation Programme In Brief

The Innovation Programme implements the Third of the four Activities of the Fourth Framework Programme (1994-1998). Run by DG XIII/D, the Innovation Programme encourages the exchange of research information and the absorption of new technologies by European companies.

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Innovation Home Page Http://www.cordis.lu/ innovation/home.html

(1) SPRINT was a forerunner of today's Innovation Programme.

biological control method from the much larger producers of Italy and Spain. But as Frandon explains, this required more than a simple adjustment of the release programme.

"Conditions in Italy and Spain are very different," he says. "The maize crop is affected by two generations of the corn borer, not one as in northern Europe. In addition, Trichogramma is poorly adapted to the very high August temperatures, when the second generation, which does the greatest damage, is active."

In the project's first year, Spanish and Italian field trials of the existing treatment confirmed that it was less effective in Mediterranean conditions. An alternative control was needed, and a promising candidate - a native strain of the same Trichogramma species - was identified by one of the project's Italian partners, the University of Udine.

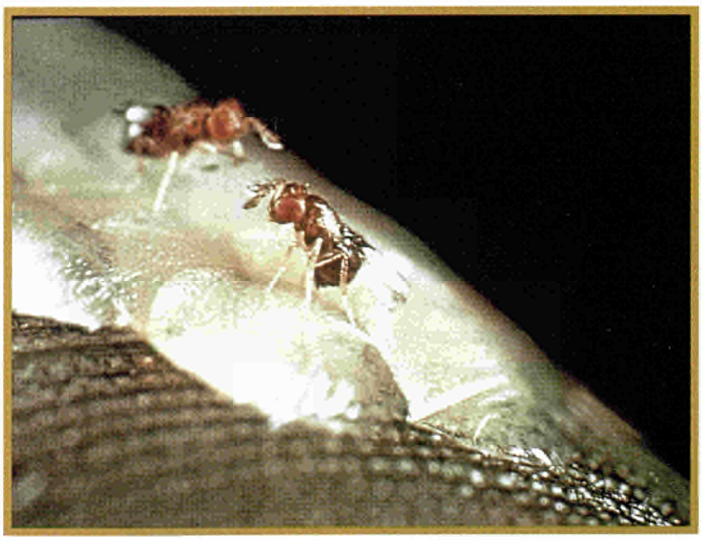
The partners embarked on parallel programmes of laboratory tests and field trials of the new strain. While laboratory studies attempted to establish its tolerance of high temperatures and to define parameters for the density and timing of release, the first field trials were spectacularly successful.

Immediate Effects

"Immediately, we could see that the new strain worked well," recalls Frandon, "particularly in Spain, where the rate of corn borer infestation is lower. The first Italian tests were conducted in fields of grain corn, used in animal feeds. This crop is not generally treated anyway, and the size of the plants made it hard for the Trichogrammes to disperse properly. But subsequent testing on crops of sweet corn yielded progressively better results, and Biotop is now working with a large Italian sweet corn producer who is very keen to continue trials."

In Spain, the project encountered a further difficulty. Although the treatment proved to be 80% effective against the corn borer in crops of grain corn, many Spanish maize crops are also attacked by a related moth, *Sesamia nonagriaides*, and most farmers apply a single chemical treatment against both. In order to compete, a biological method which protects against both pests must be developed.

"Biological controls are species-specific," Frandon explains. "That is why they ●●●



Trichogramma represents an environmentally friendly solution.

STOP PRESS

A Breath of Fresh Air

One award for innovation leads to another ...

Buissard's tractor cabin, featuring atmosphere-control technology transferred from Germany, won a gold medal for excellence at a recent international agricultural fair.

Last year Mr H. Rump, Director of Dortmund-based ETR GmbH, won the prestigious 'Diesel Prize' for his long list of inventions, particularly a new automobile sensor which, upon detecting high levels of atmospheric pollutants, triggers the closure of the vehicle air intakes.

Having started marketing the technology to the automobile industry, the company began looking around for other markets. They made enquiries both through their existing networks and through ZENIT GmbH, the Mulheim-based Innovation Relay Centre. Out of these brainstorming exercises came a possible new application - protecting farmers during the spraying of pesticides.

The risk arises from the poor atmosphere in tractor cabs while spraying, due to inadequate or poorly maintained filter systems. With concern over chemical exposure in the agricultural industry mounting, there seemed to be a market for a special tractor cab featuring a ventilation system controlled by a new version of the sensor.

Winning Gold

Enter two French companies - SP Defense, a design and manufacturing firm specialising in filter technology, and Buissard, an SME tractor manufacturer based in Normandy. The consortium applied for and won Innovation project funding.

By the time the project had entered its final phase they had designed and tested a prototype consisting of a cabin with an integrated sensor and filter system. Buissard exhibited it last November at SITEVI (Salon International des Techniques et Equipements Viti-Vinicoles et Arboricoles), where it won a gold medal for excellence.

The first markets to be targeted will be within the EU, with an early sales objective of around 5 MECU per year. Some of the partners are building on the success to date and have started a new project within the Innovation programme.

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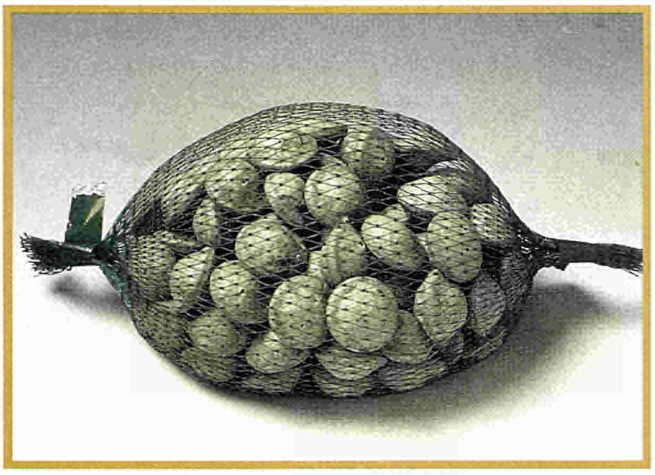

Biotop's Trichogramma capsules.

are so environmentally friendly. But it creates problems when crops are attacked by more than one pest. Trichogrammes are highly effective against *Ostrinia*, but useless against *Sesamia*." The project's Spanish partner, the Institute of Agricultural Technology Research (IRTA), is now working on a pheromone treatment designed to disrupt the breeding cycle of *Sesamia*. Mr Frandon is hopeful that in due course the two methods can be combined in order to offer producers a biological control which can be applied in a single procedure.

Optimisation

But Frandon expects the treatment developed in the SPRINT project to be introduced to the Italian market within a few years. "The project has clearly demonstrated the feasibility of using *Trichogramma brassicae* against the European corn borer in Mediterranean countries," he says. "Italian sweet corn producers are keen to use our method. We have established links with SCAM Biosystem, a local distributor of biological controls, and with their help we think we can eventually penetrate the seed corn market as well."

Two obstacles remain. First, the present Italian method involves three releases of Trichogrammes each season. Biotop believes that with further work a cheaper but equally effective programme of two releases could be developed. Second, Italian fields are much larger than those in France and Germany, and SCAM has warned that producers will demand a mechanised application procedure.

The optimisation and mechanisation of the treatment method is the subject of an Innovation project, whose definition phase has already been approved. If this progresses to the implementation phase, Frandon is confident that Trichogramma will be protecting Italian maize crops against the European corn borer safely and cost-effectively by the year 2000.

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AUDIO-VISUAL

Innovation: The Movie

The Innovation Programme has produced three new videos. Two explain the concept of innovation and the work of the programme. The third will help prospective partners prepare for a cross-border collaborative project.

'Innovating in Europe' and 'Europe: Innovating Together' offer brief summaries of the need for innovation as a source of competitiveness for European companies. They explain that the Innovation Programme aims to create a culture of innovation, in which companies can benefit from trans-border collaboration, acquiring new technologies and developing new skills.

Both emphasise that innovation concerns more than the development of new products. The transfer of existing technologies from research to industry, and between regions and sectors, is the fastest way to achieve innovation. European competitiveness demands transnational partnership involving researchers, technology suppliers and end-users. 'Europe: Innovating Together' also outlines the structure of a technology transfer or validation project, and presents three case studies.

The third video, 'Working Together', tells the story of one Innovation project's definition phase. Transnational partners are seen first in a moderated planning workshop. The value of openness in building mutual understanding and trust is convincingly portrayed. By turning problems into tasks, the partners prepare a successful application for the project's implementation phase.

The videos are available in French, German, English, Italian and Spanish, and can be viewed at Innovation Relay Centres (IRCs) in each EU country.

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High-Tech Investment Capacity Boosted

The first nine European venture capital funds to take part in the Innovation and Technology Equity Capital (I-TEC) pilot project have been chosen. They will add significantly to Europe's capacity to fund its young, high technology companies.

Mme Edith Cresson, Commissioner for research, innovation and education, announced the selection of the first nine funds in December. They were chosen for their ability to boost the level of early stage investment in technology projects.

Of the nine operations (see table), three are UK-based and three German, with one each in France, Belgium and Austria. Six of the funds have an EU as well as a purely national investment remit. All nine will focus on the financing of technology-based companies, and they have a combined investment capacity of 300 MECU, of which 186 MECU will be exclusively available for early stage high-tech investments.

Venture capital investments in high-tech enterprises were three times greater in the US than in Europe in 1995, and those in young companies nearly five times greater(1). The Commission's Action Plan for Innovation makes it a very high priority to close this gap, and the I-TEC scheme has been launched, in collaboration with the European Investment Fund (EIF), as a concrete first step. It realises the ambition expressed by last year's Amsterdam and Luxembourg European Councils to encourage the financing of high technology projects, and to build the capacity of venture capital funds to appraise and manage early stage investments in technologically innovative SMEs.

Expert Appraisal

It is management expertise as much as financial capacity which has been lacking in the European venture capital sector, according to the Commission. Too few fund operators are equipped with the technological expertise required to evaluate high-tech investment opportunities, and the cost of buying in the necessary skills and information is high.

Paul Castle is the Chief Executive of MTI Manager Limited, one of the UK-based I-TEC participants. He agrees that, in general, European venture capitalists and European inventors understand one another's needs much less well than their US counterparts. MTI's own fund managers are themselves technologists, and Mr Castle believes that having technological expertise in-house is the key to successful venture capital investment in this area. But in-house expertise, although essential, is rarely enough.

"MTI is a high technology venture capital fund, investing money and management resources in British product companies at a very early stage of their development," he says. "By their nature, these companies' products and processes involve state-of-the-art, leading-edge technologies. Our fund managers all have a general technological background, but we buy in specialist expertise to support detailed technical and market appraisals in relation to the technology concerned. We think this is absolutely necessary in order to protect our investments, but it does add significantly to their initial costs."

All nine funds in the I-TEC initiative will focus on financing technology-based companies, and have a combined investment capacity of 300 MECU. 186 MECU will be exclusively available for early stage high-tech investments.

New Funding

Over the next three years, I-TEC will contribute up to 0.5 MECU to each of the nine selected funds as a way of reducing these up-front costs, thereby lowering the barriers to investment of this kind. In particular, the fund operators are expected to recruit new investment managers with a technology background or with practical experience of running a technology-based company, and to improve their access to technological information services.

In return for the support offered by I-TEC, the participating funds have all undertaken to increase their early stage investments in technologically innovative SMEs significantly, with a special emphasis on financing projects which exploit the results of EC-funded research. Established funds have undertaken to increase their investments in this type of project by 50%, while new funds will commit 25% of their total capital.

Investment Intelligence

I-TEC is intended to increase investment capacity directly, rather than to develop good

(1) *See edition 4/97.*

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Sofinnova Partners	France	Soffinova Capital II	Jean-Bernard Schmidt, President	+33 1 45 26 78 92
Technologieholding vc	Germany	SET	Falk Strascheg, Managing Director	+49 89 1570 02 99
Technostart Beratung für Beteiligungsfonds	Germany	Technostart II	Michael Meyer, CEO	+49 711 784 63 44
VCI GmbH	Germany	Phoenix Venture Funds	Max Rueff, Director	+49 89 655 107

practice or to improve the European venture capital infrastructure. The participating funds are, after all, among the relatively small number which already have the expertise to invest in high-tech projects. But a parallel initiative, to be called I-TEC Partner, aims more widely to encourage and facilitate the financing of technological innovation by venture capital funds and banks.

The new measure will establish a forum to provide I-TEC participants and other funds with information about high-tech investment opportunities — and in particular about the commercially promising outputs of Community R&D projects. Conversely, the forum will offer participants in Community R&D programmes improved access to experienced and sympathetic investors.

The Commission hopes that the two projects will interact in a positive way. I-TEC Partner will not only facilitate the application of the venture capital funds supported by ITEC itself to the exploitation of EC-funded research results. As a source of investment intelligence, it will also be of great interest to other investors. Banks in particular are expected to benefit from an increased awareness of Europe's young technology-based firms, and from improved understanding of their needs.

But what of the firms themselves? Will their understanding of the needs of the banks and venture capitalists also be improved? The Commission is confident that it will.

Paul Castle's experience is that the business skills of a young company are always strengthened by partnership with a competent venture capital fund, although this improvement can take place in a number of different ways. "Occasionally, the technologists themselves enhance their commercial skills through management training," he says. "More often, that gap is filled first by management inputs from the venture capital fund itself, and later by the recruitment of professional managers. In general, our strategy is to try and free the technologists to focus on what they are best at." □

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► IRC CASE STUDY

Automotive Group: Taking Pole Position

At a recent car technology exhibition in the UK the first of the Innovation Relay Centre Thematic Groups, the IRC Automotive Group, showed how it has succeeded in building up an identity that is greater than the sum of its nine members. With the backing of vehicle manufacturers including Jaguar and Ford, and a rapidly-rising public profile, the Group is now starting on the serious business of international technology transfer.

"You have to go knocking on peoples' doors," says Tony Inglis of the UK's Midlands Innovation Relay Centre (MIRC). It's easy to believe that this simple philosophy of personal contacts and hard work forms the basis for the success not just of MIRC but of the eight other partners in the IRC Automotive Group, and of the Group as a whole. Thanks to their efforts, even the most reclusive SMEs in the automotive industry will soon be discovering the benefits of international technology transfer.

The Autotech exhibition held at the beginning of November in Birmingham, UK, clearly showed the benefits to IRCs of networking and keeping a high profile. Autotech is an important meeting point for vehicle manufacturers, research centres and technology suppliers. At the show, the Automotive Group shared a large and prestigious stand with the UK government's Department of Trade and Industry (DTI), car manufacturer Jaguar and technology companies including Texas Instruments (TI). The organisational effort was worthwhile, Inglis says: "We have had some good enquiries from Autotech."

Paul Mulvanny of Jaguar Cars Plc describing new 'head up display' technologies to John Battle, the UK Minister for Science, Energy and Industry.

"This is the first meeting at which the Automotive Group has presented its core image to the rest of the world: the stand, the people, a brochure, a Web site and a database of technology opportunities," adds Marco Mangiantini of the north-west Italian IRC, based in Turin. "We're not just a collection of IRCs any more, we're a solid group."

Strength in Numbers

Such cohesion is the aim of the new Thematic Groups that are helping IRCs to strike a balance between local accessibility and global opportunity, and to broaden their technical horizons. "Lack of specialisation can make technology transfer difficult," says Jonathan Loeffler of the IRC in Stuttgart, Germany. "We receive between 100 and 200 technology offers and requests every month, and we are not technical specialists." To help get around this problem, the Thematic Groups were designed to improve IRCs' links to technology from abroad and help the IRCs focus on the technologies most needed in their own regions.

The Automotive Group itself began a year ago at the Vehicle of the Future event in Dijon, France(1). ●●●

(1) See edition 2/97.

IRC Thematic Groups - Concept and Practice

So far, seven Thematic Groups have been formed, in the automotive, environmental, fish technology, materials, medical technology and wood sectors. The groups bring together limited numbers of IRCs from areas where these respective industries are clustered.

They bring a more targeted approach - and thus a higher success rate - in partner search, partner proposal matching and technology transfer. This is achieved by fostering links between academic institutions, large companies and SMEs. SMEs are also encouraged to network among themselves, enabling them to present integrated proposals when trying to win supply contracts with large companies.

The Automotive Thematic Group links: IRC-Alps (Camera di Commercio di Torino) * IRC-Bourgogne (Chambre Régionale de Commerce et d'Industrie de Bourgogne) * IRC-Rhône-Alpes (Chambre Régionale de Commerce et d'Industrie de Rhône-Alpes) * IRC-Midlands (Coventry University Enterprises Ltd) * IRC-Northern Ireland (Local Enterprise Development Agency) * IRC-Basque (SPRI Sociedad para la Promoción y Reconversión Industrial) * IRC-Western/Southern Sweden (Swedish Institute of Production Engineering Research) * IRC-Northern Germany (VDI/VDE Technologiezentrum Informationstechnik GmbH) * IRC-Wales (Welsh Development Agency) * IRC-Steinbeis (Steinbeis-Europa-Zentrum, Germany)

Since then there have been meetings in Bilbao and Turin at which the Group members have got to know one another and agreed on a common approach to marketing the group, though each IRC retains its individual character.

"There is certainly dynamism in the Automotive Group," says Loeffler. "Each of the member IRCs in the Group has a different background, a different host organisation and a different regional culture, but we all have good infrastructures. That's important, because technology transfer is a really hard job and to make it go well you need all the parts in place."

The Group now has nine members - enough to provide support and diversity without losing the personal touch. "Other IRCs will probably want to join the Group in the future, but I think we are close to the maximum effective size," says Mangiantini. "If we reached 11 or 12 members that could be too many to manage effectively."

Setting Out Their Wares

The Group's prominence at Autotech stems from MIRC's close relationship with the car manufacturer Jaguar. The DTI wanted to use Autotech to launch a project called the Foresight Vehicle, which provides grants for technology partnerships in the automotive industry and encourages links between vehicle manufacturers and SMEs. When representatives from the Automotive Group met Jaguar staff at a conference in 1996 they were asked to share a stand with Jaguar, the DTI and other partners, including Britain's Defence Evaluation Research Agency and Texas Instruments.

Paul Mulvanny, a senior electrical engineer with Jaguar, explains why links with IRCs and their clients are so important to his company. "The automotive industry couldn't work without subcontractors," he says. "We need to work with suppliers of components and systems to develop technology. For example, we need the head-up displays and in-car video systems that will differentiate our future cars from those of other manufacturers. And because the automotive industry takes only 5-10% of the global market for semiconductors - such as those used in these two applications - we also need to share standards with the rest of the world."

Reaping Rewards

Although the Group members estimate that it will be another few months before the real benefits of Autotech start to show, they have already seen some promising results. Representatives of vehicle manufacturer Ford were impressed by the Group's presence at the exhibition and suggested offering Ford's non-core technology for license through the IRCs. In the USA, Ford licenses some of its patents through a subsidiary company, but small firms may be reluctant to deal with such a big organisation, Inglis suggests. "Licensing through the IRC Automotive Group could be easier and cheaper," he says.

"In the future we are hoping to involve more SMEs — the second- and third-tier suppliers — in the technology transfer process," says MIRC Director John Latham. Swedish representative Max Maupoix agrees: "The trend to outsourcing means that the big systems suppliers get bigger, but the companies who make individual components find life much more difficult. IRCs will help the smaller companies link together, so a group of them could make complete component assemblies."

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► INNOVATION MANAGEMENT TECHNIQUES

Innovation Animation

Using carefully designed tools, the ANIMATE project will offer practical guidance and support to 100 British SMEs wishing to improve their competitiveness through product, process and market innovation.

ANIMATE is one of 29 projects running under the Innovation Programme's Innovation Management Techniques initiative (IMT)(1). Oriented towards the needs of UK SMEs, the project will develop and test a structured programme to guide client companies through the preparation and implementation of effective innovation plans.

"We are running the project in partnership with the Training Company Directorate (TCD), a national body which runs a technology transfer and graduate development scheme for the government," says David Kingham of Oxford Innovation. "We are also working with local partners, currently in four specific areas of the UK. Most are Business Links and Training and Enterprise Councils — business support agencies based on partnerships between public and private sectors."

The project will train a specialist group of consultants drawn from these partners to apply the ANIMATE tools, as well as promoting the use of innovation management techniques to the partner organisa-

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(1) See editions 4/97 and 5/97.
(2) 'Innovation Action' is a trademark of Oxford Innovation.

tions themselves. "Our aim is to create a critical mass of IMT expertise in each of the targeted regions," says Peter Baikie of Oxford Innovation. "We also hope that, through the TCD, this will provide feedback to policy development at national level."

Eventually, Oxford Innovation expects the ANIMATE tools to be widely available across Europe, and is fully engaged in a continuous exchange of information with the other IMT projects, conducted within the framework of the Access project.

Potential for Growth

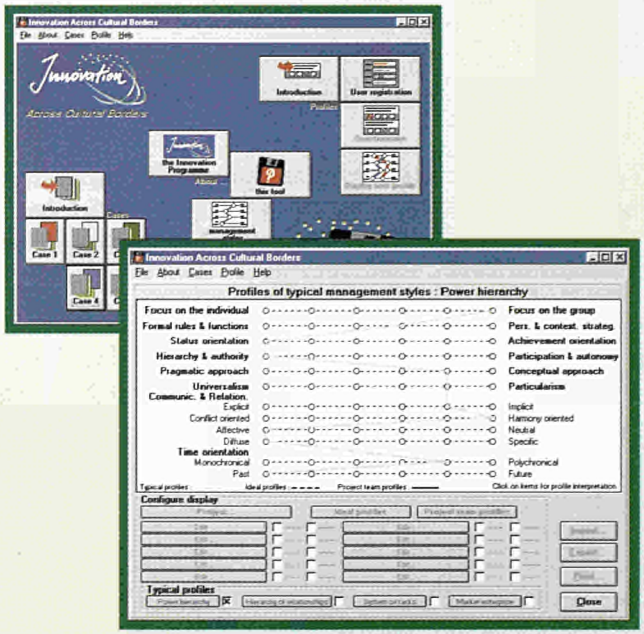
Participation in ANIMATE is open to all British SMEs but, to achieve good regional and sectoral concentration, promotion has been focused in areas where local support is strongest. "Typically, clients are companies with good growth potential, whose competitiveness depends on a technically specialised product or service," says Baikie. "In Surrey, for example, we are targeting the biotechnology, environmental technology, telecommunications, software and precision engineering sectors, and hope to recruit four or five participants from each."

Many of the ANIMATE techniques are based on the 'Innovation Action Toolkit'(2) developed by Oxford Innovation over the past three years. "We have also developed several new techniques," says David Kingham. "These include the Stepladder, which we use to assess how innovative a company is prior to its participation. We are also developing new toolkits for marketing and project management, which will be published in 1998."

Project Management

The Innovation Programme's software package and linked workbook 'Innovation across Cultural Borders' (see Edition 6/96) is now available on the World Wide Web. The package, designed to help project partners to anticipate and overcome problems caused by differences of language, culture and management style, includes six case studies and a self-assessment tool.

The book has been marked up in HTML, while the software can be downloaded as an executable file. Both are found at http://www.cordis.lu/innovation/src/culture1.htm.



Download the 1.3Mb (zipped) program to create 'management profiles' for yourself and your project partners, compare your profile of yourself to those of your partners, compare your profiles to four 'typical profiles', and explore six 'critical incident' case studies.

The Vision Thing

Client projects are likely to be varied, and may include the development of new products, the formation of strategic partnerships, research and development collaboration, the introduction of new technology, and access to external sources of funding. The ANIMATE process offers the tools and support necessary to define clear strategic goals, and to develop an ambitious but workable action plan for the implementation of a relevant innovation project.

"So often, a company's success is determined by the clarity of its goals," says Kingham. "Most know in general terms what they are trying to achieve, but many fail to pin down broad aims to specific objectives and actions. ANIMATE helps clients to arrive at their own conclusions by working through simple questions and checklists based on the experience of a wide range of companies which have faced similar challenges."

Kingham and Baikie also believe that effective management of external linkages is critical. "For most dynamic small enterprises, alliances and partnerships are essential for product development, and for entry into new export markets," says Kingham. "The key is to pick the right partner, for the right reason, and then to manage the relationship properly. For example, should you form a single tie to a multinational, or bilateral agreements with a number of companies of a size similar to your own?"

University-Industry Links

The point is well illustrated by the case of an early ANIMATE participant. The Stepladder diagnosis showed the company's internal management to be very strong — manufacturing, marketing and distribution were all competently handled. But weakness was revealed in its use of government support, its interaction with the legal and regulatory framework, and its collaboration with the research community.

"ANIMATE helped the company to think through the options for improving its access to research," Kingham recalls. "In the end, it chose to forge links with a prestigious university, as a way of protecting its intellectual property and building credibility in the market, without the risk of being swallowed up by a larger commercial partner."

Five Years of Successful Innovation

An independent expert panel has made a positive assessment of the performance of the Innovation Programme and its predecessors from 1991 to 1995. It should be given an enhanced role in the Fifth Framework Programme, the panel says, but it needs a sharper focus, increased flexibility, and improved internal coordination.

The panel's report(1) emphasises the need for a distinct European innovation policy, able to contribute decisively to other EU policies and to national and regional innovation initiatives.

Despite being hampered by a lack of resources and authority, the Innovation Programme has made progress towards such a policy and deserves to be enhanced, says the report. It should be given a more influential strategic role, interacting in a wide-ranging and flexible way with the research elements of the Fifth Framework Programme (FP5), but also acting as a 'ginger group', promoting innovation both inside and outside the Commission.

The panel would like to see the programme and its staff acting as a think-tank to disseminate ideas, experience and results, to stimulate new approaches, and to promote the processes of experimentation and reflection on which successful innovation is based.

Clear Role within FP5

Specifically, the Innovation Programme should contribute to the development and implementation of policy by Directorates-General not directly involved with R&D, in particular in the areas of industrial SME and regional policy.

In relation to research itself, the role of the Innovation Programme within FP5 needs to be clarified. The exploitation of research results requires greater attention, but in the panel's view this should primarily be the responsibility of the specific research and technological development (RTD) programmes concerned.

The Innovation Programme, meanwhile, should provide the specific programmes with guidelines for the optimisation, dissemination and application of results, and should adopt the role of monitor and mentor. It should be charged with increasing the orientation of the specific programmes towards innovation, and should be given the authority, institutional instruments and resources to do so.

Call for Tender IPR HelpDesk

Reflecting the panel's recommendations that additional effort be applied to supporting the research programmes in relation to patents and intellectual property rights (IPR), the Innovation Programme will launch an IPR Helpdesk this year (see Dossier, edition 4/97).

A Call for Tender for providing external support services to the IPR HelpDesk will be placed in the Official Journal in January.

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Recommended Adjustments

The panel makes a number of recommendations concerning the internal organisation of the programme:

- The **European Innovation Monitoring System** (EIMS) could play a more prominent role, supporting 'ginger group' activities and co-ordinating activities to raise public awareness;
- The Programme should expand and intensify its **regional actions**, promoting efficient use of structural funds to support innovation, particularly among SMEs;
- The **Innovation Relay Centres** (IRCs) should focus on the local promotion of innovation, rather than on the dissemination of information about Community RTD;
- Electronic, human and organisational **networks** are essential for effective cross-fertilisation but should eventually become self-financing, apart from the IRCs;
- The Innovation Programme should do more to foster an innovation-friendly **financial environment**;
- **CORDIS** (the Community R&D Information Service) should be enhanced to meet the needs of its users, both as a primary source of information about Community R&D, and as a conduit for the innovation message;
- Additional effort should be applied to the support offered to the RTD programmes in relation to **patents and intellectual property rights**;
- The purpose of **technology transfer and technology validation projects** should be to demonstrate and disseminate innovative approaches and practices, not to exploit specific results. The distinction between the two types should be abandoned. □

(1) 'Five Year Assessment of the Specific Programme: Dissemination and Optimization of Results (Innovation)', EUR 17600, ISBN 92-828-0628-6.

Innovation and Employment

Is technological innovation really the key to employment creation? Clearly, it can also lead to job losses. A recent EIMS study, based on Community Innovation Survey (CIS) data, set out to help policy-makers to maximise the positive employment impacts of innovation.

Unemployment in Europe appears to be stuck at a level around twice that of its principal competitor economy, the USA. The European Council met recently in Luxembourg to refocus Europe's commitment to tackling this problem, agreeing to promote education and training programmes, access risk capital and much more.

The EIMS report(1), however, points out that policy-makers can have a direct as well as an indirect influence - nearly half (48%) of Europe's GDP is controlled by government. So how can the Commission and national governments best use innovation to reduce unemployment, without at the same time undermining its contribution to competitiveness and economic growth?

Double-edged Sword

The report was produced for the European Innovation Monitoring System by the Centre for European Economic Research (ZEW), Germany. It presents an overview of academic thinking about the relationship between technological change and employment, and the results of a new analysis based on 1993 data collected for the CIS(2) in eight Member States.

Product and process innovation, says ZEW, is one of the three keys to employment growth. The others are improved competition in product and labour markets, and the stimulation of demand by government macroeconomic policy.

But innovation is a double-edged sword, not only generating employment, but also destroying and reallocating it. Whether *product* innovation leads to a net gain in employment depends on the nature of the new products, and on overall demand. If new products are complementary to existing ones, there may be a positive impact. But where they substitute for old ones, the firms which produce them will simply replace those which produced the older goods.

The situation is similar for *process* innovation, which may increase productivity, allowing firms to reduce prices and stimulating demand. This in turn will have a positive impact on demand for labour. The net effect on employment depends on the rise in demand and the reaction of competitors. In any case, firms which are unable to match technological progress in their markets will disappear. And, since European wages are high compared with those in other regions, industry tends to adopt process innovation largely as a means of reducing labour costs. Flexibility in product, labour and capital markets are absolute preconditions for innovation to produce a positive impact on employment, ZEW concludes.

Policy Levers

The report highlights the most promising policy approaches:

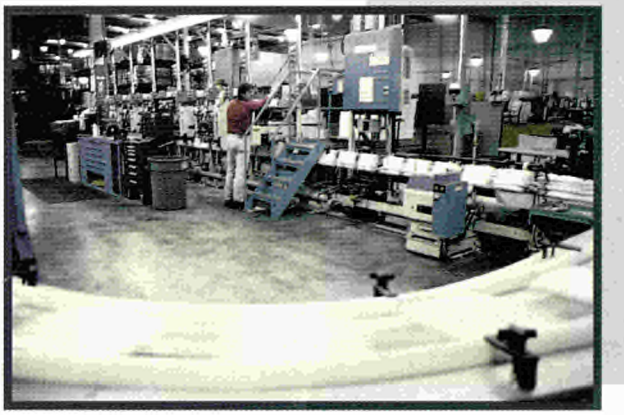
■ Redirecting innovation policy towards encouraging more labour intensive production methods to improve employment, particularly among low skilled and young, inexperienced people, should be considered. However, wage flexibility among these workers must be increased and the cost of their labour, particularly the non-wage costs, will have to be reduced;

■ This should not deflect from spending on education and training. New technologies will continue to shift demand in favour of high-skill labour;

■ Process innovation is necessary to improve Europe's advantages as a location for industrial production, both by European and non-European firms;

■ Production will continue to shift within Europe, with resulting reallocation of labour. Labour market flexibility is again necessary to cope with the temporary problems which this causes;

■ Finally, deregulation can stimulate growth through innovation. The new products and services which result will substitute for existing ones only to a small extent, and are therefore likely to generate employment. □



With industry adopting process innovation largely as a means of reducing labour costs, the report concludes that flexibility in product, labour and capital markets are absolute preconditions for innovation to produce a positive impact on employment.

(1) 'The impact of innovation on employment in Europe, an analysis using CIS data', EIMS publication number 46, 1997.
(2) See edition 4/97.

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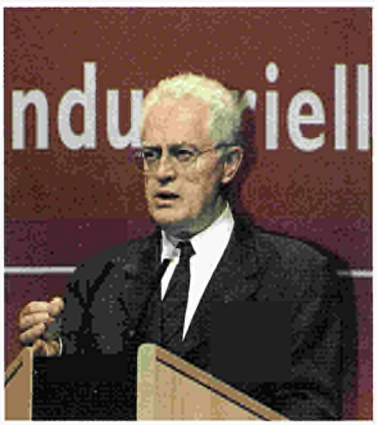
Towards the

New products, processes and organisational structures will be required to move today's manufacturing industries into the next century and achieve industrial competitiveness and sustainable growth. Collaborative research, innovation and environmental awareness are all vital aspects of this challenge.

> *"Europe was the departure point for adventurers who, in past centuries, explored the planet; it must now become the continent which pushes back the frontiers of knowledge and technology"*
>
> *Lionel Jospin*

"The factories of the future will be far better than even today's best, and the changes will come quickly," declared Torben Andersen, of Denmark's Odensk Shipyard, at a recent EC Conference on Industrial Technologies, held in Toulouse, France(1). "They'll be more responsive and productive, make higher quality goods using less raw material and energy ... better in every respect. The technologies are available now."

The key question, Professor Jovane of the Italian National Research Council added, is to make sure that some of these factories are located in Europe. "Europe's manufacturing industry provides 40 million jobs and sustains services employing another 80 million," he reminded the conference.



Lionel Jospin, French Prime Minister, opening the conference.

These jobs are at risk because the competitiveness of Europe's factories has not been keeping pace with its international competitors. As *Innovation & Technology Transfer* went to press in late 1997, the Japanese unemployment rate had reached a record 'high' of 3.5%, the USA's rate had dropped to 4.7% ... and the EU's leaders were meeting in Luxembourg to discuss how to lower EU unemployment from over 10% back into single figures.

Quite apart from its impact on unemployment, manufacturing industry holds one of the keys to sustainable development. Higher growth today at the expense of our descendants' atmosphere, water supply and raw materials will hardly be seen as a convincing triumph.

Competitiveness, employment, environment - all of these circles can be squared through the development of a vast and complex set of advanced technologies: factory technologies.

Paradigm Shifts

What are these technologies, and how will they affect European industry and society? What, in other words, will the Factory of the Future look like?

According to Gary Acres of Johnson Matthey, "the smokestack factories are not going to disappear overnight. But I think we're beginning to see the appearance of a new generation of cleaner factory. They're small, and produce only one specialised product."

Torben Andersen agrees. "The Factory of the Future will not be a large, mass production site. We'll see more suppliers sending components from geographically separate sites to the assembly location. The 'factory' will be an extended enterprise, composed of individual, even autonomous, cells."

Each cell's specialisation will improve efficiency, so in many ways competitiveness will depend on the efficiency *between* these cells as much as their productivity. They must be integrated together through sophisticated organisational arrangements and linked by effective transport and information systems. And these must be European in scope if the continent is to tap its resources effectively.

Another key to maintaining European competitiveness is the increasing development of 'product-services', where manufacturers bundle services with their

(1) see edition 5/97 for a preview.

Factory of the Future

Context

Eco-efficiency

How to profit by producing more from less.

According to Dr José-Jacinto Monge of REPSOL, a Spanish petrochemical company, all industrial competitiveness issues for the 21st century can be considered within one conceptual framework - eco-efficiency. Put simply, this states that environmental responsibility is linked to resource efficiency, which leads directly to productivity and profitability.

It links product design with manufacturing and distribution, and embraces concepts ranging from pollution prevention to Total Quality Management. Its focus on value creation and customer needs changes the questions companies ask from 'What products to make?' to 'What services to provide?'.

The World Business Council on Sustainable Development has identified seven critical factors for eco-efficiency:

- reducing the material intensity of goods and services;
- reducing the energy intensity of goods and services;
- reducing toxic dispersion;
- enhancing material recyclability;
- maximising sustainable use of resources;
- reducing material durability;
- increasing the service intensity of goods and services.

Industrial Ecology

The extended enterprise and eco-efficiency meet in an 'industrial ecology', where industrial production emulates and works in union with natural systems. "Eco-industrial parks help firms collaborate in managing environmental and energy issues," says Monge.

The first such park, in the Danish town of Kalundborg, hosts a power company, a pharmaceutical plant, a wallboard producer and an oil refinery. Steam, gas, cooling water and gypsum are circulated among the partners, with excess heat used for fish farming, heating nearby homes and greenhouse agriculture.

The partners did not create this to meet environmental regulations, but for solid business reasons: cheaper materials and energy, minimising disposal costs, turning waste from a cost to an income source, and so on. By 1993, the $60 million investment in infrastructure had produced $120 million in revenues and cost-savings.

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products to add value. This is, for many companies, a significant paradigm shift - instead of simply shipping products they will supply customer-oriented services based around their product.

Both the extended enterprise and the product-services they supply will require major improvements in information and communication technologies. The promised era of smart products, capable of seeing and interacting with the world thanks to their sensors, intelligence, communications systems and micro-actuators, will require coordinated, multidisciplinary research.

Of course, these futuristic technologies are not the only issues confronting industry - manufacturers still need improvements in today's designs, materials and production systems. Methods for refitting today's factories for tomorrow have to be found, as will new organisational structures and training schemes. A complete industrial research programme has to address all of these issues and more.

At the Crossroads

Despite Europe's competitiveness problem, the mood at the conference was of cautious optimism. The challenges may be enormous, but so are the opportunities. There is no unwritten law stating that American or Japanese factories will always be more competitive than their European equivalents - the laws of physics and chemistry are universal.

There is one aspect, however, where Europe faces a unique handicap. Unlike

its main competitors, Europe's resources are divided among many different countries. With factory technologies becoming simultaneously a much wider and more integrated field, the cross-fertilisation of ideas between academia, research institutes, large companies and SMEs must not stop at national borders.

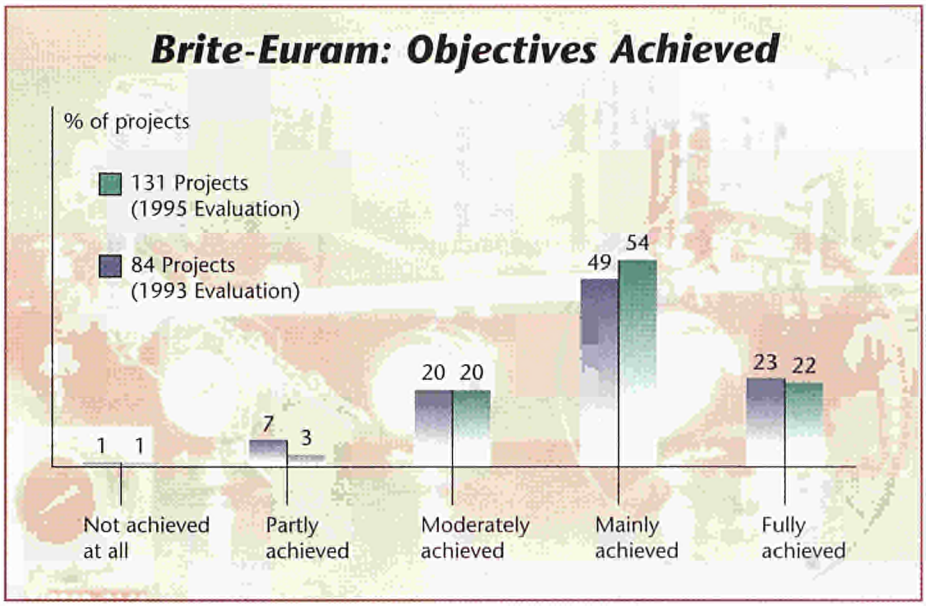
Hence the European Commission's many cross-border research and innovation programmes. While the Brite-Euram family of programmes focused on materials and process technologies, information and communication technologies were developed under three more programmes (ACTS, Esprit and Telematics Applications), and transport technologies under a fourth(2).

This will change under the Fifth Framework Programme (1998-2002), or 5FP, where - the Commission has proposed - the 'Promoting Competitive and Sustainable Growth' thematic programme will be one of just three. Targeting manufacturing industry through just one programme reflects what has been learnt over the past decade. Factories sit at the crossroads of an enormous number of different fields - from ergonomics to thermodynamics, metallurgy to human resources. Tackling these issues through a number of different programmes simply raises the number of obstacles between disciplines.

The new multidisciplinary approach will be reinforced by the launch of a Key Action - 'Products, Processes and Organisation'. This and the other five key actions in the programme will be complemented by medium to long-term research into generic technologies and a range of initiatives to support European-level research infrastructures.

Obviously, no one programme or key action will ever cover all of the technologies which could be relevant to the Factory of the Future - coordination will be particularly necessary with the 'Information Society' thematic programme. Nevertheless, the 'Products, Processes and Organisation' key action, by focusing exclusively on the different dimensions of industrial competitiveness and sustainability, should provide a much more integrated environment for industrially-oriented research across Europe.

(2) see the Dossiers 'Building the Information Society', edition 2/96, and 'Trends in Transport', edition 4/96.



The fifth and latest Brite-Euram Evaluation Report, published at the conference, found a trend towards higher numbers of smaller projects, with more SMEs benefiting from the research than ever before. It also illustrated the high quality of the research: over three-quarters of the participants considered that their project had "mainly" or "fully" achieved its technological aims.

I. Products and Processes

Research must integrate design, materials, product and production technologies.

The first challenge in manufacturing is to know what to produce. "Consumers have almost everything already, and when they do want to buy face an almost unlimited choice," Stefano Marzano, senior director of Philips Design, said at the conference. "We'll have to know them so well that we can foresee their needs long before they know them themselves."

This research into '**requirement capture techniques**' is a new field for EC industrial research, ranging as it does across social and behavioural science, market analysis techniques and methods to break down the barriers separating designers, manufacturers and consumers.

Breaking down these barriers will also - given the required technologies - help ensure that the products are designed quickly, use the most appropriate materials and technologies, and can be produced efficiently. These are questions of **design**, the source of over half of all quality problems.

EC design research aims to help industry compete on quality, customer responsiveness and timeliness, rather than cost. A number of design technologies were developed under Brite-Euram, ranging from adapting Computer-Aided Design and Manufacturing (CAD/CAM) software to low-tech industries through to the most cutting edge techniques for aerospace applications.

The keyword is integration: the associated processes should be designed together with the products themselves; and suppliers, manufacturers and consumers should be brought into the design process from the beginning. Many see **concurrent engineering**, or CE, as one answer.

"CE means basically that all the partners work simultaneously - it requires a lot of coordination but you gain in time and cost," explained Graham Storer as he presented the Concurrent Design and Engineering in Building and Civil Engineering (CONCUR) project. "We hope to use CE to cut the costs of tendering for construction projects by 50%."

Tendering is well suited to CE - it is time-consuming, expensive, multidisciplinary and requires many companies in different locations to form a 'virtual enterprise' for the duration. It is also information critical, requiring the efficient sharing of large volumes of techni-

cal, commercial and administrative data.

This information is still largely transferred on paper in batches, encouraging sequential, rather than concurrent, processes. CONCUR is developing an electronic environment which integrates each partner's activities. The same principles apply to designing new products as diverse as vacuum cleaners and machine tools.

A significant proportion of the research into design and pre-production will deal with exploiting information and communication technologies - virtual reality, simulation and modelling as well as CAD/CAM and concurrent engineering. However, there are many other techniques, such as **rapid prototyping** which allows manufacturers to test designs rapidly and cheaply.

Rapid prototyping technologies take computer-generated 3D models and build solid prototypes in a matter of hours. The partners in the PHIDIAS and PISA projects(3), for example, have adapted this technology to custom-build medical devices and implants.

It is not enough, however, to ensure that the designers know what consumers want, work closely with the manufacturers, design processes and products simultaneously, and are aware of the latest product and production technologies - those technologies must also be developed.

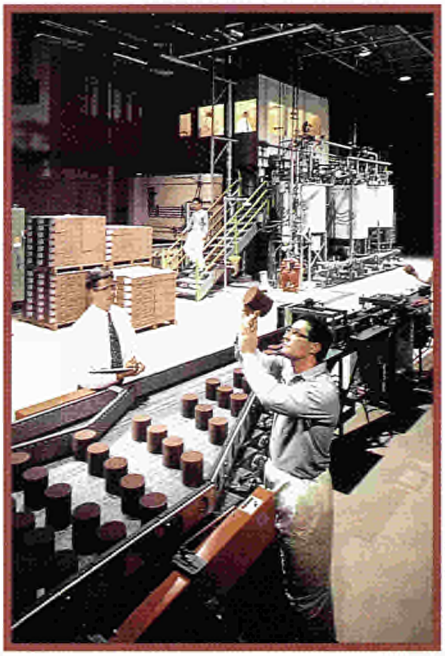
Products and Services

If there is any consensus on what the 21st century will be like, it is that it will be knowledge-based. This will be reflected in its products, which can be made **smarter**, both through microelectronics and 'smart' materials, which can vary their properties upon command.

Obviously, the right software is vital when embedding intelligence into a product. Many manufacturers are adopting **neural networks**, originally developed through research into artificial intelligence. Products can also be **miniaturised**, thanks to technologies borrowed from sources as diverse as microelectronics and molecular engineering.

An early example of these trends is the 'Electronic Nose' developed under Brite-Euram. It is a sophisticated sensor which mimics the human nose by 'tasting' the air using an array of gas sensors, sophisticated chemometrics, quartz-crystal microbalance sensors and neural network software. It is currently being developed for the same application for which we employ our noses every day - sniffing out bad food - although it will be found providing online, real-time quality control in food processing plants more often than hovering over our dinner tables.

All of these technologies point towards another important theme under 5FP - the **dematerialisation** of products. This ranges from cutting costs by reducing product mass to adding services, so that a greater portion of the value sold is wrapped up in the services, rather than the product itself.



Jonhson Mathey

Hence the product-oriented research under 5FP has many strands. On the one hand, new and improved materials will be developed, building on the many achievements of the earlier programmes. New ways of improving the products - making them lighter, more rugged and smarter - will also be developed. Finally, the entire shift towards bundling services with the product will be explored, developed and demonstrated.

Even this, however, is only part of the story. The product still has to be made.

Flexible Processes

5FP research into new manufacturing processes will be as diverse as manufacturing industry itself. On the one hand, research will be continued into improving individual manufacturing technologies ranging from bio-chemical reactions for pharmaceuticals to machine tools for automobiles.

The lines between material, product and processes technologies, of course, are so blurred as to hardly exist, so research will focus on designing and developing products and processes in concert. Major improvements in efficiency can be obtained if previously separate components or production processes are combined, for example, but in both cases the research will probably have to integrate new designs with novel materials and production and assembly techniques.

Intelligence will be built in to production systems at every level - from individual monitoring sensors, through the assembly machines and right up to the overall controlling software. Apart from improving the flexibility and reconfigurability of processes and production equipment - a key goal, considering today's rapidly changing marketplace - intelligent machines will be cheaper to maintain. Nevertheless, **maintenance technologies**, ranging from neural networks which predict equipment failure to design-for-maintenance techniques, will also be improved.

Another key aspect will be '**retrofitting**' - the integration of new technologies into existing facilities. This is vital - neither Europe's companies nor its environment can afford building new plants every time a new technology becomes available.

Finally, more flexible **logistics processes** will have to be developed. "Integrated supply chain logistics deliver multiple competitive advantages," stressed Lothar Brücher of Brandtex, presenting the results of the TARLOG (Targeted Logistics) project. Once again, "new information and communication technologies are the enabling technology. We are developing internet technologies to link the logistic and production management systems of customers, suppliers and manufacturers together, providing an agile manufacturing framework for the extended enterprise."

(3) see Case Study, edition 4/97.

II. Cradle to Grave

The final important factor when designing products and processes, of course, is sustainable development.

Almost all of the technologies mentioned earlier can be harnessed to reducing industry's environmental impact. On-line process control, for example, is as essential to improving energy and material efficiency as it is to quality; changing the materials used can reduce energy use and pollution, and allow recycling or incineration; improved design can permit component re-use.

Most Brite-Euram projects, therefore, have had a significantly positive environmental impact (see graph). According to Alfred Hoffait of Solvay, "we have made enormous progress in developing technologies, such as soil remediation, for correcting the mistakes of the past, and we've made a good start in developing products and processes which improve energy and material efficiency and minimise emissions and waste."

5FP will develop all of these technologies further, funding research into cleaner processes, lowering energy use, on-line control, in-situ waste recovery and processing. But the research will also focus on tying these 'component technologies' together to minimise each product's full life-cycle environmental impact. In particular, **product disassembly and re-manufacturing** will allow the more valuable components, such as memory chips, magnets or precious metals, to be reused in new products or, at least, recycled.

End-of-Life

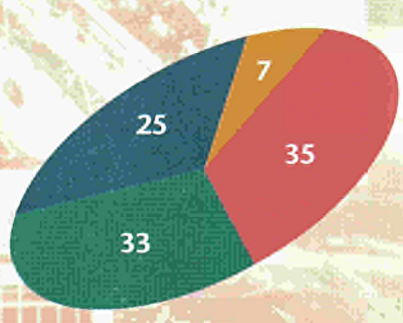
This, according to Hoffait, is the challenge for the 21st century: "Industry must commit itself to dealing with its products after they are used ... this 'cradle-to-grave product stewardship' needs new technologies to reuse or recycle efficiently."

And it is the grave - the 'end-of-life' phase - which poses the biggest problem. "Making collection and recycling economically viable means increasing end-of-life value," explains Erik Engelborghs, who is currently developing a Design for Environment methodology and software tool within a Brite-Euram project. "Our methodology helps designers improve the equation. We've already significantly improved end-of-life values of a vacuum cleaner, computer equipment and other products through quite minor design alterations."

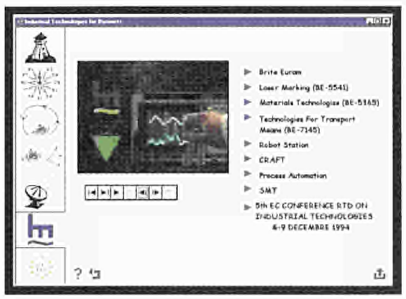
The problems extend well beyond 'hard' technological problems such as processing, recycling and reuse. In fact, one of the biggest hurdles is simply getting the discarded product back to where it can be dealt with. So-called **'reverse supply chains'** have appeared for household waste (glass and paper recycling, etc.), but setting up similar schemes for integrated circuits or construction materials is expensive, unproven, and therefore risky.

Brite-Euram: Environmental Consequences

The Evaluation found that around two thirds of the 131 projects produced results with possible environmental consequences. 177 individual environmental impacts were identified. 95% of them are positive, and are dominated by energy and material saving.



Industrial Technologies for Business



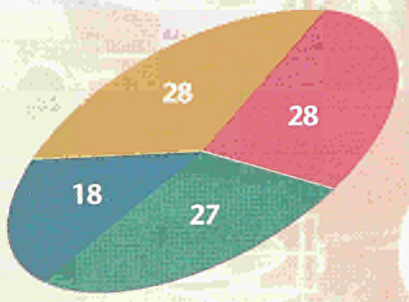
The Industrial Technologies for Business CD-ROM includes multimedia presentations of DG XII (Science, Research and Development), its industrial technologies research programmes and some example projects. It also features a projects and partners database and summaries of three Brite-Euram Evaluations.

Innovative 'soft' approaches are therefore as necessary as technological research. There are many, from tackling the regulatory environment to changing the philosophy of companies and customers. This ties in with the move towards designing 'product-services', with some companies offering 'take-back' services and using 'loyalty schemes' to encourage their customers to use them.

As Hugh Smith of Xerox, the office equipment manufacturer turned 'document company', explained at the conference, "the waste stream should be viewed as an asset which, through careful disassembly, cleaning, inspection and reprocessing, can produce components with 'as new' performance. Our customers earn points towards their next purchase by returning toner and copy cartridges, and our factories integrate both new-build and remanufacturing on the same assembly lines. Xerox saved an estimated several hundred million dollars in 1995 alone in this way."

Brite-Euram: A Healthy Impact

The Evaluation also found that just over half the 131 projects had a possible influence on health and working conditions. Of the 120 individual influences identified, 109 (89%) are favourable.



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

III. People Power

Where do people fit in amongst all this technology?

All of these technologies affect employees. For one thing, workers' lives are safer - automation is removing them from dangerous substances as diverse as spray paint and chromium dust. But are they being removed from employment altogether?

In some cases advanced technologies do replace people on the shopfloor. However, studies indicate that these technologies open up more jobs elsewhere in the economy than they close. The problem lies in retraining the workers for these new jobs.

This is also a major issue when workers must operate a new technology - the recent BRITE-EURAM evaluation, for example, showed that almost half of all project results would require an increase in operator skill levels when commercialised.

Training = Competitiveness

Encouraging **lifelong training** is therefore not just a socially responsible goal - it is one of the keys to industrial competitiveness. Robots may perform robotic tasks more efficiently than humans, but the relentless drive for improved quality opens up new applications for the skills and qualities which only humans possess - the ability to think, to be creative, to react to new situations, to work flexibly.

Exploiting these abilities requires retraining the staff and, usually, rewiring the organisational structure. But this is not the only issue reshaping company hierarchies. The extended enterprise requires a reliable, structured flow of information on quality, design, strategy, customer satisfaction and more between suppliers, manufacturers and customers. Organisational structures, often extending beyond the organisation itself, must encourage this information flow, and information technologies and logistic systems developed to match.

The shift from viewing employees as a cost to be reduced to a resource to be developed has a number of other implications. Improving worker motivation is crucial, and that means improving working conditions. This will also help attract 'new blood' to work in the factory of the future.

"We have a long way to go before we can finally leave behind the consequences of the irresponsible behaviour against workers a century ago, which led to the creation of two parties - workers and companies - acting against each other," Odensk Shipyard's Torben Andersen concludes. "Today we have workers of different skills, foremen telling them what to do, production managers planning ahead for several foremen, and support specialists. That will change - the worker will become his own master. The network will provide him with all necessary information. The worker of the Industrial Revolution will disappear."

Rewiring SMEs

All of this has particular implications for SMEs. For them to keep up with their partners they need to have an active research programme - difficult for companies of this size.

SMEs have been targeted since Brite-Euram II, under which cooperative research projects (CRAFT) and SME feasibility awards were piloted. Half of all BRITE-EURAM III projects, moreover, contain at least one SME.

Apart from involving SMEs in research, many projects also developed SME-oriented tools, such as software for benchmarking performance, communication tools and 'Anthropocentric Production System' methodologies, which complement Total Quality by focusing on the expertise of human operators.

This sort of work will continue under 5FP, which will focus on developing high performance workplaces, finding new ways of networking companies together effectively, and developing multi-skilled, highly motivated workforces. This will require new benchmarking tools, human-centred production architectures, 'learn-capable' production systems, electronic commerce tools, and more.

The focus on SMEs, finally, will be guaranteed by an entire programme - 'Innovation and SMEs' - devoted in part to helping them carry out research and exploit research results.

Further Information

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imt-helpdesk@dg12.cec.be

■ **SME Help Desk**
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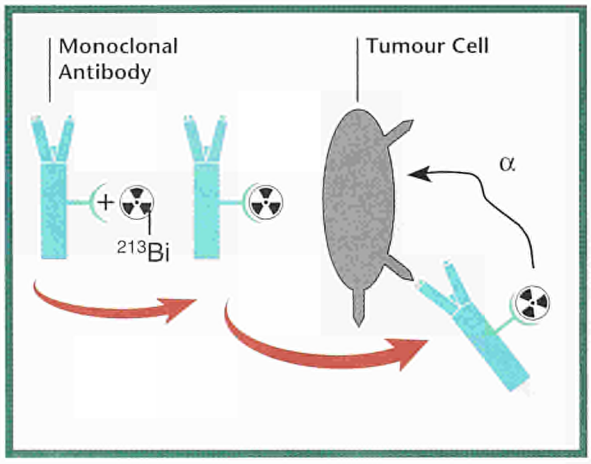
Fx: +32 2 295 7110

■ **Industrial Technologies on the WWW:**
http://europa.eu.int/comm/dg12/br-eur1.html
http://www.cordis.lu/brite-euram/home.html

► JOINT RESEARCH CENTRE

Nuclear War Against Cancer

The European Commission's Joint Research Centre has developed two innovative applications of its nuclear expertise in the medical field.



Bi-213 is coupled to a monoclonal antibody, which brings the alpha-emitting radionuclide close enough to the cancerous cell to destroy it without damaging surrounding tissue.

A radioactive isotope produced in Karlsruhe by the JRC's Institute for Transuranium Elements (ITU) has for the first time made targeted alpha-particle therapy both feasible and safe in treating cancer. Initial tests, carried out at the Memorial Sloan-Kettering Cancer Center in New York, have produced very encouraging results.

Alpha-immunotherapy is based on the emission of alpha particles by radionuclides. The isotope, bismuth-213 (Bi-213), is attached to a monoclonal antibody, which seeks out target areas in bone marrow, liver and spleen. The radionuclide delivers a high-powered, short range radiation dose, killing the cancerous cells.

The US tests on nine leukaemia patients showed that the alpha particles were 100-1,000 times more cytotoxic than beta particles, which have also been tried, and caused much less damage to surrounding healthy tissue.

While Bi-213 is only one of many sources of alpha particles, it is easier to handle than the others, and decays rapidly into a non-radioactive substance. In addition, the ITU adopted a production decay chain - actinium-225 to Bi-213 - which does not produce radon or high-energy gamma radiation.

Bi-213 does, however, have a half-life of just 45 minutes, so the ITU called upon its expertise in the area to develop an innovative transport system and hospital-friendly procedures which allows Bi-213 to be extracted just before treatment. In this way ITU has delivered more than ten clinical Bi-213 generators to hospitals in the USA and France, allowing the isotope's effectiveness against cancers such as leukaemia and lymphomas, as well as micrometastatic carcinomas, to be evaluated.

Ac-225, however, is expensive to produce and also has a short half-life (10 days), meaning that these generators must themselves be produced shortly before use. The ITU has therefore developed and patented a variety of new methods of generating Ac-225, some of which promise greater flexibility.

Boron Neutron Capture Therapy

Clinical trials of another cancer treatment based on JRC technology, Boron Neutron Capture Therapy (BNCT), are just beginning. The trials will target the highly aggressive brain tumour glioblastoma multiforme, which affects around 15,000 people in Europe every year.

In BNCT, patients are injected with a boron-based compound and irradiated by a neutron beam. The compound is selectively absorbed by cancerous cells, making them 3,000 times more likely to be struck by neutrons than healthy cells. When they are struck, the boron/neutron nuclear reaction creates alpha particles, destroying them.

The trials are taking place in the framework of a BIOMED 2 project involving hospitals and research institutes from Austria, France, Germany, the Netherlands and Switzerland, as well as the JRC's Institute for Advanced Materials (IAM) and the Netherlands Energy Research Foundation (ECN). The neutron beam - unique in Europe and one of only three in the world - has been installed in a self-contained medical unit at the JRC's High Flux Reactor in Petten (the Netherlands).

The Phase 1 trial will determine how well the new treatment is tolerated and what side effects might occur. Patients from the countries involved are to be treated by radiotherapists from the University Clinic in Essen, Germany. This is the first European clinical trial where patients from one European country are treated by doctors from another, at a facility located in a third, and thus shows the way forward to improving access to sophisticated and expensive facilities across Europe.

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► CONFERENCES

Product Data Technology Days 1998 24-26 March, Watford (UK)

The 1998 European Product Data Technology Days are aimed at managers, developers and users of product data technology. Organised by the European Commission (DG III) in collaboration with Quality Marketing Services, the 1998 conference represents a continuation of the work of the Product Data Technology Advisory Group (PDTAG-AM), a project supported under the Esprit programme for IT research and development.

The overall aim of the conference is to raise awareness within industrial and commercial enterprises of the business advantages that can be achieved by adopting and using modern PDT methods, and to share experiences on how measurable benefits can be realised.

Contact: Quality Marketing Services
Tl. +44 1252 87 84 82
Fx. +44 1252 87 73 86
E-m: billm@qmsstep.demon.co.uk
http: //www.cadlab.tu-berlin.de/~PDTAG

Business Opportunities in Genomic Research 30 March-1 April, Turin (Italy)

Organised by the European Yeast Industry Platform (YIP) with the support of the EC's Biotechnology research programme, the conference will include a showcase for practical examples and sessions devoted to specific key issues in the EU, such as intellectual property, venture capital and technology transfer from academic research.

Contact: Tech-Know Consultants SPRL
Tl. +32 2 372 09 92
Fx. +32 2 372 09 92
E-m: anne.marie.prieels@skynet.be

Electronic Commerce '98 - Distributed Systems for Electronic Commerce 3-5 June, Hamburg (Germany)

EC'98 will focus on the latest results and experiences, in both industrial and academic system and application software development, in distributed systems for electronic commerce. The conference is divided into two streams:

- The Research Forum: requirements, experiences, implementation reports and ongoing development and research work in the field of electronic commerce with a distributed systems background;
- The Industrial Forum: bringing together providers and users of electronic commerce systems.

Topics of special interest range from economic market models to workflow management for electronic markets, from platforms (WWW, COBRA, Java, and beyond) to intelligent agents and multi-agent systems.

Contact: M. Merz, Hamburg University
Tl. +49 40 54 94 23 46
Fx. +49 40 54 94 23 28
E-m: merz@informatik.uni-hamburg.de
http://vsys-www.informatik.uni-hamburg.de/ec98/

Intelligent Robotic Systems 21-23 July, Edinburgh (UK)

Supported by the Community's Training and Mobility of Researchers (TMR) programme, the Sixth International Symposium on Intelligent Robotic Systems will cover all modern approaches to robotics problems, from 3D reconstruction to fuzzy and neural networks.

The organisers are currently seeking extended abstracts (four pages) of papers for presentation at the conference (deadline: 9 March 1998).

Contact: J. Gordon, University of Edinburgh
Tl. +44 131 650 30 94
Fx. +44 131 650 68 99
E-m: judith@dai.ed.ac.uk
http://www.dai.ed.ac.uk/SIRS98/

Technology Policy and Innovation 3-5 August, Lisbon

The Second International Conference on Technology Policy and Innovation - to run in parallel to EXPO'98, the Lisbon World Exhibition - will focus on global and regional technology and innovation policies for achieving sustainable development in the 21st century.

Emphasis will be placed on the impact of science and technology and of wealth creation on sustainability. In addition to the plenary sessions, four workshops will cover environmental resources management, urban sustainability, the management and commercialisation of science and technology and the role and future agenda of innovation centres. The deadline for submission of abstracts is 14 February 1998.

Contact: Manuel V. Heitor, Instituto Superior Técnico
Fx. +351 1 849 61 56
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http: //gep.ist.utl.pt/tech_innov_conf.html

► PUBLICATIONS

■ FIFTH ANNUAL REPORT OF EUROPEAN SME OBSERVATORY

The fifth Annual Report of the European SME Observatory gives an overview of the situation and prospects of SMEs in the European Economic Area and Switzerland, and concludes that economic growth is most likely to come from micro-enterprises with ten employees or less.

The report comes as the Community and Member States are intensifying their efforts for the implementation of an integrated and coherent strategy in favour of employment. It was prepared by the European Network for SME Research, and underlines the fact that new enterprises - which are mostly SMEs - are an important source for the creation of new jobs. Some one million new enterprises are started each year in the EU, while the average EU company provides employment for six people.

Unfortunately, employment created by new enterprises tends to be unstable, with high failure rates. While only half of new enterprises survive for five years, however, employment appears to grow in those that do survive. Survival rates of new enterprises could be improved by reducing administrative burdens, improving conditions for the transfer of business from one generation to the next, and reducing problem of late payment.

The report finds that micro-enterprises, those with up to 10 employees, are less bankruptcy prone than larger companies.

Contact: EIM Small Business Research Consultancy
Tl. +31 79 34 13 634
Fx. +31 79 34 25 786

■ VIDEO: INVENTING TOMORROW

The "Inventing Tomorrow" video shows the range of activities covered by Community research and looks forward to the future Fifth Research Framework Programme.

It presents several research projects supported by the EU, showing what a typical project looks like and demonstrating the value of European cooperation in tackling major scientific and technological challenges.

It also addresses the future priorities of Community research, putting the Fifth Framework Programme into the context of today's major concerns and problems.

Currently available from EurOp Sales Agents (see Note) in English and French, while a German version is in preparation. Journalists, teachers and other 'information multipliers' may receive free copies from

the DG XII Communication Unit.
Contact: M. Claessens, DG XII Communication Unit
Fx. +32 2 295 82 20
E-m: michel.claessens@dg12.cec.be
http://europa.eu.int/comm/dg12/info/video-en.html

■ EUROPEAN ECO-INDUSTRIES DATABASE

The first edition of a "Database of Eco-Industries in the European Union", from DG XI (Environment), can be downloaded from the World Wide Web.
It contains details of over 2,000 European companies providing over 60 different environmental technologies, products and services in at least one of seven core areas of environmental protection:
- Air pollution control;
- Water and waste water treatment;
- Waste management;
- Contaminated land treatment;
- Noise and vibration control;
- Environmental monitoring;
- Environmental consultancy/services.

The Commission wishes to update and extend the database, and is therefore constantly seeking information from companies active in the field.
Contact: http://europa.eu.int/en/comm/dg11/ecoindus/home.htm

SUCCESS STORIES

As the Fourth Framework Programme enters its final year, more and more research programmes are publishing 'success stories' detailing the results of their projects.

ESPRIT

ISBN 92-828-1633-8
Four separate groups of fact sheets have been published by ESPRIT:
- ESPRIT results: outlining successful products, processes or services;
- ESPRIT in business: successful applications of results generated by ESPRIT projects;
- Companies in ESPRIT: the benefits to companies from participation in ESPRIT;
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http: //www.cordis.lu/esprit/home.html
PROSOMA: http: //www.prosoma.lu/

STANDARDS, MEASUREMENTS AND TESTING(1)

20 fact sheets describe successful SMT research projects in fields such as medicine and health, environment, agriculture and foods, and industrial processes. English, with French versions available this year.
Contact: SMT Programme, DG XII
Fx. +32 2 295 80 72
E-m: smt-helpdesk@dg12.cec.be

INCO-EAST

17 profiles of projects involving organisations from Central and Eastern Europe, financed by the International Cooperation research programme. English only.
Contact: L. Skylv, INCO, DG XII
Fx. +32 2 296 33 08

36 PROJECTS(1)

Another 36 sheets on projects from most EC research programmes are available from DG XII's Communications Unit. French, with English and German versions available later this year.
Contact: M. Claessens, DG XII Communication Unit
Fx. +32 2 295 82 20
E-m: michel.claessens@dg12.cec.be

(1) These sheets - arranged by research theme rather than programme - will also be placed on the 'Innovation in Europe' WWW site (http://europa.eu.int/comm/dg12/success/en/succ-en.html), where profiles of 50 Brite-Euram, SMT, CRAFT and Steel projects can already be found

NOTE

Publications are free unless otherwise stated. If specific contact information for obtaining a publication is not supplied, and there is a price listed in ECU, then the publication can be purchased from the sales and subscription office in your country of the Office for Official Publications of the European Communities (Eur-OP). Addresses can be found in most EC publications, on the WWW (http://eur-op.eu.int/_en/general/s-ad.htm) and by contacting Eur-Op (fax: +352 2929 42759).

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