Innovation & Technology Transfer

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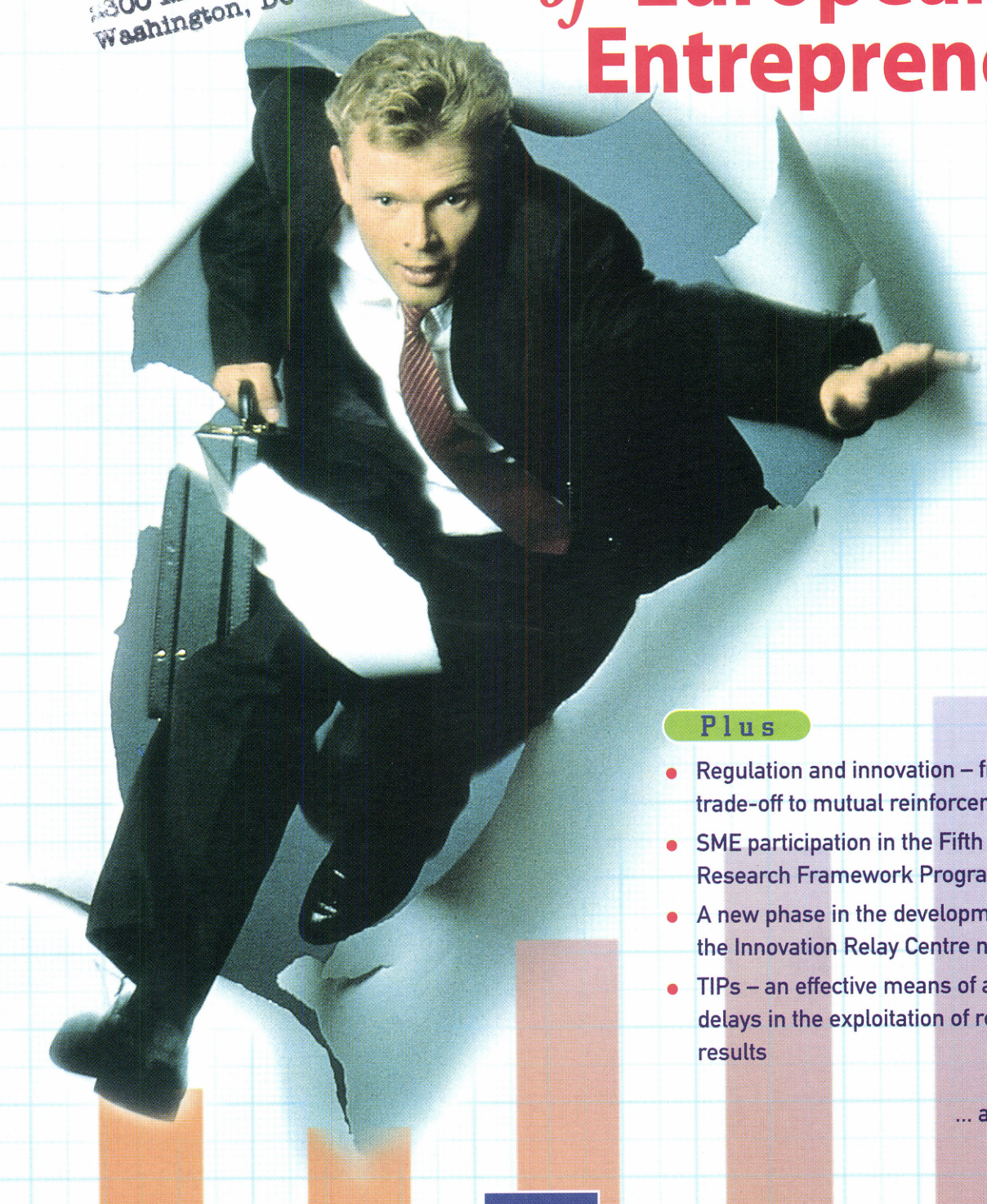
ISSN 1013-6452

INNOVATION: Facts & Figures

A New Breed *of* European Entrepreneur



Plus

- Regulation and innovation – from trade-off to mutual reinforcement
- SME participation in the Fifth Research Framework Programme
- A new phase in the development of the Innovation Relay Centre network
- TIPs – an effective means of avoiding delays in the exploitation of research results

... and more

PUBLISHED BY THE EUROPEAN COMMISSION

INNOVATION/SMEs PROGRAMME • MARCH 2000

CONTENTS

Equipped to Support Innovation

It is now four years since the European Commission established the Innovation Relay Centre network.

From April, the network will span all 31 European Union and Fifth Research Framework Programme Associated countries, offering small and medium-sized enterprises in each region access to technology suppliers, customers, licensees and research partners in every corner of Europe – and expert assistance to exchange technological know-how with them.

The 68 Innovation Relay Centre (IRCs) employ sophisticated information management tools and proven SME support methodologies. They have also forged close links with technology-oriented SMEs and the academic knowledge base in their own regions, as well as with national business support networks.

Working closely with other IRCs, they are therefore equipped to provide high-tech SMEs with a streamlined cross-border technology transfer service – a service which has already contributed to nearly 500 reported agreements for the exchange of technologies between partners from different countries.

At the start of the network's second phase, the IRC Newsletter included in this edition of *Innovation & Technology Transfer* looks back at the achievements of the network's first four years. It also looks forward to the challenges and opportunities which face it as an integrated component of the rapidly developing professional European innovation support infrastructure.

Innovation & Technology Transfer

Innovation

Innovation & Technology Transfer is published six times a year, simultaneously in English, French, German, Italian and Spanish, by the Innovation and SMEs programme, part of the European Commission's Fifth Research Framework Programme. The Programme promotes innovation and encourages the participation of small and medium-sized enterprises (SMEs) in the framework programme.

Published by:

European Commission, Enterprise DG,
Innovation Directorate, Communication and Awareness Unit

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http://www.cordis.lu/itt/itt-en/home.html

Written and produced by:

ESN, Brussels

Printed in Belgium

Sustainable Policy-Making

Improved understanding of the complex interrelationships between regulation, innovation and competitiveness is helping EU policy-makers to design environmental legislation in such a way as to maximise its contribution to economic growth and employment.

The Amsterdam Treaty's commitment to the integration of environmental protection into all areas of Community activity has significant implications for future enterprise policy. As Romano Prodi told the European Parliament: "In realising the sustainable development option, we must ensure that the quality of the environment is a positive factor for innovation and thus for competitiveness."

From trade-off to trade

For a long time, industry viewed environmental regulations merely as a cost. Yet if they stimulate innovation, leading to cost-savings and the development of new products, such regulations can produce an overall gain in competitiveness.

The Institute for Prospective Technological Studies (IPTS) of the European Commission's Joint Research Centre has just completed a major study, The Impact of Regulation on Innovation in European Industry, on behalf of the Directorate-General for Enterprise. "Its aim was to develop a new methodological approach encompassing the complex interdependences between regulation and other factors influencing innovative behaviour by companies," explains Dr Jens Hemmelskamp of IPTS.

The study has applied this approach in a number of sub-projects addressing specific sectors such as the chemical and recycling industries, and has furnished the Enterprise DG with guidance about the key elements of innovation-friendly policy-making.

Double dividend

"Community policy has reduced pollution," says Hemmelskamp. "But it has so far been mainly based on emission standards. Companies have focused on end-of-pipe solutions to make the small, incremental improvements necessary for compliance."

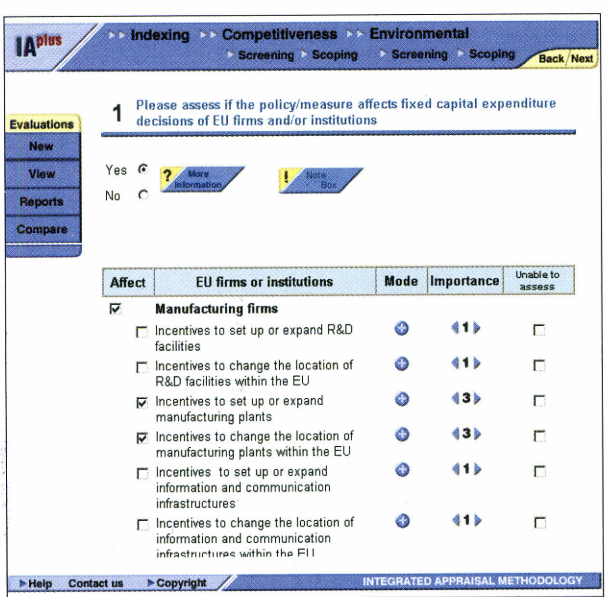
To accelerate progress – by encouraging companies to invest in clean, energy-efficient equipment as a source of competitive advantage – regulators will need to take into account the interlinkages within innovation systems.

"But there is no simple way to achieve the double dividend of competitiveness and environmental protection," Hemmelskamp warns. The study will recommend that for individual sectors policy-makers employ a mix of complementary measures, including research and development, taxation and voluntary agreements, on the basis of early consultation with the industries involved. "It is crucial that the length of the investment cycle is taken into account," says Hemmelskamp. "Companies will not respond proactively unless unambiguous policy signals are given at an early stage."

The study has established a network of experts and national governments, which first met at a conference in Potsdam last May(1), and will continue to foster debate on this subject at EU and international levels.

The drive to maximise the synergy between different policy goals also underlies a sophisticated and user-friendly software tool to support improved integration of environmental and industrial policy. The Integrated Appraisal Methodology (IAplus), being developed by IPTS and the European Science and Technology Observatory (ESTO), is intended to help Enterprise DG staff clarify the impacts of policy options on innovation, competitiveness and the environment. ●

(1) The full proceedings of the Potsdam conference will be published this spring – 'Innovation-oriented environmental regulation', ed. J. Hemmelskamp, K. Rennings, F. Leone; ZEW Economic Studies, Springer.



By guiding policy-makers through a structured sequence of simple questions, the IAplus software will help them consider the impacts of planned environmental regulations on innovation and competitiveness.

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EU and US Collaborative Research

Since the 1980s, policy-makers on each side of the Atlantic have emulated the Japanese system of research joint ventures (RJVs), but have used very different means. An ongoing US-EU study is assessing the real benefits of collaborative research – and of publicly funded research itself.

In recognition that co-operation between competitors can stimulate innovation, the NCRA relaxes tough US antitrust rules in the case of Research Joint Ventures.

America has nothing like the European Union's successive Framework Programmes of shared-cost research. "Public subsidy for research is politically difficult in the US," explains Nicholas Vonortas, Associate Professor in the Department of Economics at the George Washington University in Washington, DC. "Here, public funding is almost exclusively devoted either to basic research undertaken by federal research establishments, or to research contracts awarded by federal departments – in the areas of defence and healthcare in particular."

So in 1984, as the EU was launching its first Framework Programme, the US Congress chose to promote RJVs not by subsidising collaborative research, but by relaxing tough antitrust legislation in the case of registered RJVs. The National Cooperative Research Act (NCRA) offers participants a way of avoiding the very stiff penalties the courts can impose for anti-competitive practice.

Paper trails

NCRA registration, like the EU research programmes, has created an enormous volume of data about inter-firm collaboration in research and development, which Vonortas is using to test economic, business and policy hypotheses about the costs and benefits of this approach. "Our study will lead to improved understanding of the impacts of joint research on competitiveness, innovation and economic growth," he says.

Vonortas believes that comparison between the US and EU data will be of even greater value to policy-makers, however. In a recently completed Community research project co-ordinated by the National Technical University of Athens(1), he helped to apply the methodology developed in the NCRA studies to the construction of parallel RJV databases for seven EU Member States. "This allows comparative analysis, which will enable us to assess the relative merits of the very different methods of public intervention in science and technology adopted in the two regions," he says.

Focus on bottlenecks

Last year, Vonortas compared unsubsidised NCRA-registered joint ventures with the small number of American RJVs which received public funding under the Advanced Technology Programme (ATP) introduced by President Clinton. The results give an early indication of the kind of findings which a larger-scale US-EU comparison may produce in the future.

"We found very little difference between the programme's broad technological goals and those addressed by private joint ventures," he reports. "But if you look closer, it is clear that the government-funded research is more tightly focused on specific bottlenecks. An increasing number of complex products depend on synchronised progress in a number of different technologies. If limited public resources are concentrated on those which private sector research appears unable to advance, then in theory at least it can produce a measurable impact." ●

(1) TSER project SOE1971075 – Science and technology policies towards Research Joint Ventures.

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SMEs Take Up Research Opportunities

Throughout 1999, the specific measures designed to facilitate wider participation in Community research by small companies attracted growing numbers of proposals.

In each of the Fifth Research Framework Programme's four thematic programmes, 10% of the budget is earmarked for small and medium-sized enterprises (SMEs).

SMEs may of course participate directly in normal collaborative research projects, in partnership with other companies, universities and research centres. However, the SME Specific Measures offer the preferred route for an increasingly large number. Supported by a network of SME National Contact Points(1), which inform and assist potential participants, and with a simplified application procedure operated by a new 'single entry point' for applications to all the research programmes, the measures(2) consist of:

- the **Exploratory Award** scheme, under which SMEs receive up to 75% of the cost of preparing a full proposal for a collaborative or CRAFT project
- the **Co-operative Research (CRAFT)** scheme, which provides up to 50% of the total costs of research commissioned and managed by a group of SMEs with common needs, and performed by a third party

Small is successful

Throughout FP5, an open call for both Exploratory Award and CRAFT proposals allows SMEs to apply at their own convenience, but proposals are evaluated in batches following cut-off points in January, April and September.

In 1999, a total of 850 Exploratory Award and 150 CRAFT proposals involving over 2,500 SMEs were submitted – in each case, a 20% increase on the numbers submitted in the first 12 months of FP4. Perhaps because of this increased demand, selection rates were slightly lower, despite a significant reduction in the number of ineligible applications – 42% of Exploratory Award proposals were retained for possible funding, compared with a selection rate of 47% in FP4, while 38% of CRAFT proposals (submitted without a preceding Exploratory Award phase) were selected, compared with 42% of such proposals in FP4.

Small and very small companies formed an even higher proportion of the total than they did in FP4. Of the 2,509 SME proposers, 78% were companies with fewer than 50 employees, and 39% had less than ten employees.

Evidence of the success of the SME National Contact Points is found in the improved spread of SME proposers across EU Member States. The proportion of SME partners in Exploratory Award proposals not based in the United Kingdom, Germany, Italy or Spain rose from 50% to 57%.

Interest in LIFE

In FP4, 63% of all Exploratory Award proposals and 72% of all CRAFT proposals addressed challenges and opportunities now covered by the Growth programme in the field of industrial and materials technology.

In 1999, proposals were much more evenly spread. The Growth programme was still the most popular target, but with ●●●

(1) See 'Spreading the Word', edition 1/00.

(2) For a more detailed account of the SME Specific Measures, see 'Opportunities for SMEs', edition 3/99.

Innovation

The Innovation/ SMEs Programme In Brief

Part of the EU's Fifth Research Framework Programme, the 'Innovation and participation of SMEs' programme promotes innovation and encourages the participation of small and medium-sized enterprises (SMEs) in the framework programme. The Programme Director is Mr G.C. Grata (Innovation Directorate, Enterprise DG).

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only 41% of Exploratory Award proposals and 61% of CRAFT proposals. The Quality of Life programme attracted 30% of Exploratory Award proposals and 20% of CRAFT, a dramatic increase on the 11% of SME participation 3of 11% directed to this area during FP4, and clear evidence of the SME Specific Measures' success in facilitating SME participation.

Over the course of FP5, the spread of CRAFT projects is likely to equalise further, as many of the current Exploratory Award projects feed through into the follow-up co-operative research phase. ●

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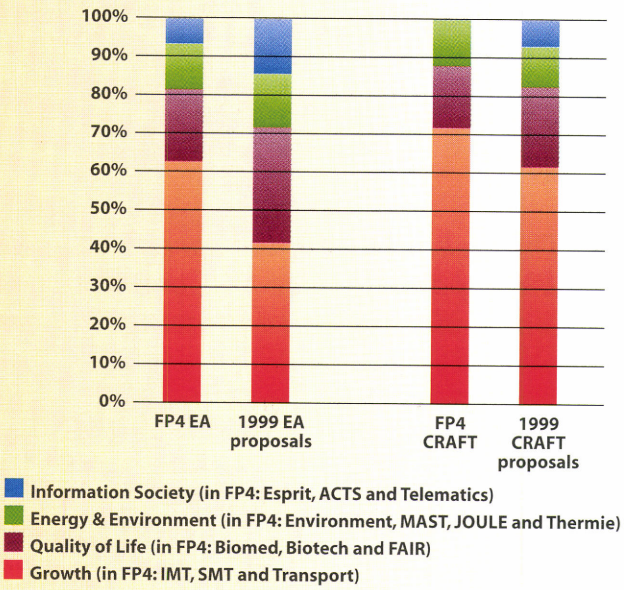
Exploratory Award and CRAFT – FP4 contracts and 1999 proposals, by FP5 thematic programme



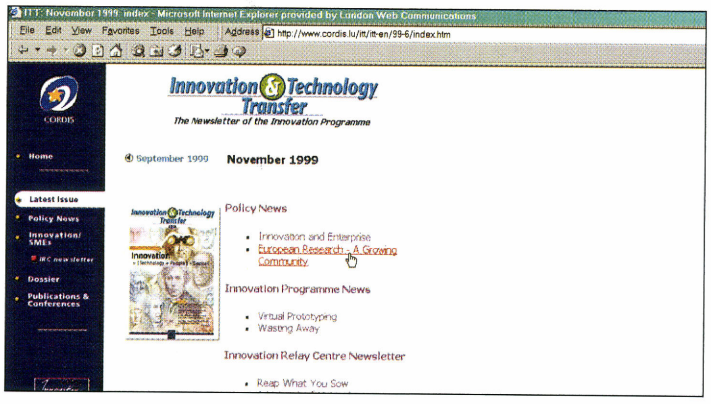
FP5's first two sets of proposals for Exploratory Awards and CRAFT projects show a more even distribution between research areas than in FP4.

Who Is Reading ITT?

Since its launch in February 1994,* Innovation & Technology Transfer *has evolved not simply as the newsletter of the Commission's Innovation programme, but as an important component of Europe's innovation infrastructure.

ITT's bi-monthly issues are read by around 50,000 innovation actors in technology-oriented firms, universities and research centres, as well as intermediary organisations such as trade associations, chambers of commerce and business support agencies, and national, regional and corporate policy-makers.

A total of 40,000 copies of the printed magazine are mailed to nearly 20,500 subscribers, many of whom distribute copies to organisations in their own networks – 24,000 in English, 7,000 in French, 6,000 in German, and 1,500 each in Spanish and Italian.



A further 10,000 copies of the IRC Newsletter, which appears in alternate issues of ITT, are distributed by the Innovation Relay Centres as a stand-alone product.

ITT on-line

Hosted by the Commission's CORDIS service, ITT has been available on-line since January 1997, but use of the site has really begun to take off in the past 12 months. The number of pages visited rose from around 10,000 per month at the start of 1999 to over 40,000 per month by the end of the year.

Each issue of the magazine is presented in browsable format, offering easy access to the additional web-based resources highlighted in most articles. Complete editions may also be downloaded from the archive section in PDF format, for local printing. Visitors can subscribe to the printed edition of the magazine on-line, and are encouraged to submit comments or suggestions for future articles in the feedback section. ●

Contact

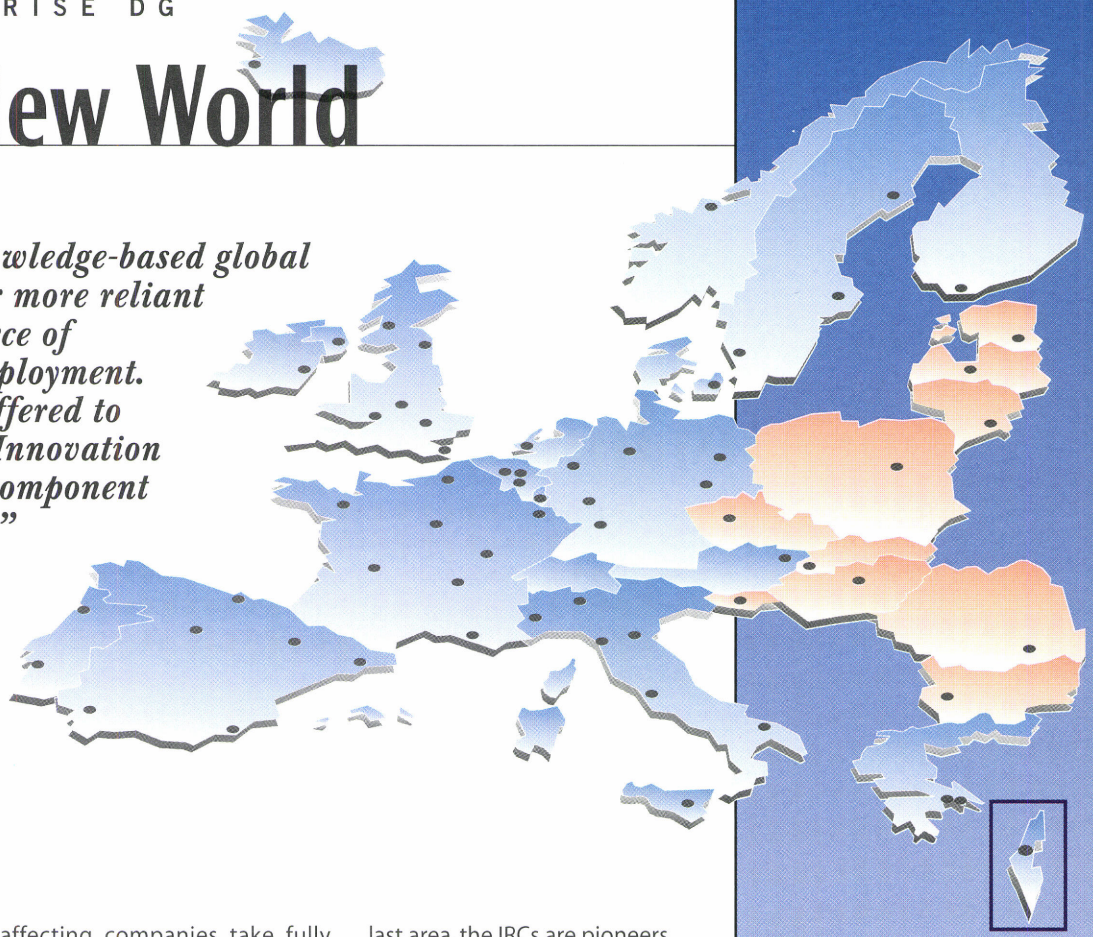
- **To subscribe, use the form on the back cover, or visit ITT's website at: http://www.cordis.lu/itt/**

Innovation Relay Centre
Newsletter

IRCS IN ENTERPRISE DG

O Brave New World

"In an increasingly knowledge-based global economy, Europe is ever more reliant on innovation as a source of competitiveness and employment. The practical support offered to innovators by regional Innovation Relay Centres is a key component of EU enterprise policy."



Following the integration of the Innovation Directorate, together with those responsible for industrial and SME policy, within the new Directorate-General for Enterprise, we asked its Director, Giulio Grata (pictured above), to look into the future.

Q: Does the reorganisation reflect a change of priorities concerning innovation?

GG: Only in the sense that it places innovation at the heart of the European Union's enterprise policy, just as the structure of the Fifth Research Framework Programme has placed it at the heart of EU research policy.

Within the Commission, the role of the Innovation Directorate at the interface between research and industry will continue to be pivotal. The reorganisation will help to ensure that policy decisions in key areas affecting companies take fully into account the impact on their innovation capacity.

The mission of the Enterprise DG is to work with Member States to create an environment in which European firms can realise their potential as engines of prosperity and employment. The task of stimulating innovation stretches from the diffusion of new technological know-how to support for dynamic entrepreneurship, and from ensuring that European goods can compete freely in global markets to the promotion of broader societal acceptance of change.

Q: How will this affect practical innovation support measures such as the IRC network, over the coming years?

GG: Practical action is an essential part of our work – testing new approaches, spreading good practice across national borders and, in collaboration with the Member States, putting in place a professional European innovation support infrastructure. In this last area, the IRCs are pioneers.

They are a cornerstone of that infrastructure today. But they are also helping to build the dynamic, self-sustaining innovation system of the future – linking companies from different regions, building strong regional networks of researchers and entrepreneurs, and working closely with the National Contact Points and Business and Innovation Centres, as well as the Euro Info Centres and BC-NET (Business Co-operation Network), now managed within the same DG.

Q: IRCs' primary function is to provide expert assistance for the transnational transfer of technology. Can they contribute to innovation policy objectives in other ways?

GG: Innovation requires access to research results, adequate means of protecting intellectual property, availability of development finance, and a supply of appropriate business skills. And these elements have to be knitted together in order to create ●●●

The IRC Network in Brief

The Innovation and SMEs Programme's network of 53 Innovation Relay Centres (IRCs) spans the EU, Iceland, Norway, Switzerland(1) and Israel (see map), with 'twinning' arrangements extending it to some central and eastern European countries (shaded in red).

Each IRC is its region's window on European innovation, helping companies and research organisations transfer technologies to and from the rest of Europe. Further information about the IRC network is available on the IRC homepage (http://www.cordis.lu/irc/home.html).

(1) Associate Member

an environment which encourages entrepreneurs to take risks.

At regional level, IRCs are helping to create such an environment by offering entrepreneurs a single point of access to the entire range of expert support they need – both from their own staff and systems, and through their links to other regional and European resources.

However, their core business remains transnational technology brokerage. This is where they have built their reputation and can provide services with the greatest added value. ●

Case Study

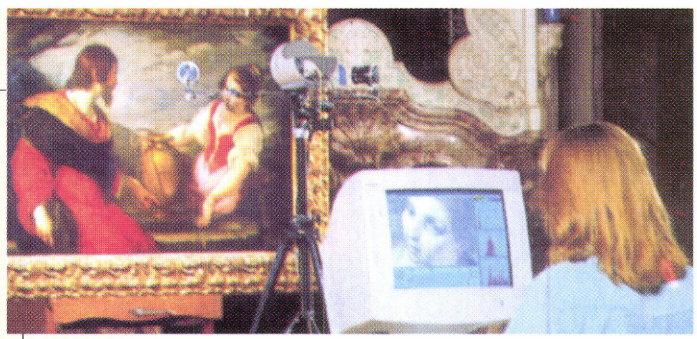
Science for art's sake

Transnational transfers of technology usually take the form of partnerships for the development of new products or processes, or of licences to exploit research results. But IRC support bridges not only the borders between countries, but those which separate the worlds of science and commerce, of the investor and the researcher, and may also lead to the creation of new companies.

Art Innovation is a Netherlands-based firm established with the support of the Innovation Relay Centre network as a joint venture between the Greek research centre FORTH (Foundation for Research and Technology) and a Dutch venture capital fund.

MuSIS, the patented system which Art Innovation now markets world-wide, is a state-of-the-art tool for the non-destructive analysis and documentation of painted art works. Developed by FORTH's Institute of Electronic Structure and Laser (IESL) in the course of nationally funded research, it combines in one portable unit all the imaging techniques used by museums for the verification and restoration of paintings – greatly reducing the cost and difficulty of these vital tasks.

Initially, FORTH hoped that the Dutch venture capital would help to finance a marketing campaign. However, when the partners agreed to set up a joint venture company, it asked IRC Greece for help.



Real-time imaging enables the user to view a fluorescence, ultraviolet or infrared image on a computer monitor while restoration work is being carried out.

"We found contract law specialists to advise on the company's legal framework," explains the IRC's Nikos Melanitis, "and provided continuous support to both parties throughout the negotiations."

Now, in collaboration with IRC Netherlands, the IRC offers ongoing 'after-sales service' – helping to convert a transnational joint venture into an international commercial success.

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THE NETWORK'S FUTURE

Building on Solid Foundations

The next phase of the IRC network's development will build on the successes of the past. But further professionalisation, a tighter focus on transnational technology transfer and strengthened collaboration with providers of other specialised services will improve its ability to meet the needs of SME clients.

"The recent call for tenders to provide regional Innovation Relay Centre services over the next four years[1] was extremely successful," says Javier Hernández-Ros. "We received good or excellent proposals covering nearly all the EU Member States and Associated Countries, and were able to renew the contracts of a large proportion of the network's existing members. This continuity will allow the network to capitalise on the achievements, experience and contacts developed during its first four years."

On the other hand, he says, the network remains committed to continuous improvement. In the short term, clear, quantified performance targets will be set for each IRC and for the network as a whole, while a thorough review of the network's services and organisational options will be undertaken as the basis for a mid-term development strategy (see box).

As well as delivering an expert technology transfer support service, IRCs will help clients to find other appropriate specialists.

Evolution, not revolution

The IRC network will in future focus on the core business of supporting the transnational transfer of new technology. This implies more than passing responsibility for encouraging SME participation in Community research to the network of National Contact Points (NCPs)(2).

"A more professional network is evolving to meet the needs of an established client base through active assistance," says Hernández-Ros. "We have selected new members who will contribute fresh energy and ideas on technology transfer. At the same time, we recognise that IRCs should not attempt to provide a comprehensive range of support services directly."

Their role, he says, is to facilitate links not only between technology suppliers and technology users in different countries, but between these clients and the various specialists they need – helping them to put together a complete technology transfer package. "It is not appropriate for IRCs to prepare business plans, draft licensing agreements or write patents," he explains. "But they should be able to direct clients to professionals who can provide them with this in-depth support."

IRCs will also signpost clients to other Community business support networks as appropriate. In 2000, the Commission is to launch a Communication on mechanisms for improved inter-network collaboration, and the IRC network as a whole is sure to strengthen its links with networks such as the NCPs, Euro Info Centres (EICs) and Business and Innovation Centres (BICs)(3).

Innovation infrastructure

In fact, says Hernández-Ros, the IRC network is now taking its place as a fully integrated component of the comprehensive infrastructure of professional innovation services which the Commission is helping to build across the EU and candidate countries.

"The IRCs' geographical spread, and their excellent contacts with researchers and technology-based firms both locally and transnationally, make them ideal partners for services such as the LIFT and IPR Helpdesks," he says. "IRCs need links with sources of specialised information and advice on financing and patenting, while these services need local partners to provide hands-on follow-up support." ●

(1) See also this edition, page 12.
(2) See 'Spreading the Word', edition 1/00.
(3) See 'A Network of Networks', edition 6/99.

IRC Strategic Review

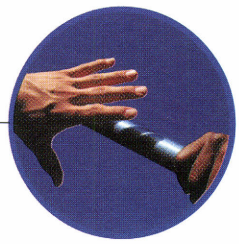
The first research projects of the Fifth Research Framework Programme (FP5) may only just have been launched, but planning for FP6 is already under way. With ideas for the new Framework Programme needed in 2001, the current year is a time for careful reflection about the mid-term future of the IRC network, emphasises Hernández-Ros.

"The Community cannot reasonably be asked to continue committing significant financial and human resources to the network, without solid evidence both that it provides an effective service and that it does so in the most efficient way possible," he explains.

The strategic planning exercise will be launched shortly after the start of the second IRC phase, in April. It will assess the perceived added value of the network's services to clients and peer organisations, examining the efficiency and impact of the IRCs' work to date and benchmarking this performance against other means of delivering a comparable level of service.

"Should the network begin to develop autonomously?" asks Hernández-Ros. "We may conclude that this is not yet possible. But we cannot justify continuation of the present 50% EU funding unless we have taken a long, hard look at all the other options."

Managing with a Personal Touch



Hard work, transparency and a strong reliance on personal contact characterise the European Commission's management of the continent-wide IRC and RITTS networks – a colossal responsibility for such a small team of officials.

The IRC team from left to right: Riccardo Carelli, Yannis Tsilibaris, Marina Somers, Marie-Anne Lenancker, Marco Cecchini, José Antonio Hoyos Pérez, Colin Stewart, Mika Rantakokko, Javier Hernández-Ros, Charlotte Avarello, Michael Busch, Veronique Magnette.

"We are like a family," says Yannis Tsilibaris, Head of Sector in the Enterprise DG's Networks and Services Unit. "The working relationships within the team are excellent, as they are between its members and the managers and staff of the IRCs."

Effective co-ordination and animation of the Innovation Relay Centre network is based on close personal contact between individual Commission officials and the staff of the IRCs in particular countries. Every team member has many opportunities to meet people from all the IRCs, through the Annual IRC Meeting and Thematic Group activities, for example. But each officer works especially closely with a portfolio of between ten and 15 IRCs in up to eight countries.

High-quality contacts

"They know the managers and key staff of their own groups of IRCs personally, and meet them regularly – for example, at national co-ordination meetings," explains Tsilibaris. The IRCs of larger countries such as Italy, Spain, the United Kingdom, Germany and France, and of the Scandinavian countries, meet at least once a year in national co-ordination meetings, convened by the responsible team member (see box) to discuss progress and key issues.

The Commission team manages the running of the network and handles all contractual issues. In addition, an external IRC Co-ordination Unit (IRC-CU) provides a range of central support services to the network, in close collaboration with Tsilibaris and his colleagues.

The IRC-CU provides advice and practical assistance to the IRCs regarding the promotion of the network – contributing, for example, to the production of a range of common promotional publications. It supports both the Thematic Groups and working groups on the standardisation of IRC services and on information-management tools, as well as the present series of good practice workshops[1]. It follows up technology transfer success stories, and assists network members in collaborating with the IPR and LIFT Helpdesks. It also designs and runs training workshops for new IRC staff members, and on operational issues such as database quality control and use of the IRC website.

Complementary networks

The Commission's IRC team is responsible for the management of both the IRC and the RITTS (Regional Innovation and Technology Transfer Strategies) networks. The two have different missions but are in many ways complementary[2]. Both dedicated to innovation support, RITTS function at the strategic level, IRCs at the operational level.

While the primary concern of IRCs is to support the diffusion of innovation by providing practical assistance for the transnational transfer of new technology, RITTS support the development of regional systems to promote and stimulate innovation through a structured process of assessment and analysis, consensus-building, planning and co-ordination.

Each RITTS brings together key innovation actors from the region concerned – public authorities, industrial and professional associations, companies and the academic research base. Together, they draw up a plan designed to make best use of available resources to create the infrastructure and provide the services needed, by SMEs in particular, in order to encourage the growth of a dynamic and self-sustaining culture of innovation in the region.

(1) See 'A High Standard of Service', edition 6/99.

(2) See 'Two Sides of the Coin', edition 4/99

Stated simply, the role of RITTS is to plan regional innovation infrastructures and support services for SMEs, while that of IRCs is to deliver such services. It is for this reason that, as part of the European Commission's new approach to innovation under the Fifth Research Framework Programme, the two networks are managed in parallel to ensure maximum synergy between their respective functions as the strategic driver of innovation support for SMEs and its operational delivery mechanism.

The task is as difficult as it is important. "The team will be placed under particularly intense pressure in the coming months," admits Tsilibaris, "both by the growth of the IRC network brought about by the full inclusion of the newly associated countries, and by the evolution of the RITTS scheme as a tool for inter-regional co-operation among the 'movers and shakers' of European innovation." ●

Members of the IRC/RITTS team, and their country responsibilities

Nine Commission officials work in the Networks and Technology Transfer sector of Mr Hernández-Ros' Networks and Services Unit. The table below shows the 'IRC country portfolios' of each official – but does not indicate the range of additional tasks which each performs.

Name	Responsibility	Phone	e-mail
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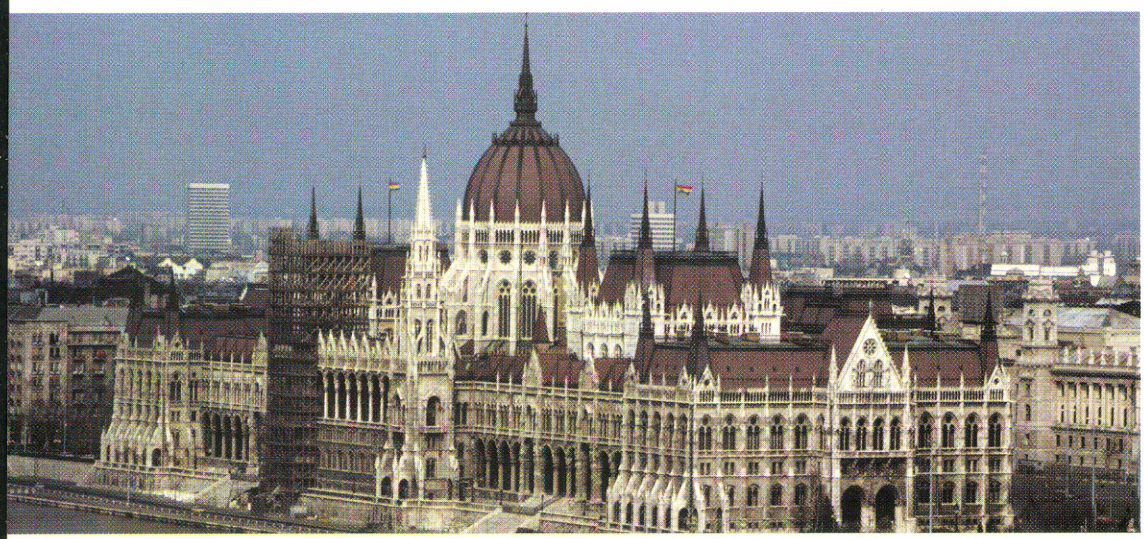
High-Quality Response

Following evaluation of the recent call for proposals, the European Commission will award contracts to almost 70 consortia – many of them members of the existing network – to provide IRC services in 30 countries over the next two years.



Launched in June and closed on 20 September 1999, the call produced 79 proposals, the quality of which was, in almost every case, very high. Their technical aspects were assessed by independent evaluators appointed by the Commission. Advice from representatives of Member States was also taken to avoid unnecessary overlaps in geographical coverage and to ensure efficient co-ordination with national research and innovation systems.

An indicative budget of €35 million has been allocated for the EU contribution of up to 50% of the total costs of operating each of the selected IRCs for two years. The contracts may be extended by a further two years following a mid-term evaluation.

Continental coverage

The approved proposals will cover the entire territory of the European Union and Associated States with the exception of Liechtenstein, whose SMEs will be able to call on the support of the Austrian, Swiss or German IRCs.

The distinction between IRCs and FEMIRCs (the Fellow Members to the IRC Network, which offered a complementary service in the Central and Eastern European Countries under the Fourth Research Framework Programme) will be dispensed with. In future, a standard service will be available to SMEs, companies and research organisations in all 15 EU Member States plus Bulgaria, Cyprus, the Czech Republic, Estonia, Hungary, Iceland, Israel, Latvia, Lithuania, Norway, Poland, Romania, Slovakia, Slovenia and Switzerland.

As in the past, the service will be adapted to the specific needs of each region but will focus in all cases on the following core tasks:

- promotion and assistance for transnational transfers of technology to and from the region served by the IRC
- promotion of the transnational dissemination and exploitation of the results of Community research
- promotion of trans-regional innovation initiatives
- provision of information on the actions of the Innovation and SMEs programme
- signposting to other innovation support services, including the network of FP5 National Contact Points (NCPs)

New blood

The relatively few changes in the make-up of the network reflect the shift in emphasis of the IRC mission towards in-depth, hands-on assistance to SMEs in planning and implementing transnational technology transfers. The new members of the network have been chosen for their particular strengths in this area. ●

The Go-Betweens

In the first phase of the IRC network, from 1995 to March 2000, a fully functioning pan-European network was created from scratch to link technology suppliers and technology users in different regions efficiently – a service which, prior to 1995, was scarcely available.

"The key achievement of the first phase has been to forge a real family spirit, enabling professionals from 28 countries to co-operate both in the day-to-day business of transnational technology transfer and in the further development of the network's capacity," says Yannis Tsilibaris, Head of the Sector which deals with the Innovation Relay Centre network. "It took time for the members of the network to develop the methods and personal links needed to work together efficiently, but already nearly 500 technology agreements have been signed as a result of their work."

In addition to agreements like that between YIT and Helix (see case study), Tsilibaris highlights four areas of practical achievement of which his Sector is especially proud:

- the eastward extension of the network to encompass the ten central and eastern European countries associated with the Fifth Research Framework Programme (FP5)
- the creation of 13 Thematic Groups of IRCs, focusing on support for specific industrial sectors
- the development of a range of powerful web tools as the basis for communication both with potential users of the IRC service and between network members
- successful application of methodologies such as 'SME visits', and the on-going exchange of good practice[1] between IRCs so that all learn as rapidly as possible from each others' experience

Partners, methods, tools

With the creation of FEMIRCs (Fellow Members to the IRC network), Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Slovak Republic and Slovenia have all joined the network since 1997.

"Until now, their mission has been slightly different from that of the IRCs, with the focus on the diffusion of information rather than on technology transfer," explains Tsilibaris. "But through 'twinning' arrangements with specific IRCs they have rapidly achieved a high level of professional competence, and will assume full membership."

To date, 13 IRC Thematic Groups have been established as a framework for co-operation and joint action by IRCs in whose regions specific industries are strongly represented (see box).

Thematic Groups enable IRCs with complementary technical expertise to offer specialist support to enterprises in the sectors ●●●

(1) For further information about the exchange of good practice between IRCs, see 'A High Standard of Service', edition 6/99.

IRC Thematic Groups

Sector	Current chairperson	e-mail
Agrofood	Angel del Pino, IRC Cenemes-Valencia	mjperis@ainia.es
Automotive	Claude Sabatin, IRC Rhône-Alpes	sabatin@rhone-alpes.cci.fr
Biotechnology	Sylvie Marino, IRC Rhône-Alpes	marino@rhone-alpes.cci.fr
Electronic and multimedia	Michiel Hamberg, IRC Central Sweden	michiel.hamberg@electrum.se
Environment	Peter Wolfmeyer, IRC North-Rhine Westphalia	de@www.zenit.de
Fire and fire safety	Mark Schneidler, IRC Midlands	mirc@coventry.ac.uk
Fish technology	Terje Bakken, IRC Norway	terje.bakken@indman.sintef.no
Marine science and industry	Eckhard Paschen, IRC North Germany	ati-kueste-hro@t-online.de
Materials	Erhard Gartner, IRC Saxony	etb-neisse@t-online.de
Medical technology	Sarah Hart, IRC Northern England	sarah.hart@rtcnorth.co.uk
Renewable energy	Barbara Hartmann, IRC North Germany	b.hartmann@nati.de
Textiles	Costas Boutris, IRC Greece	etakei@compulink.gr
Wood	Rolf Olsson, IRC Northern Sweden	rolf.olsson@centek.se

concerned, and create a platform for closer links with the relevant key actions of FP5's thematic programmes. Trade missions and brokerage events jointly organised by Thematic Group members have proved effective as a means of stimulating new transnational partnerships.

The IRC website, hosted by CORDIS, provides tools which are essential for a network which stretches from Iceland to Israel, and from Portugal to Norway. "The added value of the IRC service is its transnationality, and this depends on good communication among the network's members, largely based on the web service," says Tsilibaris.

The public area of the website offers technology-based companies and research centres general information about the IRC network and its members, including a directory of regional offices and a calendar of forthcoming events, as well as an on-line version of this Newsletter. The password-protected private area, meanwhile, is a forum in which the IRCs can do business on behalf of their clients in confidence – publishing technology offers and requests and searches for partners in specially developed databases, which also offer selective distribution to members via e-mail.

Business trips

IRCs can cover part of the travel expenses of SMEs wishing to participate in brokerage events in another European region in order to offer or seek a technology. The face-to-face meetings made possible by such 'SME visits' have proved extremely valuable in creating active and lasting links between technologists and entrepreneurs in different countries.

An IRC methodology, designed to ensure that such trips are as useful as possible, is under development. "The two IRCs should carefully select matched participants from portfolios of client companies long before the trip itself," advises Laurent Le Gall of IRC Lower Normandy, Brittany and Pays de Loire. "We have found that trips of at least four days, involving groups of not more than six visiting companies, work best."

Of course, foreign business trips are nothing new. But the presence of IRCs both in the country of the travelling SMEs and in that of the hosts makes it possible to ensure that meetings are relevant, that travel and accommodation arrangements are reliable, and that follow-up support is available to hosts and visitors if they wish to formalise their contacts. ●

Case Study

Routine preventive maintenance is the traditional means of keeping today's complex industrial process plants running smoothly, but often leads to the replacement of costly components before the end of their serviceable lives. Transnational collaboration was necessary to bring the advantages of neural network technology to industrial process engineers.

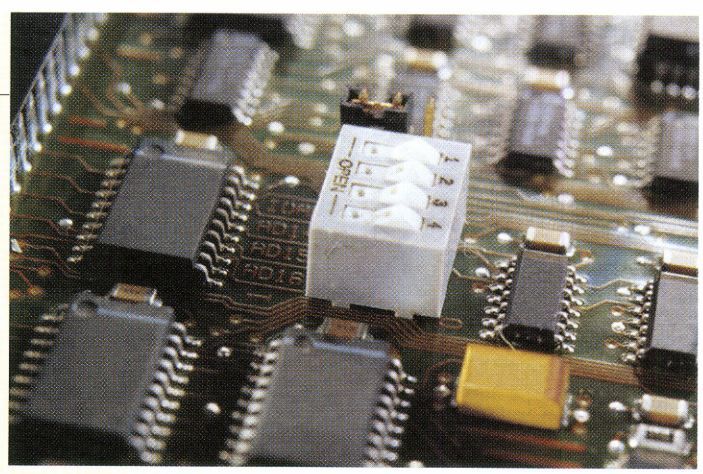
Finnish company YIT Service Ltd developed a computerised monitoring system based on the principle of the neural network, which is able to 'learn' a plant's standard operating conditions, and to issue warnings if acceptable parameters are exceeded.

Unlike conventional monitoring systems, which use complex central processing units, neural networks employ a large number of much simpler processors. They are capable of analysing very large sets of data and applying the knowledge to new situations.

Trump card

YIT hoped to commercialise its system in the form of a PC-card based on a custom-designed printed circuit board – but had no in-house manufacturing experience or capacity. "YIT had a fine technology," recalls Hannu Juuso of IRC Finland. "But to bring it to market, they needed a manufacturing partner."

Juuso distributed the request to all the other IRCs via the network's web-based Intranet, and YIT has selected a small Scottish company, Helix Research, from among the responses. Supported by both IRC Finland and IRC Scotland, the two firms are negotiating a partnership to manufacture and market the system, which Juuso believes will be more reliable than traditional maintenance monitoring equipment, as well as 50% cheaper.



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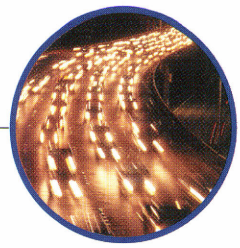
Next Year's Model



As environmental legislation tightens, new motor vehicles increasingly come equipped with engine management systems (EMSs) as standard. By integrating novel sensing technologies and innovative computational algorithms, the Aeneas consortium hopes to demonstrate a cost-effective EMS with radically improved flexibility.

"The quality of our environment is not improving." This was how, in November 1999, EU Environment Commissioner Margot Wallström summed up the result of the EU's Fifth Environment Action Programme, which was just ending.

Traffic growth is at the top of the list of causes. Unleaded fuel and catalytic converters have cut the amount of some pollutants emitted by new cars. But the big picture remains grim. From 1990 to 1995, for example, the total amount of the greenhouse gas carbon dioxide produced by road transport in the EU went up by 120%.

Despite low consumer awareness, the EMS could play a major part in emissions control for as long as the internal combustion engine rules the roads. Its function is to control engine combustion. Dr Tony Truscott of Ricardo Consulting Engineers, the lead partner in the Aeneas Innovation project(1), points out that in doing so, it must strike a balance between three competing objectives – optimum performance, maximum fuel economy and minimum emissions. With a microprocessor at its heart, it can strike that balance more precisely than is possible with electromechanical means alone.

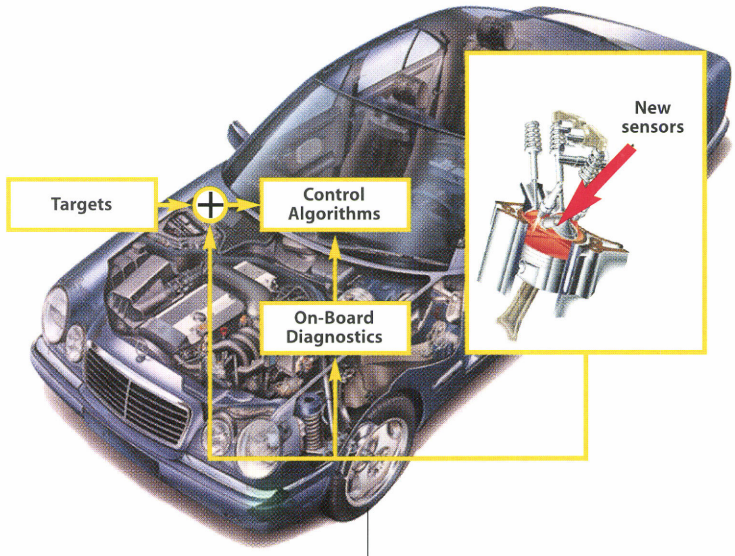
Maps to models

In an ordinary spark-ignition petrol engine, a basic EMS works by controlling two output variables – the amount of air and fuel admitted to the cylinders for combustion, and the timing of the ignition sparks. It continually adjusts each in response to changes in key input variables such as air and engine temperatures and accelerator position.

The appropriate values for the output variables have to be determined by the EMS itself. A conventional EMS does this very simply. It just looks them up in tables, or 'maps', stored in its digital memory. But this established technique has its drawbacks. Many maps are needed, making EMS calibration expensive, especially as it has to be redone for almost every variant of every vehicle model to which the EMS is fitted.

The EMS now fitted to the engine on the Aeneas consortium's test bed is different. It is a model-based EMS. The idea is to replace some of the maps with equations describing the behaviour of the engine. As Truscott puts it, "What we're doing is developing algorithms which actually incorporate the laws of physics in the engine."

The crucial advantage is flexibility. With clever programming, the model-based engine-control algorithm can adapt to inevitable but unpredictable changes in the engine. Wear is a prime example. Engine behaviour is affected by wear, but in ways too complex for a map-based system to handle. As a result, engine performance deteriorates gradually over its lifetime. Flexibility also means transferability – model-based EMSs can be easily transferred from ordinary gasoline engines to other types, such as Gasoline Direct Injection engines.



Innovative sensors and advanced control algorithms are the basis for an Engine Management System which is more flexible, more reliable and more cost-effective than current technologies.

Measuring pressure directly

Until recently, the model-based EMS has been an unrealistic proposition for mass-produced vehicles. The sensors available for monitoring key engine variables, especially cylinder pressure, have been unsuitable. "Fortunately, there have been improvements in sensor technology, with very robust material systems like silicon on insulator and silicon carbide on insulator," Truscott points out.

Sensors based on these materials are being developed by Ricardo's two consortium partners, Kistler, a sensor company, and DaimlerChrysler, the vehicle manufacturer. They measure ●●●

(1) IN301056I – Application and evaluation of a novel engine management system based on intelligent control algorithms and utilising innovative sensor technology (Aeneas).

cylinder pressure directly, unlike the sensors that have been tried in the past. Thus, as Truscott explains, the EMS "really takes the internal combustion engine to its limits because the sensors provide information of exactly what is going on at the heart of the engine".

Smart algorithms

The other factor critical to the Aeneas EMS is the set of intelligent control algorithms that will process that information. An algorithm developed by DaimlerChrysler uses the precise cylinder-pressure measurements from the new sensors to calculate another key engine variable, the mass of air flowing into the engine. The Aeneas system can thus do without the transducer used by conventional EMSs to measure mass airflow, saving cost and improving reliability.

Control algorithms are currently being developed for the Aeneas EMS. Some have already been tested using data obtained from a test bed engine fitted with new cylinder-pressure sensors. The next step is to complete the development and testing on a vehicle demonstrator to validate the Aeneas technology.

While the demonstrator is the objective of the Aeneas Innovation project, the long-term plan goes further. After validation, DaimlerChrysler will take on the task of bringing the system into production, while Ricardo will be responsible for the marketing. In the meantime, interested parties can register for updates on the project's progress by joining the Aeneas Club through its website. ●

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PRODUCTION TECHNOLOGY

If the Shoe Fits ...

Laser sensor systems allow much more accurate computer imaging of feet than conventional measurements for orthopaedic shoes. As well as aiding manufacture of shoes for more difficult feet, the 'foot digitiser' has the potential to stimulate the European market in custom-made shoes.

People of all ages, with conditions which may be inherited or arise from accidents or illness, need specialist shoes to help them cope with foot pain and give at least partial mobility. Conventional orthopaedic shoes are not usually stylish, and wearing them can be an embarrassment especially for the young. And, until now, achieving a good fit has involved a large number of measurements and adjustments - tedious for the patient and difficult for the orthopaedist.

François Venel of the French research consultancy Cetiop (Conseil-Expertises Technologies Industrielles Organisation de Production) became interested in using computer imaging techniques to model the shape of individual feet in the early 1990s. He had discussions with the footwear manufacturer Gabilly about the technical feasibility of this approach, building on Gabilly's knowledge of measuring a malformed or injured foot. They realised early on that more partners were needed to undertake the costly development involved in taking the idea further.

European market

Venel foresaw that the planned product should have a market all over Europe, both because it was so innovative and because the market for orthopaedic shoes is small within each Member State. "It would have been good," he says, "if the law had existed to enable a European company to be set up to develop the technology. But instead, we put together a consortium of companies with medical and orthopaedic expertise, plus knowledge of the European shoe market."

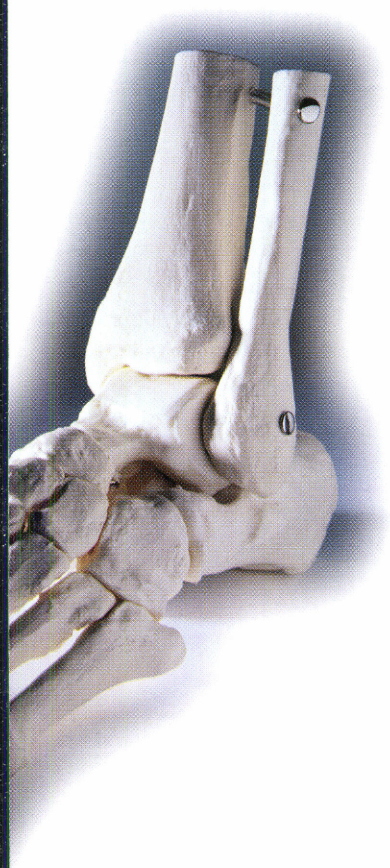
Buratto from Italy, BT from Germany and De Pretre from Belgium all offered expertise in orthopaedic measuring, complementing Gabilly's understanding of the French market, while Buratto already had some experience with computer footprint measurement.

Apart from Buratto, all the companies were very small, with fewer than 12 employees, and

none had extensive research capability of its own. The CRAFT programme offered an ideal source of support, as it enabled the consortium to locate and subcontract research to outside specialists.

Early discussions between the partners established that their new digitiser must be able to measure feet very accurately and quickly to create a 3D model which could be linked to an automated manufacturing unit. Ideally the system should be portable and compact so that it could be moved and used by individual orthopaedists. "The aim was to enable the production of high-quality orthopaedic shoes, without the usual delays and difficulties, and with a comfortable and preferably stylish end-product," says Venel.

Further, the consortium wanted to bring down the high costs of manual production – a long-term concern for the national social services responsible for funding special shoes.



From research to market

Full development of the system became possible with the start of a two-and-a-half year CRAFT project(1) in 1995, bringing in four new French partners. The research organisations Ens-Cachan and IFMA took responsibility for developing the laser system and its operating software. Strategies produced the CAD/CAM system to store the digital measurement data. The fourth company, Elmetherm, built a prototype digitiser and prepared for manufacture of the final product.

The CRAFT project was completed in June 1997, but collaboration continues to bring its results into commercial production. Gabilly, Buratto, De Pretre and BT have formed a new French company, Dilaco, to do this. The partners are hoping to begin production in 2001. "Demand from the European markets is strong, both from orthopaedists and shoe manufacturers," says Venel. "It is clear that the market is waiting for this type of product."

Fashion accessory

The foot digitiser could also have an application in the fitting of non-medical custom-made shoes. It is primarily designed for professional orthopaedists, but could be used without modification by manufacturers of top-of-the-range shoes, to offer customers a perfect fit. The retailer would record the foot profile using the digitiser, and supply the data to the shoe manufacturer. At this stage, it appears better-suited to the market for men's shoes than for women's – men buy fewer pairs of shoes, and are therefore more likely to justify the cost of custom-made ones.

No one expects custom-made, digitally-measured shoes to penetrate the mass market, but they could find a profitable niche in the luxury market. The Dilaco technology could be just what is needed by the European shoe industry in response to cheap shoe imports from Asia. It has the potential to revive interest in custom-made shoes of the highest quality, and encourage the maintenance of traditional shoe-making skills alongside the benefits of computer-aided fitting. ●

The foot digitiser is portable – the patient's foot rests on the rectangular plate and interrupts laser beams from the top, back and sides.

(1) CR140291 – Dilaco.

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A New Breed European I

Measuring the intangibles of the knowledge-based economy presents a formidable challenge to innovation surveys.

Innovation monitoring systems, now well-established at E the Member States, provide evidence that despite marked in the business environment a new and distinctive style of entrepreneurship is starting to emerge throughout the Comm

Innovation – the conversion of new knowledge into new products and services – has long been recognised as the key to future economic growth, especially in the high-wage economies of North America, Europe and the Far East. The essential elements of the dynamic and self-sustaining innovation which has so spectacularly delivered employment and prosperity in the United States over the past two decades are clear. At the top of the list are access to risk capital, availability of technical and business skills, and a culture of 'can-do' entrepreneurialism in which failure is seen as a stepping stone to success.

However, the precise conditions required for the development of such an innovation system have remained a matter of debate, and the US achievement has proved difficult to replicate on this side of the Atlantic. What should policy-makers' priorities be, if they wish to transform existing industrial and institutional structures as rapidly, as efficiently and with as little collateral damage as possible into those required to sustain European competitiveness in tomorrow's knowledge-based economy?

Measuring intangibles

Speaking to the Research Council last December, Enterprise Commissioner Erkki Liikanen made clear that the collection and analysis of data on innovation, and the benchmarking of regional innovation performance[1] were a high priority for the European Union. "Policy-makers and entrepreneurs need a firm basis and a clear rationale for the design and implementation of initiatives in the area of innovation," he said.

The OECD's Science, Technology and Industry Scoreboard similarly aims to provide governments world-wide with the best available statistical evidence of technological and economic trends, as the basis for policy design and evaluation and for comparison of their own country's performance with that of others. But the 1999 edition[2] emphasises that, in today's increasingly knowledge-based, increasingly interconnected world economy, monitoring such trends is as difficult as it is necessary.

"The competitiveness of firms depends crucially on how well they make use of their own intangible assets, such as skills and creativity, and gain access to new ones by co-operating with other firms and with universities," say the report's authors. "Yet, because of their nature, intangibles are very difficult to measure. It is far less easy to obtain facts and comparable indicators for intangibles than for tangibles."

1. The Community Innovation Survey

Comprehensive and comparable data about the actual innovative behaviour of European firms is now collected on a regular basis.

In Europe, the Community Innovation Survey (CIS) is starting to answer policy-makers' questions about innovation – even those related to intangibles such as skills and knowledge. Co-ordinated by the European Commission's statistical office, Eurostat, and the Innovation Directorate, the second survey (CIS2) was carried out by the EU Member States in 1997/98. The results are already being used by national governments such as the United Kingdom's, which draws on CIS2 for its UK Competitiveness Indicators 1999[3], and the first Commission studies based on analysis of the data will be published during 2000.

"The real benefit of CIS is that for the first time it enables us to test propositions found in the theoretical literature of innovation," explains Georg Licht of the Centre for European Economic Research (ZEW), responsible for gathering data from German companies. "By making comparisons between countries we

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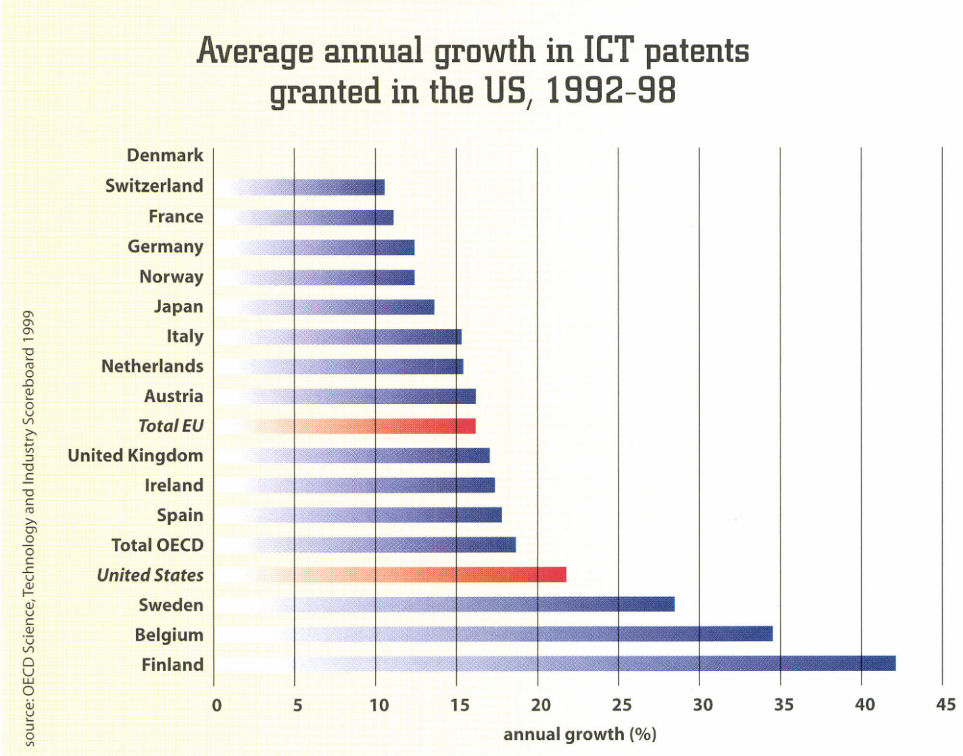


The intangibles of innovation in a knowledge-based economy are hard to measure. However, in the field of information and communication technologies, where US companies accounted for 60% of patents granted by the United States Patent and Trademark Office, the gap between the US and most European countries appears to have widened in recent years.

can see, for example, how the different structures and resources of the academic research bases in the United Kingdom and Scandinavia and those in Italy and Spain influence the way that knowledge flows within their economies. This kind of insight is of tremendous value to policy-makers at national and EU levels."

Heterogeneity

The CIS is still evolving towards a system which produces truly comparable data from all Member States. "The first survey had a number of weaknesses which invalidated EU totals and averages, so that we were only able to publish the separate results for each country," admits Frank Foyn of Eurostat. "Although there are still some issues to be sorted out, the CIS2 questionnaire and survey methodology was much better harmonised." This makes it possible to compare aggregated national data, and to calculate EU averages – for example, for the value of sales of new and improved products, by company size and sector.

Licht and colleagues at ZEW have recently produced a report on innovation in the service sector, based on exhaustive analysis of German CIS2 data, for the European Commission's Innovation Studies series(4). For him, the picture revealed by the CIS data is one of heterogeneity – not just between European countries but also between, and even within, industrial sectors. But he believes that even more reliable and useful findings could be produced if researchers had direct access to company-level micro-data, rather than simply to aggregated national figures.

At present, in order to comply with the data dissemination laws of all Member States, Eurostat has released micro-data only for eight countries, and then only in the cases of a small number of studies commissioned by the Enterprise DG. "Most researchers do not even have access to the micro-data from their own country," says Licht.

In detail

The broad-brush comparisons which can be made using aggregated data are valuable in their own right. "Policy-makers are already gaining an insight into the relative importance of different obstacles to innovation, and into the role of the customer or of venture capital in the innovation process," Licht says. But ZEW's statistical analysis of the company-level German data makes it possible to observe trends at a much higher resolution. ●●●

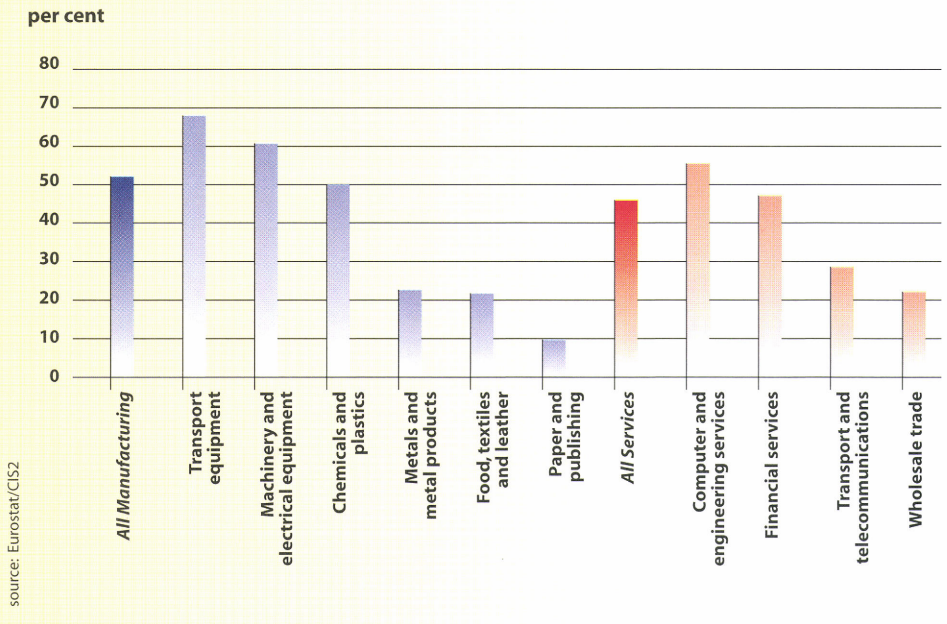
(1) Through the Trend Chart on Innovation in Europe – see 'Benchmarking Innovation in Europe', edition 3/99.

(2) OECD, 'Science, Technology and Industry Scoreboard 1999: Benchmarking Knowledge-Based Economies'.

(3) The full report can be downloaded from the website of the UK's Department of Trade and Industry at http://www.dti.gov.uk/comp/competitive/

(4) The Innovation Studies series continues the former European Innovation Monitoring System (EIMS) reports. A list of available reports, which can also be ordered on-line, is at http://www.cordis.lu/eims/src/stud.htm

Spending on in-house R&D as a percentage of total innovation expenditure, by sector, 1996



Across all EU Member States, innovation expenditure of all types is lower in the service sector than in manufacturing industry, while service sector spending on research and development is also lower as a proportion of the whole.

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He offers the example of the role of consulting firms in facilitating the flow of new technological knowledge. "In German manufacturing industry, consultants play a limited role, normally as providers of market information," he says. "In the service sector, by contrast, they form a critical link between small and medium-sized enterprises and the academic knowledge base."

But it is unclear whether this is an effect of Germany's knowledge infrastructure, or if the pattern is common to EU countries with quite different research institutions. For example, do consultants play a more or less important role in the British service sector, where universities are more engaged in contract research? Licht was able to compare German and Canadian data, and was surprised to discover that consultants perform a very similar function in the service sector there. "But comparisons of this kind require access to the micro-data, so we cannot yet compare Germany with other EU countries."

Standardisation

Licht is hopeful that in future, qualified researchers will be given access to the CIS micro-data. "We have to find a solution for CIS3," he says. "Overcoming the differences in national data protection laws will probably take at least five years. A short-term alternative would be for Eurostat to make the data available to researchers willing to travel to Luxembourg to work on it in strict confidence."

He also looks forward to the day when other OECD countries collect comparable innovation data. "Eurostat plays an important role in encouraging international discussion, with a view to introducing a standardised survey methodology," he says. "Canada and Australia already produce some CIS-comparable data, and there are signs that the US will implement a similar system in the near future."

2. An Entrepreneurial Subculture

"A coherent EU Enterprise policy has to have innovation as one of its main guiding elements," Commissioner Liikanen told the Research Council.

In November, welcoming the launch of Charles Leadbetter's booklet *Europe's New Economy*[5], Mr Liikanen identified the key components of such a policy as "entrepreneurship, innovation and risk capital". "We have too few people wanting to become entrepreneurs – too few prepared, trained or educated to take a calculated risk to set up, run and develop a business opportunity," he said.

Knowledge-based economy

According to Leadbetter, a policy adviser to the Blair government and a former *Financial Times* journalist, policy-makers must engage actively in the painful but inevitable process of transformation from a European economy based on manufacturing to one based on knowledge.

"The generation, dissemination, application and exploitation of distinctive know-how is *the* driving force behind economic growth in a globally interconnected economy," he says. Globalisation, the shift from manufacturing to services, the increasing complexity of manufactured products and the acceleration of the flow of science into new products and new industries make intangible assets – ideas, knowledge and skills – "the fundamental sources of wealth and value".

To date, Europe has been slower than the US to respond to this new challenge, Leadbetter says. Above all, its governments, institutions, industries and entrepreneurs cling to outdated attitudes towards risk and opportunity. He calls for further deregulation, pointing to the success of telecommunications liberalisation in stimulating innovation by exposing the European industry to greater competition.

He recommends the introduction of entrepreneurship training at every level of the education system, to strengthen Europe's entrepreneurial capacity, as well as measures to encourage academic and corporate researchers to establish spin-off companies. He demands

A new generation of entrepreneurs is emerging throughout Europe, despite widely differing institutional environments.

support from governments, large companies, universities and chambers of commerce for the development of networks linking investors and entrepreneurs. Finally, he calls for a legal and tax framework which facilitates and rewards entrepreneurialism.

Distinctly European

New technology-based firms (NTBFs) are the keys to economic growth, job creation and competitiveness, and policy should be directed at fostering their growth and spreading their influence, Leadbetter says. Those now emerging across Europe, despite current obstacles to their development, he calls "a new business generation… with shared aspirations, values and outlooks".

Europe's older companies are profoundly shaped by national cultures of industrial relations, corporate governance and financing. But Leadbetter finds the features shared by the new companies more striking than their differences, although there are still too few of them to have a real impact on Europe's economy. "They are not, as in the US, part of the mainstream business culture," he says.

With partners in France, Belgium and Germany, UK-based Central Research Laboratories (CRL) has recently completed a report on Success Factors in *Fast-Moving High-Tech Sectors*(6) for the Commission's Innovation Studies series. Unlike the ZEW study, this report is based not on CIS2 data but on in-depth interviews with 50 companies of the kind highlighted by Leadbetter, and backs up many of his assertions.

"We found world-class young firms throughout Europe," says CRL's John Weaver. "But in some countries they are still comparatively rare, and the authorities and the industrial establishment still regard them as exceptional. Despite this, the similarity between the firms was striking. We found a common, European company culture thriving in a wide variety of external environments."

Thinking big

Though they span the electronics, software, biosciences and materials industries, CRL's case studies share a number of key characteristics.

In their first few years, they tend to develop on the basis of relationships with single customers. Company founders with backgrounds in technology rapidly buy in business skills – as their first employees, 36% hired sales, 36% financial, and 20% marketing specialists. Nearly two-thirds had taken part in EU-funded research projects, but had benefited less from the technological results than from on-going business relationships developed within the research partnerships. Half want relaxation of tax laws for new companies, and for share option schemes, in preference to grants for research or innovation. Finally, although small, these companies tend to compete globally from the outset. "The majority address European, or European and North American markets from day one," says Weaver.

The problem of skills shortage is the most serious shared by the companies interviewed, contributing to the decision made by many of them to locate at least some of their research and development work in the US at the earliest opportunity. "Shortages both of business and of high-level technical skills were a major problem in all the sectors we looked at," Weaver says.

The report calls for greater efforts to raise awareness of the option of a career in NTBFs, and so stimulate the supply of qualified personnel – as employees, managers and new entrepreneurs. Among its principal policy recommendations is curriculum development for innovation-oriented education, from primary school right through to university. "It is not only that there are too few qualified scientists coming out of Europe's universities," Weaver explains. "Neither science nor business graduates are sufficiently equipped or motivated to think in terms of creating and developing enterprises of their own." ●●●

(5) Charles Leadbetter, 'Europe's New Economy', Centre for European Reform (http://www.cer.org.uk/), December 1999; ISBN 1 901229 14 9, GBP 10.

(6) A summary of the report is available from Tomás Botella at the European Commission's Innovation Directorate (see contacts).

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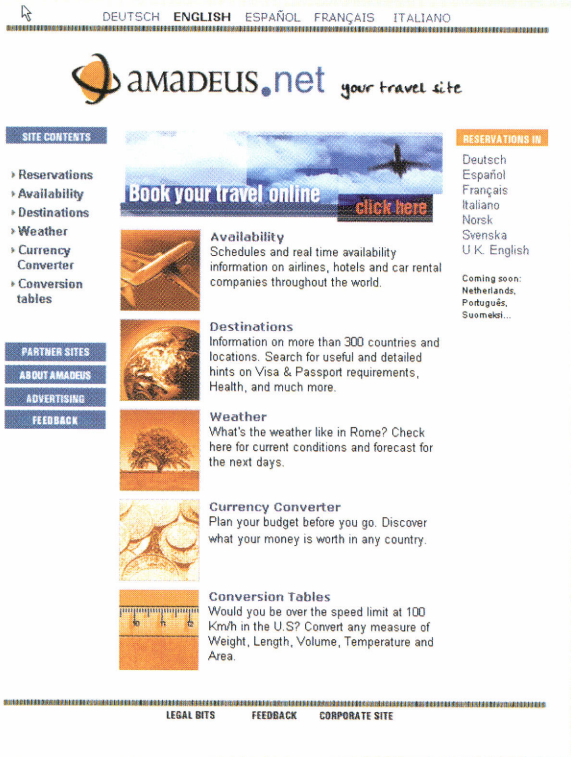
CASE STUDY

The Sky's the Limit for Services

Rapid technological change makes innovation a way of life for IT-intensive service providers such as airline reservation specialist Amadeus.



Amadeus has used the web to develop a range of innovative applications, such as its public flight information and booking service.

Founded in 1987 as a joint venture by a consortium of European airlines, Amadeus soon established itself as a leader in the market for real-time on-line distribution, marketing and sales systems and software applications for airlines and travel agencies. Its powerful networks now provide links to its databases from 199,000 terminals in 132 countries, and more international flight bookings are made through Amadeus than through any other system.

Welcome aboard

"It is the constantly evolving needs of the market that stimulate us to innovate. We have to respond to the demands of our customers, and we use the latest technologies to do so quickly and at an attractive price," says Helmut Semmler, General Manager at Amadeus' data processing centre near Munich, Germany.

With roots in traditional mainframe technologies, the company has progressively moved from Fortran to programming languages such as C and C++. "It has taken a lot of time and effort to make the transition from the mainframe-terminal architecture to the client-server structure of the Unix and NT worlds," Semmler explains. "But it has enabled us to offer the travel industry new functionality, new applications and greater flexibility, and to develop web-based Internet applications."

As an example of the way innovation helps Amadeus to maintain its leadership in a highly competitive market, Semmler describes the company's Application Program Interface (API). "Through the API server, new customers can connect to our databases using their existing IT infrastructures. We have just put a New Zealand travel agency with 160 offices on-line in under three months. In the past, it would have taken us over six months to install and connect PCs and Local Area Networks."

Salary spiral

Amadeus is competing not only for market share but also for skills. "Access to qualified staff is a critical factor," Semmler says. "All over Europe, and even in the US, it is becoming increasingly hard to recruit good IT personnel. Here at our data processing centre, Amadeus is currently understaffed by around 10%."

He is trying to fill that gap through on-the-job training and trainee programmes for university and college graduates. But the IT job market is so competitive that it is hard to hold on to existing employees. Although good promotion prospects and a high-quality working environment make a difference, money is the main factor - and competitors are just as likely to increase their salary offers in order to acquire the skills they need.

"Younger people especially no longer expect to build a career within a single company," says Semmler. "They are happy to move around, very often between countries. Half of our staff here in Erding are non-Germans."

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3. The Shift to Services

Detailed examination of data from the German service sector reveals distinctive features with profound implications for European innovation as a whole.

CIS2 extended the Community Innovation Survey to cover a wide range of services for the first time. With access only to German company-level data, ZEW's study focuses almost exclusively on that country's service sector, but Georg Licht believes that many of its conclusions are valid for other EU countries. "The forces which drive innovation in services – deregulation, the diffusion of information and communication technologies, and the growing tradability of services – are the same throughout Europe," he points out.

The sector itself, on the other hand, is highly heterogeneous, encompassing both traditional activities such as transport and trade and knowledge-intensive business services, where innovation is in many respects similar to that found in technology-oriented manufacturing sectors. This is one reason why careful statistical analysis is essential before any firm conclusions are drawn from the data.

In addition, Licht cautions that traditional measures of innovation inputs (research expenditure and research staff) and outputs (new products or processes, and resulting productivity growth) are often difficult to transpose to the service sector. "Due to the intangible nature of their products, most firms find traditional definitions of research hard to understand. Similarly, innovation is more often associated with changes in the quality or availability of a service than with conventional productivity gains," he says.

Incremental innovation

ZEW's research has, nevertheless, identified some features clearly. First, both the scale and the structure of innovation expenditure in the service sector is very different from that in manufacturing. "In services, product innovation is mainly incremental, with in-house development of new products more common than in manufacturing industry. But total innovation expenditure amounts to only 1% of turnover, compared to 5% among manufacturers, while both participation in research and research intensity are also lower."

The second key characteristic – the rapidly increasing demand in the service sector for highly qualified staff, which Licht refers to as a 'skills shift' – is intimately related to the first. "Investment in human capital turns out to be even more important in services than in manufacturing," he says. "Human capital replaces research as the principal input factor for product and process innovation, with service companies relying heavily on tacit knowledge embodied in owner-managers and key employees."

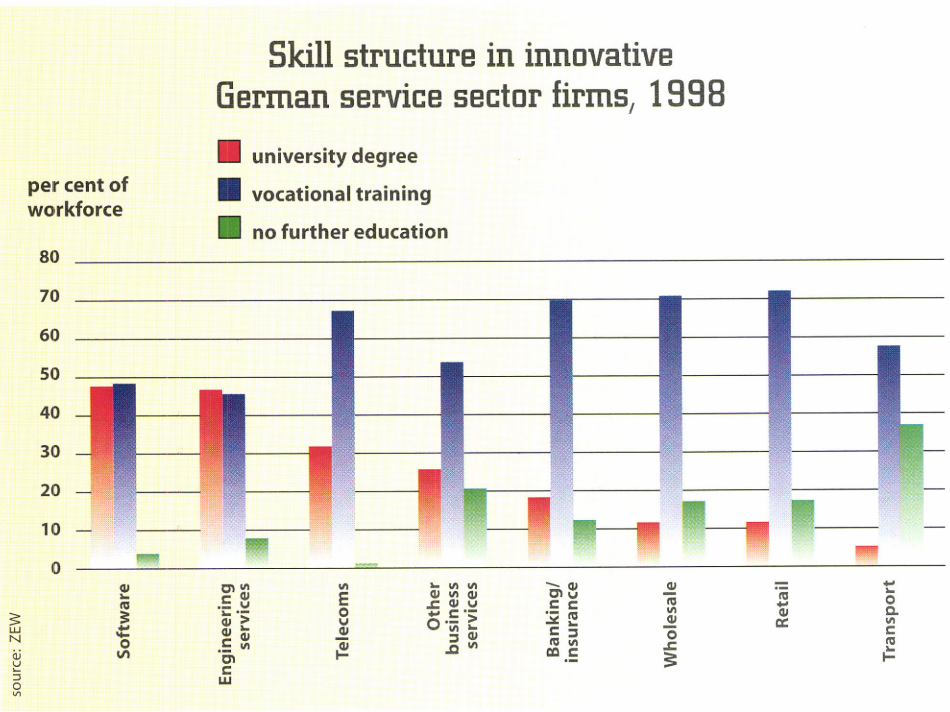
Employment is growing among innovative service sector firms, but the new jobs are mainly for highly qualified people. At the same time, there is little evidence of companies training poorly qualified staff to use new technologies. "In the service sector, training represents almost as large a share of total innovation expenditure as research does in the manufacturing industry. But in-house training schemes are primarily directed at the already-qualified, and new technical know-how tends to be acquired through hiring," he says.

Skills shortages

If this pattern continues, ZEW predicts both a widening skills gap and a crippling skills shortage. Innovation policy should include measures to increase the service sector's capacity to absorb new technologies, the report recommends – both encouragement to reinvest in human capital, and an improved flow of know-how from public research institutions to the sector's SMEs.

There are too few qualified information technology workers, and engineers and IT specialists lack project management and other essential business competences. In addition, university research is still geared towards industrial production processes. "The academic research base has been slow to adapt to the structural change towards a knowledge-based service economy," Licht believes.

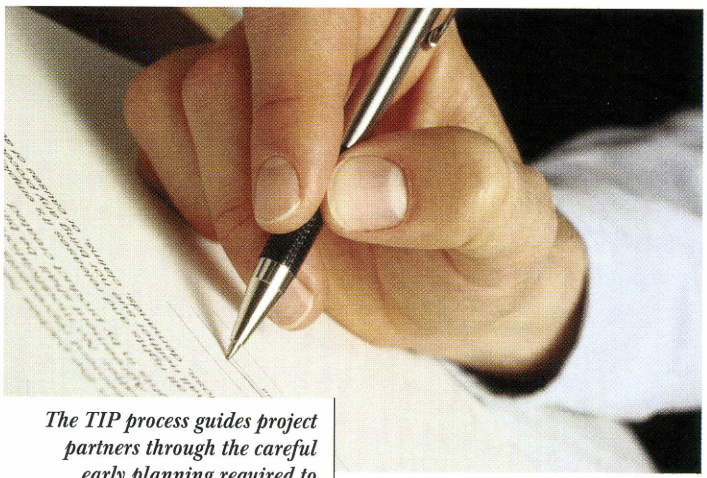
"Universities could make a much greater contribution to the deployment of new knowledge relevant to the needs of the service sector," he concludes. "An increase in public as well as private investment in human capital is the key to successful expansion of an innovative service society." ●



Especially among innovative firms, demand for highly qualified staff is greatest in IT-intensive sectors – but is likely to increase in all service sectors in coming years, according to ZEW.

A TIP for the Top

Under the Fifth Research Framework Programme (FP5), every research project is required to complete a Technology Implementation Plan. Experience from FP4's Brite-Euram programme is that the procedure will do much to increase the rate at which research results are exploited.



The TIP process guides project partners through the careful early planning required to convert research results into commercial success.

Technology Implementation Plans (TIPs) have been introduced across all FP5 thematic programmes. They will document the technical and commercial results of each research project in the three years after the end of the funded work, as well as the means by which new intellectual property is protected, and the direct employment effects within the partner organisations.

The TIP procedure performs a threefold function.

- First, the information supplied by contractors will help the Commission to evaluate the effectiveness of FP5's research programmes by assessing their technological, economic and innovative impacts. Information about partners' own commercial exploitation of their results will be kept strictly confidential, but will be used as the basis for monitoring the programmes' long-term impacts.
- Second, the Commission will use information optionally submitted by projects to diffuse the exploitable results of their research through the CORDIS Technology Marketplace – making summaries of those results and their potential applications immediately available to potential investors, licensees and co-developers.
- Lastly, the process of preparing a TIP gives research partnerships a framework for the early clarification of their exploitation plans, helping them to bring results to market as swiftly and efficiently as possible.

Forewarned is forearmed

Patrick Trousson of the Competitive and Sustainable Growth programme stresses the practical benefits to the projects themselves. "The main aim is to help research contractors achieve the greatest possible success as the result of their joint work," he says.

The TIP procedure is largely based on the experience of Brite-Euram, the Growth programme's precursor, which successfully applied a similar exploitation planning process throughout FP4.

"The exploitation plans have already generated valuable inputs to the Brite-Euram impact assessment," says Trousson. "But projects which took the process seriously found it a really effective way of avoiding the misunderstandings about the exploitation of results which can arise between partners at the end of the collaborative phase."

Partners benefited most, he says, when they were asked to complete drafts of their plans at the mid-point of their projects. "Of course, they were not able to answer all the questions at that stage, but it gave them an early opportunity to think about these issues, leaving plenty of time to work out remaining details before the end of the project."

Offering a basic checklist of the key decisions and actions required to bring research-based new technology to market, exploitation planning helped partners to clarify their individual and collective goals, forcing them to consider problems, opportunities and resource requirements together. Decisions about the ownership of intellectual property rights were made at an early stage, for example, streamlining the process of protecting and exploiting these rights.

"Too often, researchers are caught unawares by a competing invention which appears on the market before they can commercialise their own work," Trousson points out. "When their ownership of new knowledge is clear, people take greater responsibility for monitoring the state of the art, and are able to avoid such unpleasant surprises."

Revelations

Many partners in the new Growth projects will find the TIP procedure familiar, from earlier

participation in Brite-Euram. But what of researchers in other fields, to whom TIPs are an entirely new concept?

"So far, there have been no problems," reports Waldemar Kütt of the Quality of Life programme. "Some contractors have welcomed the tool as a means of structuring their planning of the dissemination and exploitation of their results. Not surprisingly, others express caution about revealing details of their commercial strategies. We are able to assure them that if they plan to exploit their work themselves then the timetable for this exploitation, which we will use to monitor progress at a later stage, is submitted on a strictly confidential basis."

In order to get the most out of the TIP process, Trousson believes that many contractors will find some training useful. "Brite-Euram established a programme of two-day seminars in response to requests for assistance from projects, and it has proved very popular," he says.

Hosted by regional Innovation Relay Centres and led by qualified experts, the seminars are free of charge. Together, the partners of three or four different projects are helped to complete the TIP forms. They are also given assistance to analyse the technical results of their projects and to consider their market potential, intellectual property protection options and funding needs, identifying opportunities and risks.

"I now see my project in an entirely new light," commented one researcher after attending the seminar. ●

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The latest versions of all TIP documentation can be downloaded from http://www.cordis.lu/fp5/tip.htm

BIOTECHNOLOGY

Vaccines Good Enough to Eat

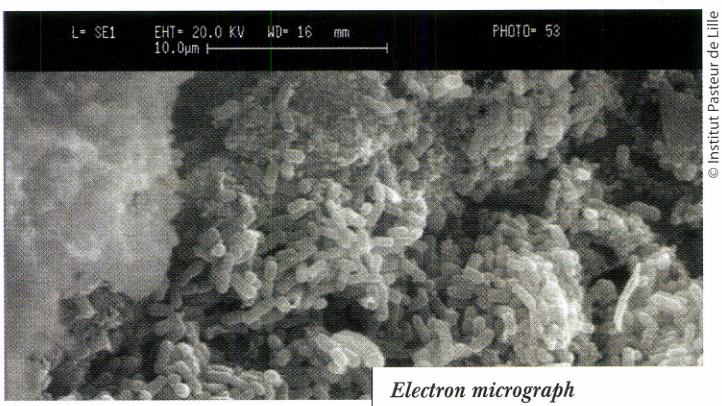
A European consortium of industrial and academic laboratories has taken the bold step of using harmless bacteria normally found in food as vehicles for vaccines. The success of their approach heralds a new era in vaccine development that could produce a family of safe oral vaccines within the next 20 years.

Effective vaccines for killer diseases such as polio, smallpox and measles were a significant achievement of 20th century medicine. Most successful vaccines are based on a purified component of the disease-causing micro-organism involved. However, not all bugs yield to this approach. Many bacteria, for example, go 'unseen' by the body's immune system unless they penetrate cells and tissues and set up an infection.

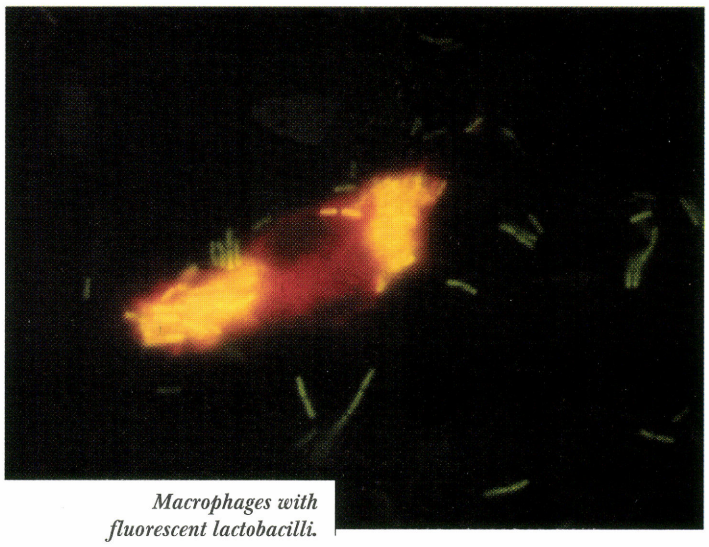
Trying to develop a live bacterial vaccine that does this without causing disease is one of the major challenges of vaccine research. It is possible to produce weakened disease-causing organisms such as the bacterium *Salmonella typhimurium* and use them as vectors to carry vaccine components. But few live vaccines of this type have entered clinical trials. Their widespread availability is not yet assured because of fears that the vector itself may cause illness.

The yoghurt angle

Now at the Institut Pasteur de Lille, France, Annick Mercenier and co-workers at Transgene SA decided in the mid-1990s to tackle the problem from a new angle. "I had worked for several years on the lactic acid bacteria (LAB) for applications in the food industry. LAB are safe, and indeed many are normal inhabitants of the gut and other parts of the human body. They seemed to be ideal candidates for use as oral vaccines and drug delivery vehicles," she recalls. ●●●



Electron micrograph of lactobacilli.



Macrophages with fluorescent lactobacilli.

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The idea of using food or intestinal bacteria to develop vaccines for life-threatening infectious disease was regarded as 'interesting' by workers in the vaccine field. "But people were sceptical that it would actually work," adds Mercenier.

With support from the European Commission, Mercenier and like-minded colleagues set up a large collaborative project that ran for two years. "Because this approach had not been tried before, we needed to demonstrate that our ideas were feasible. A large amount of multidisciplinary basic scientific research had to be completed in a short time, something that would have been impossible without a network," says Mercenier.

After two years, even sceptics were forced to admit that a number of LAB could be used as vaccine vectors. The result created ripples of excitement. Since LAB can be taken by mouth, they would be much easier to administer than injected preparations. Also, because dietary LAB themselves have GRAS status ('generally regarded as safe'), they would be particularly useful when developing a vaccine for the young, the elderly and those with compromised immune systems.

The right response

The first project ended in 1996, but the network was reformed immediately, this time with just nine academic partners and one commercial company, Innogenetics NV. This was the start of Labvac[1], a new three-year project within the Biotech programme's larger Starlab initiative.

Having established protocols to ensure the reproducibility of their results, the partners investigated whether mucosal immunity could be induced in animals by administering a live LAB vaccine through different immunisation routes.

Mucosal immunity – a measurable antibody response in the secretions of the intestine, vagina or rectum – is a key requirement for a successful vaccine against mucosal pathogens. "Most pathogenic organisms get into the body through the mucosal surface. In an adult human this has a total area of up to 400m^2, offering plenty of scope for microbial invasion," explains Mercenier.

The network engineered LAB to carry two different molecules. One is a component of the toxin produced by the bacterium that causes tetanus, the other a protein from the Aujeszky's disease virus, which causes pseudorabies in pigs.

Using these test antigens, the partners tested several strains of LAB and showed that they could induce a good antibody response to the antigen they carried. Moreover, results to date show that the immune response protects against challenge with live organisms in the tetanus model. Preliminary experiments have also been conducted with *Streptococcus gordonii* in monkeys.

In demand

The Labvac project is now completed, but the partners are planning several fascinating lines of further research, including the potential for using a lactic acid vector as a vaccine against viral infantile diseases. They are also investigating whether LAB strains can be used as live therapeutic agents for immunological or metabolic disorders.

This latter approach – which involves using LAB as vehicles to deliver interleukins locally, for example – is receiving increasing interest. "There are still unanswered questions and much work to do, but we have come a long way in five years. In the past we spent a lot of time trying to interest vaccine development companies in our work. Now they seek us out," says Mercenier. ●

(1) Biotech project BIO4960542 – Lactic acid bacteria as cell factories for the production and delivery of mucosal immunogens.

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European IST Prize 2000

Now in its sixth year, the European IST Prize awards three Grand Prizes of €200,000 and 20 Winner Prizes of €5,000 for groundbreaking products representing the best of European innovation in information technology. It provides public recognition and extensive media coverage to entrepreneurial teams which excel in generating and converting novel ideas and research into marketable products. The high standard of applicants and the competitive selection of the winners make this the most distinguished European award for new information technology driven products.

The closing date for applications is 16 May.

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Product Data Technology Europe

2-5 May, Noordwijk (Netherlands)

PDT provides a unified framework for data covering every stage of a product's life, from early conception to eventual disposal, and offers a basis for integrating and re-engineering the business processes relating to the product, leading to reduced costs and shorter time to market.

The aim of PDT Europe, which continues the work of an Esprit project, is to raise awareness within industrial and commercial enterprises of the business advantages which can be achieved by adopting and using modern PDT methods, and to share experience on how measurable benefits can be realised.

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Drug discovery and therapies from natural products, and the role of plants as pharmaceutical factories

5 May, Stirling (United Kingdom)

Plant and animal extracts have enormous untapped potential in alternative medicine and as the basis of combinatorial drug discovery techniques. Plants are also finding increasing application as pharmaceutical 'factories'. This conference will bring together leading European and US researchers to discuss these research areas and to debate their economic, social and ethical implications.

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Opportunities for local authorities within FP5

11 May, Birmingham (United Kingdom)

Jointly organised by the Midlands Innovation Relay Centre and the Institute of Local Government Studies on behalf of the UK's National Contact Point, this event is designed to introduce local authorities to the Framework Programme, and to explain their possible role in helping research projects identify and achieve social objectives, as required in FP5.

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PATLIB 2000 – The Next Generation

16-18 May, Helsinki (Finland)

PATLIB 2000, an event for patent information in the public sector, will focus on the next generation of patent information centres – likely to be 'lite' versions of traditional libraries. Other major topics will be staff qualifications and specialisation, the impact of new technologies, outreach programmes and revenue generation.

The conference will also feature presentations from providers and users of patent information in the commercial and institutional sectors, and workshops on issues such as setting up Patent Information Centre websites and organising patent clinics for SMEs.

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LES 2000 Conference – A World of Innovation

21-24 May, Amsterdam (Netherlands)

With 10,000 members, the international Licensing Executives Society (LES) is one of the largest intellectual property related groups in the world. Its annual conference includes a wide-ranging programme of lectures and workshops on the latest developments in licensing, intellectual property management and protection, and technology transfer.

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Remote Sensing in the 21st century

14-16 June, Dresden (Germany)

The 20th European Association of Remote Sensing Laboratories (EARSeL) symposium will celebrate a decade of trans-European cooperation in the field of remote sensing. Split into sessions for different disciplines, it will provide an opportunity for researchers from Western and Eastern Europe to meet and discuss their research and possible future collaboration.

Topics will include land applications and environmental modelling, water applications, atmosphere and global change, data calibration and correction, and new sensors nearing operational use.

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World Engineers' Convention

19-21 June, Hannover (Germany)

The World Engineers' convention will run as the technical preliminary event of EXPO 2000, and adopts the same theme of 'Mankind-Nature-Technology'. It will bring together around 3,000 engineers and leading experts from other fields to discuss topics under the general headings of environment, climate and health, the future of work, mobility, information and communication, and energy.

There will be an exhibition and presentations, workshops, and real and virtual forums designed for engineers, students and women in engineering.

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Inventory of public biotechnology R&D programmes in Europe

EUR 18886/1, ISBN 92-828-7235-1; €7

The Research DG has published the output of a Biotech accompanying measure project. This volume contains an analytical report, intended as the basis for improved co-ordination of research at European level. The authors have adopted an 'innovation systems' approach to highlight problems which may be susceptible to intervention, and to identify national biotech innovation systems which might be clustered to generate synergies. Volumes II and III contain an inventory of publicly funded and charitable biotechnology research programmes in 17 European countries.

New possibilities for accessing the capital markets for small and medium-sized biotech enterprises

EUR 18908, ISBN 92-828-6925-3; €17.5

This study was funded by the Biotech programme (1994-98), to examine why venture capitalists have been slow to support biotech SMEs in Europe, and offer solutions or suggest incentives to assist growth in this sector.

Among the reasons for the poor access to finance of biotech SMEs in Europe, the report cites high research costs, high levels of risk and the long lead times caused by testing procedures and product certification legislation.

The report explains the costs of stock market flotation, the behaviour of investors in biotech stocks, the role of European stock markets, and the impacts of changes in Member States' financial systems on biotech SMEs.

EU research annual report now available on-line

An illustrated version of the annual report on EU research, published by the European Commission's Directorate-General for Research, is now available on-line.

The report outlines the research and technological development activities of the European Union in 1998 and considers the future of RTD actions for 1999. Three main sections cover the adoption of the Fifth Framework Programme, EU-funded research activities in 1998, and the outlook for 1999.

Contact:
http://europa.eu.int/comm/dg12/reports/1999/index_en.html

Biomedicine and Health publications on-line

Three more reports on the European Commission's work in the field of biomedicine and health are now available on-line.

- a survey of the current status of research into ageing in Europe by the Ad Hoc Advisory Committee on Coordination of RTD policies, 1999. (EUR 18594)
- a survey of the current status of genome research in the European Union by the Ad Hoc Advisory Committee on Coordination of RTD policies, 1999. (EUR 18593, ISBN 92-828-6617-3)
- the future directions of human genome research in Europe – Florence strategy meeting 1999

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http://europa.eu.int/comm/dg12/biomed/biomed-p.html

Note

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