

Innovation & Technology Transfer

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- European Forum for Innovative Companies in Lyon
- Technology transfer from large public research institutes
- Visualisation software for urban planners

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Innovation

Policy News

- New European charter protects the interests of small enterprises
- A higher success rate among corporate than among academic spin-outs
- New rules on R&D co-operation facilitate research joint ventures
- European Science and Technology Week raises the profile of transnational research

Innovation/SMEs programme

- Second European Forum for Innovative Enterprises – awards of excellence
- European Trend Chart on Innovation – information products for policy-makers
- Benchmarking technology transfer from large public research institutes
- Innovation project – modelling and visualisation software for urban planners
- Innovation project – users help to shape improved pollution management procedures
- CRAFT project – new CAD-based technique reduces the costs of metal casting
- LIFT Helpdesk assists entrepreneurs to secure finance for growth
- Pilot project boosts university technology transfer performance
- New pilot action to create an internet portal for high-tech entrepreneurs

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Programme Briefing

- EU Contest for Young Scientists raises awareness about patents

Conferences & Publications

Innovation & Technology Transfer

Europe's Mobile Assets

There was a time when the value of a business corresponded closely to that of its buildings, equipment and other physical assets. In today's knowledge economy, however, tangible assets represent an ever smaller proportion of a company's worth. In emerging high-tech sectors in particular, value resides overwhelmingly in human capital – in the knowledge, experience and skills of key staff – which is hard to quantify and harder still to retain.

The mobility of skilled personnel is both a danger and a necessity. In those sectors engaged in the development of Information Society Technologies – the subject of this edition's dossier article – skills shortages are already a constraint on competitiveness and growth, and the situation will get worse before it gets better. While wage costs spiral upwards, the departure of a key developer or manager can make share prices plummet. The recent volatility of high-tech stocks may be very largely due to our inability to value, and to manage effectively, the human capital on which our economies now depend.

But the commercial application of new scientific knowledge which sustains prosperity and employment relies on the unfettered circulation of people and ideas. As highlighted by the European Forum for Innovative Companies (see page 7), the flow of knowledge and qualified personnel from universities and corporate research centres to new spin-out companies is a critical factor in the ongoing renewal of Europe's industrial fabric. Similarly, collaboration and exchange of good practice between regions is the lifeblood of the European Research Area now under construction.

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Big Plans for Small Enterprises



Future economic growth in Europe is dependent on developing conditions in which small and medium-sized enterprises (SMEs) can flourish. In June 2000, the General Affairs Council adopted a European Charter for SMEs, setting out the actions necessary to allow them to succeed.

Developing the right environment for SMEs to thrive in has long been considered a vital part of the European Union's plans for sustaining future economic growth. In June 2000, a detailed blueprint for this development, the European Charter for Small Enterprises⁽¹⁾, was adopted by the General Affairs Council and later welcomed by the Feira European Council.

The Charter is a direct result of the Lisbon meeting of the European Council in March, which committed the EU to becoming the "most competitive and dynamic knowledge-based economy in the world" by the end of the decade.

Seeds of success

The Charter recognises the importance of SMEs as a source of employment – and hence as a key component of a sustainable European economy. Importantly, it stresses the need to cut red tape so that SMEs can expand without becoming snared in excessive bureaucracy.

The Charter acknowledges that there must be adequate reward for SMEs' success in reacting dynamically to rapidly changing market places. The role they play in social and regional development within the new knowledge economy is also stressed. The Charter does not ignore the risks involved in entrepreneurship either, stating that "some failure is concomitant with

responsible initiative and risk-taking and must be mainly envisaged as a learning opportunity".

Furthermore, it pledges to make certain that the correct fiscal and regulatory framework is in place, and offers a commitment to "ensuring access to markets on the basis of the least burdensome requirements". By providing access to finance and the best research and technology, the Charter pledges that "the EU will offer the best environment for small business in the world".

Growth medium

In the field of education and training, the Charter wants entrepreneurship to be taught at all school levels, while training institutions will be encouraged to adapt programmes to the specific needs of SMEs.

It also encourages SMEs to co-operate more closely so as to strengthen their technological capacity. Inter-firm clusters and networks will be supported as well as pan-European co-operation between small enterprises. SMEs will be encouraged to adopt successful e-business models in the pursuit of best practices.

Wherever possible, the Charter asks for regulations to be simplified so that companies can be created quickly and, conversely, not pilloried in the event of failure. In line with this, tax systems "should be adapted to reward success (and) encourage start-ups".



Cutting administrative red tape is the first step towards releasing SMEs' innovative potential.

Annual harvest

The UEAPME⁽²⁾ has supported the ideas and the adoption of the Charter, drawn up by the Commission and the Member States. Furthermore, the Economic and Social Committee⁽³⁾ is in favour of the proposals, backing the Charter in a spring 2000 opinion.

To ensure rapid progress, the Charter includes an obligation to "monitor and evaluate progress annually ... at the Spring Summit". In the Charter, Member States commit themselves to working towards its goals using the method of 'open co-ordination' of national enterprise policies.

(1) The text of the European Charter for Small Enterprises is available at http://europa.eu.int/comm/enterprise/enterprise_policy/charter.htm

(2) The European Association of Craft and Small and Medium-sized Enterprises, <http://www.ueapme.com/>

(3) The Economic and Social Committee, <http://www.ces.eu.int/>

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Universities Can Learn from Industry

The Joint Research Centre's Institute for Prospective Technological Studies (IPTS) has found that corporate spin-off companies are more likely to succeed than university-based start-ups. This assessment provides valuable pointers for policy-makers wishing to improve universities' spin-off performance.

Until recently, policy-makers have focused attention on university-based start-up companies as a central factor in the exploitation of research results. Studies at IPTS, requested by the European Commission's Enterprise DG, are now showing that spin-offs from commercial companies have higher growth rates, a lower chance of failure (around 15%), and often produce more innovations than high-tech start-ups or university spin-outs.

Corporate spin-offs benefit from greater business experience and better access to development capital and markets, and offer better job prospects. University start-ups, on the other hand, tend to grow slowly, with commercialisation hampered by bureaucracy and a less entrepreneurial approach. About 45% eventually fail.

In a spin

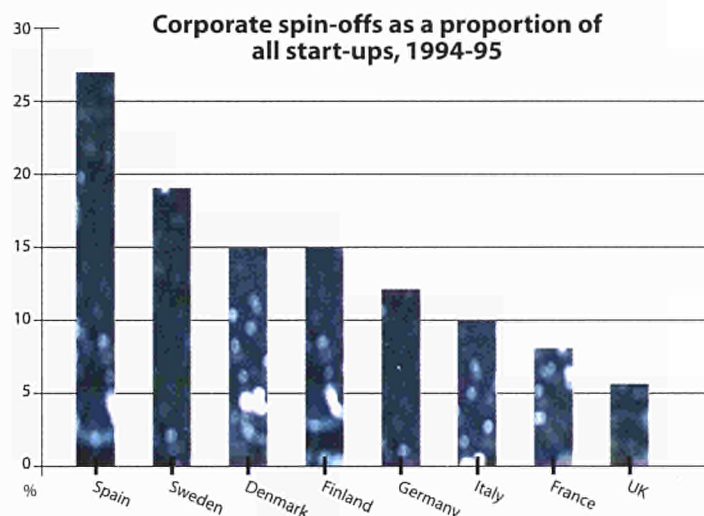
Corporate spin-offs may result from restructuring – typically when a company disposes of units which no longer match its core activities, or are too expensive. By contrast, entrepreneurial spin-offs enable technological

potential that would never be realised by the parent company to be bought out and developed, either in collaboration with the parent or in competition with it.

The IPTS study collected information on corporate spin-offs from Denmark, France, Germany, Italy, Spain, Sweden and the United Kingdom. A survey of European manufacturing and service industry brought responses from 144 companies, with further input at an industry seminar from large companies such as Hoechst, Finmeccanica, Deutsche-Stein-kohle, Ericsson, and Nestlé.

Where restructuring is involved, spin-offs often result from privatisation – as in the UK steel industry – or from deregulation in the telecommunications and energy sectors. Success frequently depends on support from the parent company, often in the form of management expertise and financial investment. Entrepreneurial spin-offs are also common in the service sector.

The French Thomson group has a strong spin-off policy. It has set up 51 restructuring-driven spin-offs since 1984, and 327 entrepreneurial spin-offs



Comparison of corporate spin-offs in eight EU Member States shows very wide variation in the level of activity. (Source: IPTS)

since 1993. Because they facilitate outsourcing, and allow restructuring without a reduction in employment, spin-offs produce economic benefits for the group. Philips, in the Netherlands, has a redesign centre which develops business units outside its core activities, allowing them to separate when they achieve profitability.

Improved environment

The IPTS is formulating advice for policy-makers who wish to intensify co-operation between research bodies and companies on both corporate and research-based start-ups. Recommendations are likely to include benchmarking and exchange of spin-off best practices – for example,

better arrangements for secondment and leave of absence, tax harmonisation and concessions for temporary equity holdings in spin-offs, and improved access to capital. An IPTS expert workshop will this month investigate governments' role in fostering public and private spin-offs, and seek to raise awareness of their importance to innovation, employment and growth.

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Making Research Co-operation Easier



New rules on R&D co-operation aim to clarify the application of competition rules in this area, and give European businesses greater flexibility in the drafting of co-operation agreements.

New rules on R&D co-operation agreements came into effect on 1 January⁽¹⁾. The European Commission has carried out a substantial reform of competition rules applicable to horizontal co-operation agreements – that is, agreements between companies operating at the same level in the market. The changes are designed to reduce the regulatory burden for companies, while maintaining effective control of agreements likely to distort competition.

Block exemption

Given their importance for the promotion of innovation in Europe, R&D co-operation agreements – in particular between SMEs – are able to benefit from special conditions. The Commission's 'block exemption' regulation on R&D agreements has now been significantly modified so as to introduce greater flexibility and freedom of contract. Provided that the combined market share of the parties to the agreement does not exceed 25% (formerly 20%), and that it does not breach any of the hard core restrictions (the 'black list') set out in Article 5 of the Regulation, an R&D co-operation agreement can be assumed to benefit from the block exemption. In these circumstances, companies are given a seven-year period of grace in

which they can reap the benefits of their innovation. In general, all parties to an agreement should have equal access to the results of R&D co-operation. An exception is made, however, for academic bodies or specialised research institutes, which may be allowed to forego their commercial rights.

Donncadh Woods and Joachim Lücking of the Directorate-General for Competition are quick to point out, however, that even for agreements that fall outside the block exemption, the analysis is likely to be favourable as long as they are good for innovation and demonstrably present no serious threat to competition. "The spirit behind the new rules is very much to promote innovation as far as possible without distorting competition," Lücking explains.

Promoting innovation

As a complement to the block exemption regulation, the Commission has developed a set of guidelines⁽²⁾. This describes the general approach to follow when assessing horizontal co-operation agreements, and sets out a common analytical framework. It is intended to help companies falling outside the block exemption to assess with greater certainty whether or not an agreement qualifies for an individual exemption. To facilitate this assessment, the guidelines also



Technology-based SMEs, often highly specialised but under constant pressure to innovate, will benefit especially from new rules making cross-border R&D co-operation easier.

offer a number of concrete examples. Once more, the 'black list' of hardcore restrictions applies. These essentially concern price-fixing, market-sharing and co-ordinated reduction of output.

The new rules and guidelines offer a significant increase in legal certainty, apply to more companies and generally make it easier to engage in R&D agreements. They are expected to be of particular benefit to SMEs, which are under pressure to innovate continuously. Through their inherent

facilitation of R&D co-operation, the new rules are also likely to help increase Europe's overall innovation capacity. ●

(1) Commission Regulation on the application of Article 81(3) of the EC Treaty to categories of research and development agreements.

(2) Guidelines on the applicability of Article 81 to horizontal co-operation agreements.

Contacts

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• Both the Commission Regulation and the guidelines may be found, in all EU languages, on the Europa website at <http://europa.eu.int/comm/competition/antitrust/legislation/>



Art for Science's Sake

Research is vital as a source of innovation, but depends on sufficient numbers of both scientists and teachers. Events held throughout Europe during European Science and Technology Week were designed to raise public awareness of the contribution science is making to society.

By 2002, there will be 1.6 million vacancies in the Information and Communication Technologies sector in Europe. Other technology sectors will be similarly affected and there is already a severe shortage of science graduates.

Against this background, last November's European Science and Technology Week saw many events aimed at improving public understanding of the complexities and benefits of science. The week's activities formed part of a broader EU initiative to encourage young people to develop an interest in science. As Philippe Busquin, European Commissioner for Research, commented: "The decline of interest among young people for science studies and careers, combined with current demographic trends in Europe, presents a major threat to our future socio-economic development."

What a week

"One of our roles is to present the public with a well-balanced view of scientific facts," says Stephen Parker of the Commission's Human Potential Programme. "Science is a collaborative venture and is one of the few



Commissioner Busquin gives European science a boost.

cultural activities that does not have national boundaries. The Science Week gives us an opportunity to demonstrate the value of scientific collaboration at European level."

Among the highlights of the week was the *Physics on Stage* show at CERN, in Geneva, which brought together 400 physics teachers from 22 countries. In the face of dramatic staff shortages, the aim was to show how physics could be taught in a more interactive and stimulating way. *Radioactivity: a Facet of Nature* showed how a natural phenomenon can be harnessed to yield benefits to society. The multifaceted exhibition opened in

Paris and was shown simultaneously in Wiesbaden and Milan. A travelling demonstration, *Fly me to the sun*, featured the collaborative design of a spaceship. Modules made by young students across Europe were assembled to show how teams of students and scientists could successfully work together. Other activities covered mathematics, genetics and climate change.

Educate to innovate

The activities of European Science and Technology Week are closely aligned with the aims of the recent Commission Communication *Innovation in a knowledge-driven economy*⁽¹⁾, among whose main objectives is the goal of making society more 'open to innovation'. As the Communication states: "We need to make both the opportunities and risks

of new technologies as transparent as possible in a broad dialogue with science, business and the general public." Improved public understanding of science is also a goal of Commissioner Busquin's European Research Area (ERA) initiative⁽²⁾, which aims to improve collaboration, communication and co-ordination across public and private sectors.

The Science Week can only serve to stimulate interest and an openness to technological progress among a public whose faith in science has recently been shaken by the BSE crisis and other food scares. If it also succeeds in encouraging more young citizens to take up careers in science, it will have made an important contribution to Europe's future safety and prosperity. ●

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(1) See 'Time for an Innovation Upgrade', edition 6/00, and Special Edition of November 2000.

(2) See 'Dawn of a New ERA', edition 6/00.

Achievement and Optimism

Optimism for the future, and pride in Europe's current rapid progress in building a network of dynamic regional innovation systems, set the tone at two major conferences held back-to-back in Lyon last November.



Commissioner Erkki Liikanen (holding microphone) with the winners of the Award of Excellence.

In Lyon, birthplace of Jacquard's loom, technological innovation has long been a source of regional prosperity. Today, the city's considerable research capacity in the field of biotechnology, and that of neighbouring Grenoble in micro and nanotechnologies, are the twin engines of rapidly growing industrial clusters. Close to 100 high-tech start-ups are created in the Rhône-Alpes region each year.

The French Presidency of the European Union made it especially fitting that Lyon should host both the Second European Forum for Innovative Enterprises and the high-level symposium *Towards a European Innovation Area* (see box on page 8).

Innovation Oscars

The Forum, organised by the European Commission's Directorate-General for Enterprise in the framework of its PAXIS pilot action⁽¹⁾, brought together 500 innovation actors from around Europe – entrepreneurs, technology transfer and business development professionals, and

policy-makers. It also saw the presentation of awards of excellence to the first 15 members of the PAXIS networks. These link regions of outstanding performance in the creation of new high-tech companies – including Rhône-Alpes – for the exchange of experience and the collaborative development of good practice.

"Regional innovation is both an asset and an objective," Christian Pierret, French Secretary of State for Industry, told the Forum. "It is an essential source of renewal for Europe's industrial fabric, and therefore of new employment. It will be at the heart of the future European Research Area, and of the EU's Sixth Research Framework Programme, and is the central concern of the French Presidency."

For Rhône-Alpes itself, Anne-Marie Comparini, the region's president, told participants that "increasing regional support for the creation and growth of innovative companies is central to our strategy for realising the full socio-economic value of our region's exceptional research

base". The prize reflected the success of close collaboration between policy-makers, scientists and companies, and the developing appetite among the region's industrial clusters to abandon rivalry in favour of co-operation, she added.

"Innovating companies have a positive impact on the whole of a regional economy," said Erkki Liikanen, European Commissioner for Enterprise and the Information Society, presenting the awards. "That is why we wanted to establish this club as a showcase of regional innovation."

A people business

Earlier, three parallel sessions addressed the topics of entrepreneurship, networking and regional innovation systems – each critical for the creation of new high-tech firms.

...

(1) See 'The Innovation Connection', edition 6/00.



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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Commissioner Erkki Liikanen (extreme left) presenting Awards of Excellence to representatives of the four regions collaborating in the KREO network – left to right: Hugo Brunner (Oxfordshire, UK); Michel Destot, (Rhône-Alpes, France); Vasco Errani, (Emilia-Romagna, Italy); Jürgen Wüst, (Karlsruhe, Germany).

•••

Introducing the entrepreneurship workshop, Paavo Uronen of Helsinki's University of Technology pointed to the close correlation between entrepreneurial activity and GDP growth. Per Olof Berg, President of the Stockholm School of Entrepreneurship (SSES) described its establishment in 1999 as a collaborative venture between the city's medical, technical and business universities.

"Competition between institutions and regions is increasingly intense. But critical mass is essential for survival, so competition is also a spur to collaboration, both within and between regions," he said. "Regional innovation systems, drawing on specialised competence clusters, are now the key sources of employment and economic growth. SSES will deliver high-quality entrepreneurship courses to 300 students per semester from a competence mass of 30,000 people."

Berg also spoke of the fundamental importance at all levels of 'personal networks' of actively collaborating individual players – a theme echoed by other participants. To survive in today's networked global economy, a high-tech company must focus tightly on its core business, collaborating with other specialists

to address international markets, said Maija Hämäläinen, managing director of Finnish start-up Codeonline, a wireless entertainment content provider.

But to progress from survival to success, creativity and continuous improvement are absolute necessities. "To innovate at such a rapid pace, continuous company-wide thinking and learning are needed," she said. "You must be willing to accept mistakes. And you must find a way to involve people emotionally – financial incentives are no longer enough to retain qualified staff."

The members of the workshop panel welcomed compe-

titions and awards as a means of stimulating entrepreneurial activity. But they agreed that participation in EU Framework Programme research was still too difficult for start-up firms, and called for a dedicated research programme with greatly simplified application procedures and a maximum four-week response time.

Watch this space

The one-day Forum generated a wealth of ideas. But as Giulio Grata, head of Enterprise DG's Innovation Directorate, acknowl-

edged, there was not as much time for discussion as many participants would have liked. "However, the debate need not end today," he announced. "We invite you to continue to contribute your ideas, suggestions and even criticisms over the coming weeks."



Commissioner Liikanen (centre) with representatives of the four member regions of the Highest The Net network – left to right: Mercedes Bresso (Turin, Italy); Annika Annerby-Jansson (Sydsam, Sweden); Alain André (Alpes-Maritimes, France); Arto Brygarre (Helsinki, Finland).

Towards a European Innovation Area

Policy-makers and practitioners from around Europe were welcomed by the Mayor of Lyon, Raymond Barre, former French Prime Minister and a veteran champion of European innovation. "In this century of intelligence the process of innovation will be decisive," he declared. "If Europe is to meet the ambitious target set by the Lisbon Summit⁽¹⁾," said Commissioner Liikanen, "we must improve the efficiency not only of each component, but of the links between them. Current innovation performance varies too widely between Member States. It is not necessary to impose uniform provision, but transnational collaboration is the best way to exchange good practice."

Laurent Fabius, French Minister of the

Economy, Finance and Industry, emphasised the strength of Europe's scientific research base. But to convert science into successful innovation, EU-wide co-ordination was now crucial, he said.

Three round tables addressed key aspects of European innovation, and the 600 delegates voted to select the top priorities – in the area of financing, **early-stage support for innovative businesses**; in relation to competitiveness and social cohesion, **training and support for entrepreneurship**; and for research, measures to **boost public and private sector R&D spending**.

(1) See 'Radical Response to a Quantum Shift', edition 4/00.

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Fruitful Trend

The continuous monitoring activities of the European Commission's Trend Chart on Innovation are now generating a steady stream of information products, helping national policy-makers to learn from one another's successes and mistakes.

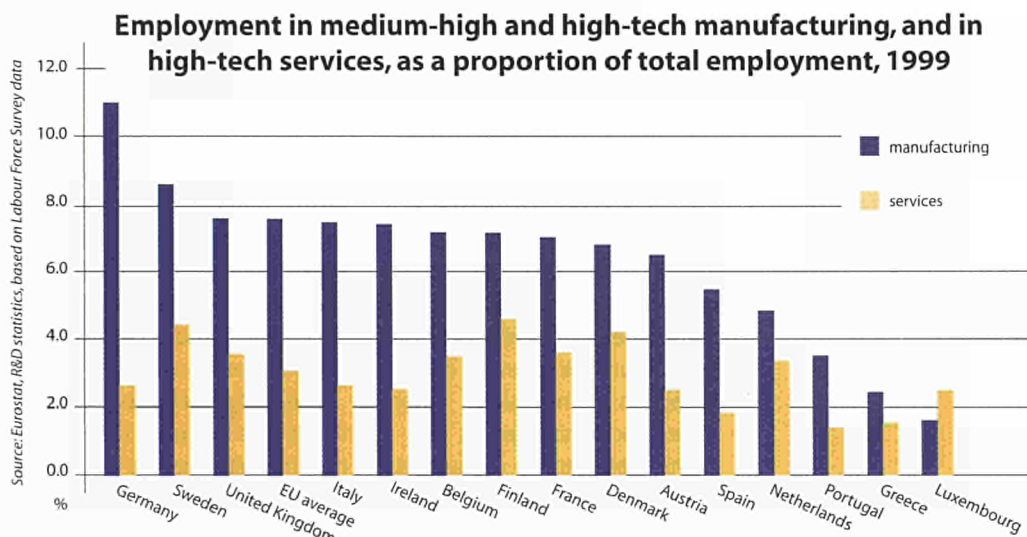
The Trend Chart was launched in 1999 as part of the Fifth Research Framework Programme. Experts in each Member State continuously gather information about national measures designed to stimulate or facilitate innovation. The work focuses on four key areas – financing, protection of intellectual property, the creation of high-tech start-up companies, and the transfer of new technologies from the research base to industry.

Seeing what works

"The objective is to streamline improvement of the environment for innovation across Europe," says Peter Löwe of the European Commission's Directorate-General for Enterprise. "By distributing information about what is being done in each country, we aim to help policy-makers to avoid reinventing the wheel and build on schemes that have already proved successful elsewhere."

A pilot phase, completed in 1999, has produced both a substantial report and a 40-page brochure⁽¹⁾ summarising the position in each Member State. Now the network of correspondents has been extended to cover the EU accession countries. Further annual reports are planned, as well as a newsletter and bulletins on each participating country and each main theme, which will be published periodically.

The information collected by the correspondents is continuously added to a database, acces-



The European Trend Chart on Innovation is designed to stimulate improvement in Europe's innovation performance on the basis of international comparisons. Employment in high-tech manufacturing and services are among 16 indicators used.

sible to national and regional authorities via the Trend Chart website (see Contact). Here, policy-makers can find not only detailed descriptions of the measures implemented in each country, but contact details for the bodies which administer each scheme.

Best of breed

The Trend Chart also gathers statistical data on national innovation performance. This has already been used to produce the *European Innovation Scoreboard*⁽²⁾ as part of the wider competitiveness benchmarking exercise carried out by the Enterprise DG in response to a request from the European Council at Lisbon.

"The next task is to link qualitative information and statistical data to assess whether, over time, specific measures really do contribute to improving innova-

tion performance," Löwe says. The diversity of national circumstances makes a single set of best practices impossible – what works in one region is not necessarily best-suited to the needs of another. Nevertheless, the Trend Chart will attempt to benchmark innovation policy-making by comparing different approaches, and Löwe acknowledges that an element of 'naming and shaming' is involved.

"Benchmarking does have a competitive aspect," he says. "But it also creates a platform for collaboration. Only policy-makers themselves can decide whether something will work in their own country. Discussion and exchange of experience, based on reliable, up-to-date information, should enable each of them to improve performance." The first two in a planned series of workshops brought together practitioners and policy-makers from all Member States to examine

structures for the co-ordination of innovation policy and measures to encourage and support learning networks.

(1) 'European Trend Chart on Innovation: Innovation Policy in Europe 2000', NB-27-99-144-EN-C, ISBN 92-828-8866-5, is available, free of charge, from the Innovation Helpdesk (Tel. +352 4301 33161; Fax. +352 4301 32084; innovation@cec.eu.int)

(2) The European Innovation Scoreboard is available as an Annex to the European Commission Communication 'Innovation in a knowledge-driven economy' (<http://www.cordis.lu/innovation-smes/communication2000/home.html>), or see Special Edition of November 2000.

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Storming the Ivory Tower

Future economic growth depends on the continuing supply of new knowledge. But Europe's public research institutes need to be more aware of the potential applications of their work, and to collaborate better with industry. A recent Innovation Policy study proposes a blueprint for action.

There is no such thing as a typical large public research institution (LPRI). This was just one of the problems faced by the team that recently carried out a comprehensive study⁽¹⁾ for the Innovation Directorate of the European Commission's Enterprise Directorate-General.

The team, led by consultants Arthur D Little (ADL), set out to identify best practices related to

agement, management of intellectual property rights, networking and entrepreneurship, and new business creation. Each of these areas, which are of equal importance, requires a clear strategy, the team found.

The study's main recommendation is for a European LPRI Benchmarking Initiative. This would be a collaborative effort, but it would also set the LPRIs in competition with each other. "Change cannot just be imposed on research institutions," explains ADL's Michael Braun. "The scheme we propose would enable each LPRI to see how others are doing. This transparency, and the platform for discussion between peers, creates a learning opportunity. The scheme is dynamic. A simple recipe for success would soon be out of date, but the use of benchmarks will maintain a sense of urgency and provide continuous feedback to the learning process."

tional change. Public institutions look at leading private sector research labs and say, 'It's brilliant, but it's not right for us.'

Another problem can be the lack of professional management skills. "For senior positions, you must define the profile of the required person and then choose the best candidate," Braun explains. "In LPRIs, there is a tendency to promote people to positions of responsibility on the basis of research performance rather than of managerial ability."

Although they can be helped to overcome such institutional barriers to change, the study team believes that responsibility for doing so should rest with the LPRIs themselves. Change has to come from within – what LPRIs need is the freedom to do the job for themselves, through collaboration.

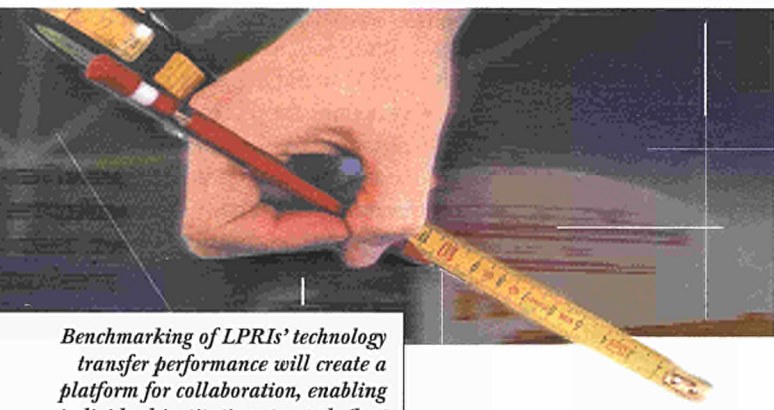
The battle, not the war

The Benchmarking Initiative fits well with the objectives of the planned action to create 'European centres of excellence' as part of the European Research Area⁽²⁾. Such centres of excellence are expected to deliver economies of scale, to improve competitiveness and to raise the level of research conducted in Europe.

Of course, LPRIs cannot change overnight. "There is no universal model of technology transfer. Best practice varies between

technology transfer – the various processes by which the results of LPRIs' research work is commercialised by licensees or new spin-out companies, or through other forms of industrial collaboration. The report aims to provide the basis for improved performance by LPRIs, and their enhanced contribution to national and European economic policies.

Thirteen institutions in eight countries took part in the study, which was completed in March 2000. It identified six key success factors – market focus, culture, organisation and internal man-



Benchmarking of LPRIs' technology transfer performance will create a platform for collaboration, enabling individual institutions to apply 'best in class' practices. But regulatory differences and lack of management skills constitute real obstacles.

Trojan Horse

In many countries the regulatory framework, and the resulting culture of public service, constitute a major obstacle. As governmental bodies, LPRIs are accustomed to grant funding, and often have little incentive to look for applications for the basic research that they perform. "Everyone pays lip-service to market focus," says Braun. "But they are often less enthusiastic about concrete proposals which would necessitate significant organisa-

countries, between institutions, and from project to project. But consensus among policy-makers would help to bring it all together," says Braun.

That is where the Member States have a part to play, promoting technology transfer as much as the underlying research, and monitoring its impacts in terms of new employment, the creation of spin-off companies, and market competitiveness. As for the European Union, Braun adds, "It has an important role to play in linking and co-ordinating national efforts. To compete successfully in a global economy we have to move towards transnational innovation systems."

The need for innovation as a means of improving economic welfare throughout Europe is intense. The LPRI Benchmarking Initiative offers a mechanism for research institutions to learn from each other in order to speed their transformation from ivory towers to real drivers of innovation-based economic growth. ●

(1) 'Getting more innovation from public research', NB-NA-17-026-EN-C, ISBN92-828-9580-7, available from the Innovation Helpdesk (Fx. +352 4301 32084, innovation@cec.eu.int).

(2) 'Towards a European research area', available at <http://europa.eu.int/comm/research/area.html>

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URBAN PLANNING

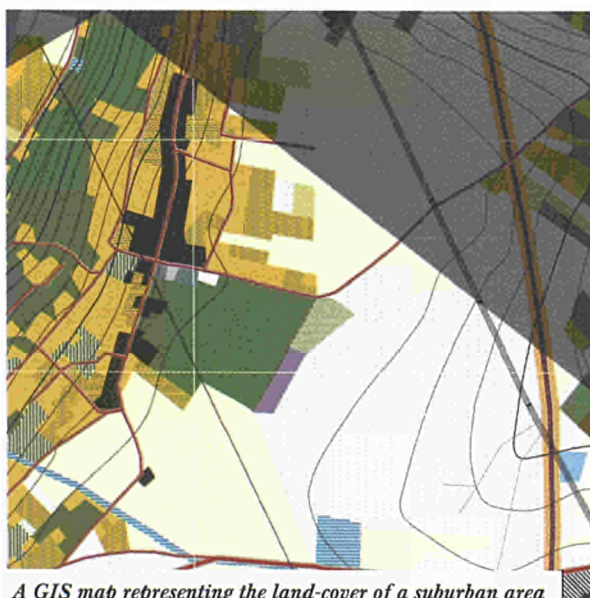
From GIS to Virtual Reality

Equipping the specialists and non-specialists involved in urban planning to work together far more effectively than in the past, an Innovation project has developed software which connects GIS databases to a powerful modelling and visualisation package.

European regional and urban planning authorities use dedicated Geographical Information Systems (GIS) both in the planning process and to present information to planning committees and the public.

Unfortunately, existing GIS offer only resolutely two-dimensional maps. When critical planning decisions need to be made, or when public agreement and confidence must be obtained, three-dimensional images are much better. "Yes, but what will it actually look like in ten or 20 years?" is an understandably common question from non-experts involved in planning decisions.

Today, the only solution is to

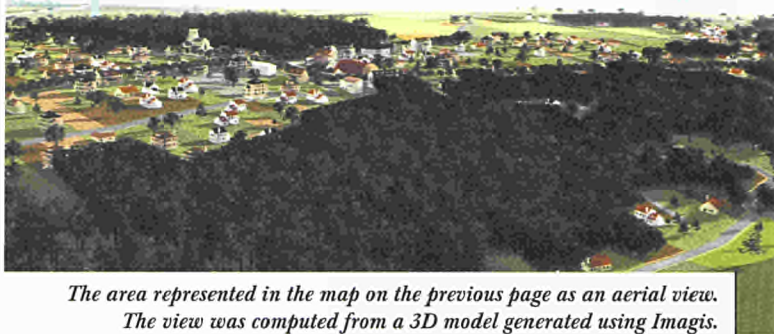


A GIS map representing the land-cover of a suburban area of Île de France in 1994. source: IAURIF (SIGR)

produce 3D images based on traditional CAD models and aerial 'orthophotos' – much too inefficient to allow rapid iterations of possible landscape scenarios. The quality of decision-making is compromised because the consequences of different options cannot be 'seen'.

Chance meeting

The Imago Metropolis project⁽¹⁾ originated in a chance cross-disciplinary contact typical of the innovation process. In 1993, Laurent Perrin of the Île de France Urban Planning Institute (IAURIF) conducted a technology survey of 3D-visualisation software with possible



The area represented in the map on the previous page as an aerial view.
The view was computed from a 3D model generated using Imagis.
source: IAURIF (image, I. Mambretti)



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urban planning applications. As he recalls, "I attended several seminars, and at one in particular I was introduced to researchers from the Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD)".

CIRAD was developing AMAP⁽²⁾, a suite of very powerful software tools for modelling plants' architecture and for simulating their growth. "When they added a tool to place plants and other objects within a landscape scene, I began to think about how this could be combined with extensive GIS datasets," Perrin recalls. "To complete the consortium for the Innovation project, we chose partners with technically diverse needs. Eurosense needed a fairly detailed model

of a river valley into which its client was contracted to build a high-tension electric line – very different from IAURIF's broad-brush needs. Milan Polytechnic was interested in reconstructing archaeological landscapes for research and dissemination purposes."

3D and 4D decisions

AMAP is able to compute very quickly plant models that are true to life, at various ages, thanks to its 'growth engine'. This 4D technology is based on extensive botanical measurements and mathematical rules. Landscape-oriented GIS combine many layers of spatial information such as Digital Terrain Models (DTM), land-cover, and other themes.

Imagis⁽²⁾, the 'procedural' modelling interface developed in the project, links these two applications as the basis for its completely novel ability to describe 'urban fabrics': "An urban fabric is

a pattern of land plots, buildings, roads and vegetation, logically assembled according to planning rules defined in special procedures," Perrin explains.

Imagis' capacity to create 3D views of urban landscapes is unique, and its built-in features allow modelling of landscape scenarios to be integrated into the iterative planning and design process. Importantly, it also improves communication between expert planners and elected decision-makers on planning committees, who often find it difficult to visualise 2D GIS data. "Imagis can be looked at as a bridge between urban planning, where rapid, iterative changes in scenarios are needed, and urban design, where architectural and landscape features are fitted into the selected plan," says Perrin.

Technical challenge

Three pilot projects were deliberately chosen to present different technical challenges. "The many GIS in use around the world today differ greatly in level of detail, scale and data types, and very few systems are interoperable," explains Perrin. "We designed the software to work with a wide variety of GIS, and to cover a large set of needs."

All three pilots were com-

pleted successfully. Milan Polytechnic, for example, has created a series of images of the Etrurian landscape from the Neolithic period to the present, which is currently being used to aid the search for undiscovered ancient settlements.

For the future of Imagis, the consortium has a dual strategy. In the short-term, a user club is being formed to drive forward further innovation. Perrin stresses the effort that the partners are devoting to attracting new collaborators. They are disseminating their results through conferences, papers and the project's highly visual website. "We want to attract new partners from the professional and research fields who have the interest and resources to test and develop Imagis further," he says.

Commercialisation is the medium-term aim. CIRAD, on behalf of the Imago Metropolis Consortium, is seeking private partners to market Imagis. Some companies have already expressed interest, and first-round financing is being sought. •

(1) Project IN20515I – Adaptation and validation of a plant modelling software (AMAP) to simulate landscape changes with 3D realistic images for planning.

(2) AMAP and Imagis are both registered trademarks.

2nd Call for Innovation Projects

The call produced many high-quality proposals, not only from technology providers and users, but from industrial federations and national, regional and local authorities. "A community of players is developing, capable of large-scale action in support of European innovation, rather than just linear transfers of technology," says Guido Haesen of the Directorate-General for Enterprise.

Of the 124 proposals, which involved 830 organisations drawn from all Member States and associated countries, 63% addressed generic technical, economic, organisational or social aspects of innovation. Thirty-eight projects were selected, of which 30 can be financed within the available budget.

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Savings Flow from User Involvement

The requirement for unpolluted water is common to all Member States. Now, an Innovation project has shown that any effective solution must take account of multiple factors, including climatic conditions and the interactions between drainage systems, sewage treatment works and the receiving waters.

In 1999, the European Commission launched five pilot projects to test the effectiveness of the Urban Pollution Management (UPM) procedure⁽¹⁾. This had been developed in the United Kingdom by the Foundation for Water Research as a means of assessing the capacity of water management systems to deal with urban discharges. The procedure uses a range of software tools to model water quality, and generates recommendations for improvements in the systems under study.

The pilots were conducted by local consortia in Belgium, Ireland, Italy, Portugal and France, with the Flemish group Aquafin acting as overall project co-ordinator and HR Wallingford Ltd providing technical co-ordination. The projects have now finished and their results are being used to develop a blueprint for the future.

"The most important lesson is that you can only solve the problem of pollution with an integrated approach," says project manager Patrick Swartenbroekx. "Sewage engineers and staff at water treatment plants must collaborate and work towards the same goals. Otherwise, sewers that meet their own standards may still cause pollution in the rivers into which they flow." The pilots have also demonstrated that climatic and cultural differences must be considered. In Italy and Portugal, where rivers are 'dry' for six months of the year, normal standards for pollution cannot reasonably be applied, for example.

Challenges and solutions

According to project engineer Johan Van Assel, "the pilots were ambitious, since everyone wanted to have the best possible technological solution to their most pressing problems".

In fact, the UPM procedure provides solutions for the full range of urban pollution problems. "It acts like a common-sense checklist, pointing you towards the priorities for your particular project," explains Van Assel. "If you have some 25 options for dealing with a problem, the UPM procedure indicates which five will produce the best results in the most cost-effective way. And it is very flexible – different technologies can readily be incorporated into the procedure."

One of the most successful pilots was run in Italy by the Centro Studi Deflussi Urbani (CSDU). "They were well organised from the outset," Swartenbroekx explains. "They understood the technology and applied it correctly and, importantly, they worked in a pragmatic fashion." The Portuguese pilot, based in the Loures region, was also interesting as it started from what was almost a green-field situation. "Although they focused primarily on the collection of data, by the end of the pilot they were more aware of all the issues involved in pollution control," he says.

The pilots have been extremely valuable as demonstrators, but widespread take-up will require active promotion. "The European



Flooding of the sewer system in Leuven, Belgium. Recent floods around Europe have posed a widespread threat to human health.

Environment Agency has an important role to play and needs to be more involved with our work in this area," Swartenbroekx says. A new body, the Integrated Modelling User Group (IMUG), has members in Australia, New Zealand and the United States as well as in Europe. As the IMUG's current chairman, Swartenbroekx sees the body as a loose federation with a shared interest in monitoring international activity in this field, and in anticipating future developments with a two-to three-year time horizon.

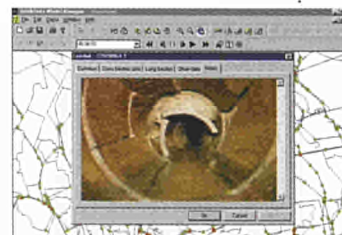
What does the future hold?

Following approval of the EU Water Framework Directive (WFD)⁽²⁾, which aims to protect all surface waters and groundwater in the EU, the next step will be to apply what has been learnt in the pilot project to other regions – both within the participating countries and elsewhere in

Europe. The first non-pilot projects have already started in Belgium, and plans for others in Portugal and Italy are well advanced.

Swartenbroekx is also keen to emphasise UPM's potential to support harmonisation of water quality standards in the EU accession countries of central and eastern Europe. If one of these countries simply implemented all the actions necessary to meet the Water Directive,

...



Application of the UPM procedure can be made more efficient using a GIS-based modelling environment.

it would have to spend around €2.5 billion in 12 months. Using UPM will help them to define priorities, enabling them to save a lot of money.

"Rolling out the UPM procedure across Europe would lead to a huge improvement in the quality of European water," Swartenbroekx concludes. "Further enhancements are still needed, however. First, we must truly integrate in a single toolkit what is currently an assortment of different tools linked through manual intervention. Second, and more importantly, we require stronger

international guidance to ensure that the lessons learned are applied widely. We need a European body to listen and take actions. In a sense, we need an international regulator. Only then, with the introduction of a top-down approach, will we begin to exploit the full benefits of this research."

(1) Innovation project IN1034011 – The transfer of the Urban Pollution Management (UPM) procedure.

(2) See http://europa.eu.int/water/water-framework/index_en.html

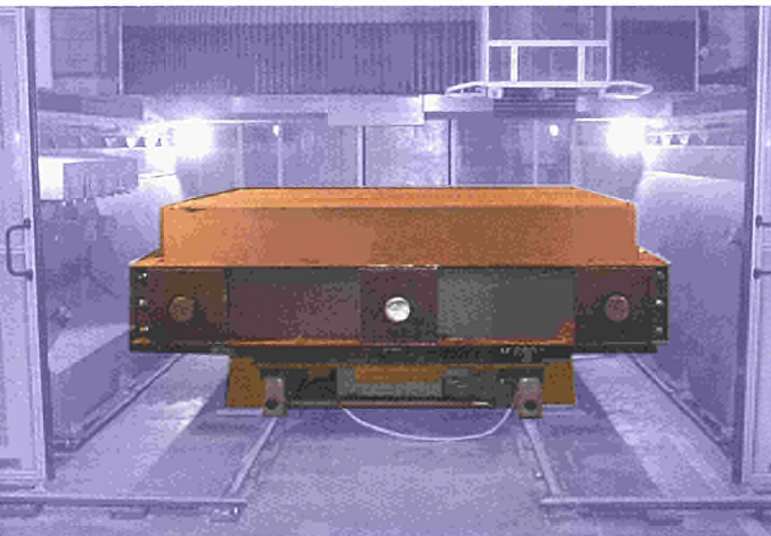
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ENGINEERING INDUSTRIES

Casting Doubt Aside

In a recent CRAFT project, a group of small companies set out to improve the speed and flexibility of a traditional industrial process. The emergent benefits they discovered along the way reflect the spectacular returns which frequently reward investment in innovation.



A block of bonded sand being machined on the five-axis universal milling CNC machine at the Castings Development Centre.

To the layman, the metal casting industry may conjure up images of streams of molten metal in dark, spark-lit foundries – of technologies little changed since the Bronze Age. In reality it is a technically sophisticated industry, producing finely engineered parts often taken for granted in modern life, but critical to many downstream applications. The performance of ships depends crucially on the accurate casting of their propellers, which are specifically designed for each individual ship's hull, for example. In the automotive sector, where castings are essential for volume production, quality is again a decisive cost driver.

Robust process

In the casting process, wooden patterns are used to form sand moulds. The pattern is then removed and metal poured into the sand mould. The CRAFT project⁽¹⁾ addressed the high cost and long lead-times associated with the manufacture of these wooden patterns, which are traditionally handmade. "Time-to-market was the driver," explains Dr Peter Haigh of the project's research co-ordinator, the Castings Development Centre. "Industrial manufacturers can ill afford the long lead-times inherent in current casting technologies."

The key technical innovation was to shape sand moulds

Sixteen 75kg aluminium-bronze propeller blades were cast with a consistent accuracy that could not have been achieved with a pattern – and in less time than it would take to make the pattern itself.

directly using computer numerical control (CNC) machining. This removes the wooden patterns from the production process, thereby saving up to six weeks in the prototyping phase.

Implementation required the development of bonded sand materials that could support the machining process, and the adoption of CNC machining techniques suitable for a difficult environment containing sand particles. The research team also developed interface software and a mould-handling manipulator.

The feasibility of the project's original aims – to reduce lead-times and costs – was demonstrated by a robust production process which immediately confirmed the new technique's industrial potential. When it was used to make pilot castings in the foundries of the 13 small and medium-sized enterprises that initiated the project, the partners were delighted by its multiple benefits.

Additional benefits

Firstly, the accuracy of the castings is excellent, significantly reducing the cost of hand-finishing the cast metal parts. "Anything nearer net shape considerably reduces finishing costs, which can

be significant," explains Haigh. "One partner has already made the most accurate propeller casting in their 95-year history."

Secondly, the precision of the castings is very high – particularly important where replacement parts may be needed some years later. Finally, storing patterns digitally as CNC files removes the huge overhead cost of physical storage, which often take up as much as 30% of a foundry's floor-space and incur high insurance premiums.

In addition, the project revealed CNC's potential as an enabling technology. "With the widespread use of CAD systems and rapid prototyping techniques, foundries' customers expect ever greater design flexibility," explains Haigh. "Now the CRAFT partners can meet this demand, as the technique is based on CAD input."

Taken together, these emergent features of the new technology have positive implications for the whole supply chain, which go far beyond the project's original aims.

Members of the cast

"The success of the project had its foundation in the combined skills of the Europe-wide consor-

tium, which represented a complete cross-section of the industry, from end-users to equipment manufacturers," Haigh stresses. The consortium included an Italian partner from outside the casting industry but with extensive experience of machining in difficult environments.

The collaboration will continue to build on this success. "It is unlikely these partners would have worked together without the CRAFT scheme," says Haigh. "Previously, although serving primarily local markets, they were virtually competitors. Now they

are working together on commercial projects, and the collaboration even extends to companies which were not directly involved in the project but expressed strong interest in its results."

There is enormous interest from the entire casting industry, and further evaluation castings have been made both for the partners and for other foundries. Worldwide, over 90% of castings currently use wooden patterns. Haigh does not underestimate the challenge of ensuring widespread take-up of the CNC-based production method, which is particularly suited to one-off and small batch castings. "To overcome industry's conservatism, any innovative advance must outperform current technologies by a fairly wide margin," he says. "We believe that the benefits of this new technology to the whole supply chain exceed that threshold. Now, the task is to convince the industry."

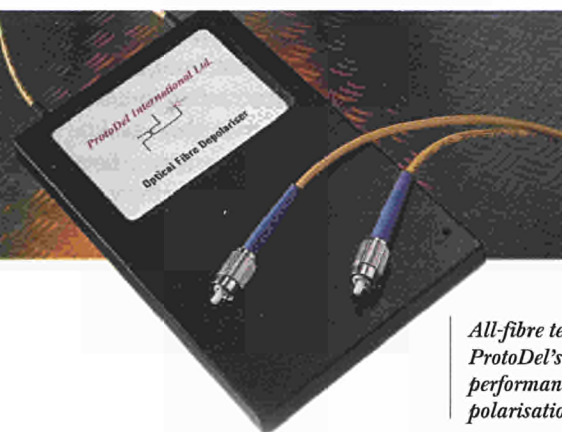
(1) BRST-97-5130 – Short lead-time 'patternless' manufacture of prototypes and small batches of large or small castings.

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Hitching a LIFT to Business Angels

The hopes of many start-ups quickly crumble when they seek funding from a succession of unsuitable investors, or approach the right ones inadequately prepared. Now, the Commission's LIFT service is helping entrepreneurs to find the financial backing necessary for successful innovation.



All-fibre technology is the basis for ProtoDel's competitive and high-performance range of optical fibre polarisation control products.

Linking Innovation, Finance and Technology (LIFT), a service of the European Commission's Innovation and SMEs programme, comprises a team of financial and technology experts who can assist with business

planning and offer advice on how best to approach potential investors. In addition to a helpdesk, LIFT provides a toolkit of self-help materials and holds frequent workshops throughout Europe.

Success story

Among approximately 2,000 enterprises helped by LIFT in 2000 is ProtoDel, a British manufacturer of optical fibre products. In August, MTI, an independent venture capital fund manager, agreed to fund ProtoDel – initially with €2.25 million, and with the prospect of a further €2.25 million.

ProtoDel's Ian Giles first contacted LIFT in August 1999. "We were in a rapid growth phase at the time, looking for more equipment and manpower. From the start, simply discussing the possible routes for achieving our aims was very useful," he recalls.

After adopting a series of amendments suggested by LIFT, a new business plan was ready at

the beginning of January. Giles then sent the executive summary to investor organisations on a list provided by LIFT. "I was working from a much bigger list prior to that, but it was far too general," he explains. "Without a specific pointer from LIFT, I might never have found MTI. Their pre-selection of companies investing in technology helped us considerably." Just four carefully chosen potential investors were contacted, of which two responded with interest, one being MTI.

LIFT objectives

Ties van der Laan at the LIFT Helpdesk sums up the service: "We aim to familiarise entrepreneurs with the way investors think. Particularly in the early stages, entrepreneurs can be too focused on their own products. In reality, investors respond far better to a market-oriented attitude. Preparation is the key, principally through the business plan. Most business plans tend to be poor, though it is very difficult and time-consuming to produce a good one. Yet in the end that is what allows you to present a powerful and convincing story."

Key Business Planning Tips

- Prepare extensively before approaching investors.
- Investors invest in people rather than products, so sell the management team.
- A business plan must demonstrate clearly the commercial viability of the proposed venture.
- A business plan should have the following outline:
 - Executive summary
 - Market
 - Product, process or invention
 - Management
 - Marketing and sales strategy
 - Manufacturing (if applicable)
 - Financial forecasts – sales, cash flow, break even
- Control of the business
- Required financing package
- Annexes
- Use the internet to find independent resources for the completion of the business plan, such as market research institutes, libraries, technologists and accountants. They can all strengthen your case.
- Plans should be kept short, between 20 and 30 pages, with no more than two pages for the executive summary.
- The executive summary is the single, most important part of the business plan.

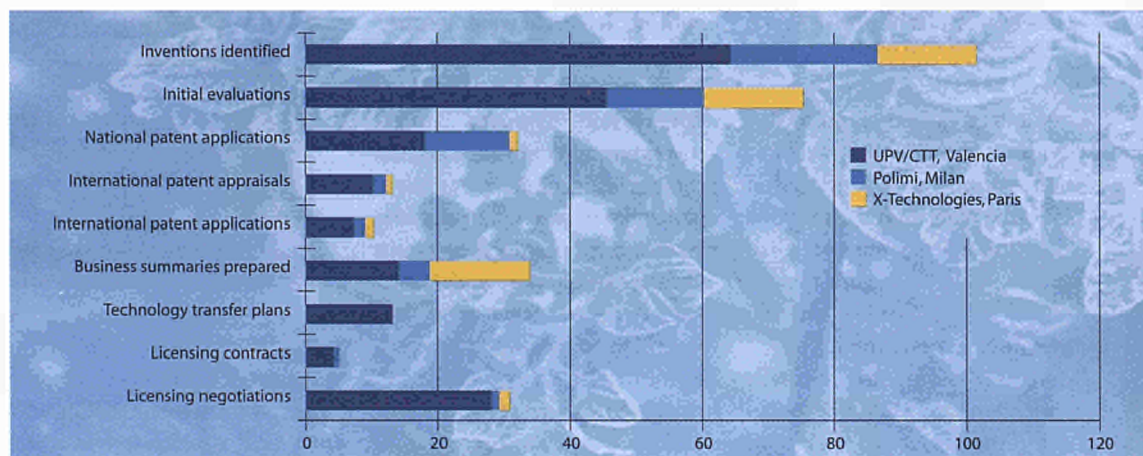
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Invention – Realising the Potential

A range of intellectual property (IP) management schemes shared between eight research bodies has raised awareness through expert evaluation and advice on exploitation. A second project will further stimulate entrepreneurship, technology transfer and the creation of spin-out companies.

Results of the Neico project in Spain, Italy and France



Although UPV's technology transfer office had made a number of patent applications before the Neico project, there was no systematic process for evaluating and exploiting inventions. Polimi set up a patent office within the framework of Neico.

University researchers are often unaware of the potential of their work for commercial development and exploitation, and of the need to protect their inventions with patents. The two-year Network for European Innovation Co-operation (Neico) project⁽¹⁾, which finished in December, offered participating universities access to four pioneering IP management schemes already in use by individual consortium members. Transfer of such tools to other regions is effective and can lead to the development of successful new IPR programmes.

The UPAS scheme from the Universidad Politécnica de Valencia (UPV) aims to encourage R&D initiatives and raise researchers' awareness of the commercial value of intellectual property. SAFE is a programme of the Ministry of Research and Education of North-Rhine Westphalia to promote patenting in universities. It offers a method for evaluating research projects and early identification of potential for commercial development. BUS is closely linked to SAFE, and helps inventors to prepare business summaries based on patented results for presentation to potential investors. The fourth scheme, InnoTULI⁽²⁾, comes from Finnitech Finnish Technology Ltd Oy and tests the commercial feasibility of inventions.

Neico's other partner universities and institutes were the University of Bonn's Euroconsult

Research & Education, which coordinated the project, the Paris-based Ecole Polytechnique (X-Technologies), the Politecnico di Milano (Polimi), Dublin Institute of Technology (DIT), Loughborough University and the University of Bielefeld.

Natural selection

The universities chose IPR schemes that filled gaps in their own IP management, later extending them to create new systems. The UPV selected the SAFE model as the basis of its TRIP scheme to evaluate inventions and to structure the process of patenting. Euroconsult's Birgit Wirsing comments: "This was a very important development for the university's technology transfer department, and was so successful that the Ministry of Education and Culture is now supporting its extension to all Spanish universities."

Using SAFE structures, Polimi similarly set up a patent office and has already applied for 13 national patents. The DIT set up its Prospect project using parts of the UPAS scheme. With funding from Enterprise Ireland, Prospect raises awareness of IPR and is enabling market testing of inventions and subsequent business planning.

Neico's partners attracted substantial backing from regional and national authorities. The Valencia TRIP scheme was awarded €50,000 by the Spanish Ministry of Education and Culture, plus €18,000 from regional government. The University of Bielefeld won €63,000 from the North-Rhine Westphalia government. X-Technologies in Paris drew €114,000 over three years from the Département de l'Essonne to implement its X-Invention project, launching new high-tech companies on the basis of patented inventions. It is also

developing an incubator to support start-ups, dealing with IPR and sourcing seed finance. Polimi has started to offer some of its patent office services to the whole region of Lombardia, with permanent funding of €80,000 per year.

National differences

The main problem involved in the transfer of Neico schemes, according to Wirsing, has been the differences between national legal requirements for patent applications. "Spanish universities are exempted from fees for applying for patents, so they try to patent all the inventions," she explains. "In Italy, on the other hand, normal fees are charged, so academic patent applicants are much more selective. Significant adaptations of the Neico schemes were needed to meet partners' individual needs." Wirsing also highlights the barrier presented



Tomato Yellow Leaf Curl Virus (TYLCV) weakens the whole tomato plant, causing up to 100% loss of fruit yield. A new rapid method for detecting TYLCV, developed at UPV using genetic engineering, should allow faster treatment and prevent crop losses.

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by the difficult procedures and high costs of obtaining a European patent. "Neico participants are all very much looking forward to the Community patent," she says.

The new Patent Academia network⁽³⁾ will build on the achievements of Neico, by establishing a network of academic institutions across Europe for benchmarking and exchange of good practices to make the best use of innovation and inventions. "Neico focused on IPR, but Patent Academia has a much wider scope," explains co-ordinator Manfred Schmiemann of the European Commission. "The new project covers entrepreneurship, spin-out companies, incubators, transfer of personnel between participating institutions, training curricula, patent exploitation and licens-

ing." Patent Academia has the unusually long timescale of four years, with a projected start in mid-2001. It will work primarily with the industrial liaison offices of universities but also with other publicly-funded research organisations.

(1) Part of the Innovation Programme of the Fourth Research Framework Programme.

(2) InnoTULI is a registered trademark.

(3) One of four 'Gateway 2 Financing' networks - see below.

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INNOVATION FINANCE AND IPR

A New Gateway to Innovation

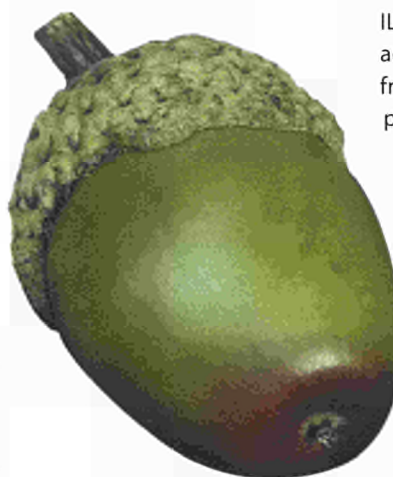
The European Commission's Directorate-General for Enterprise has launched a pilot action to increase Europe's innovation capacity by co-ordinating networks of key actors - early-stage venture capital funds, technology incubators, industrial liaison offices and academic experts.

The overall objective is to facilitate the access of innovative firms to private finance, and to effective means of protecting and exploiting new knowledge, by assisting those who deliver these services to collaborate and exchange experience at European level.

Industrial Liaison Offices (ILOs), for example, support the transfer of new technologies from universities and other public research institutes. In some Member States, national networks of



Great oaks from little acorns grow - but before they can produce wealth and employment, innovative companies need careful nurturing in the early stages.



ILOs already exist. "But the administrative and regulatory framework affecting the exploitation of publicly-funded research varies widely from country to country, and to date there is no Europe-wide network," says Manfred Schmiemann of Enterprise DG.

However, most Member States are in the process of introducing more favourable laws, so there is real potential for



Through networking, incubators and hatcheries for high-tech start-up companies can learn from one another's successes and failures.

rapid and widespread improvement in the performance of ILOs. The planned European network will create a platform for the exchange of good practice in industrial collaboration and the creation of spin-out companies. "By bringing together both established technology transfer 'champions' and less experienced ILOs, the network will give the profession a stronger voice, increasing its impact on policy-making," Schmiemann believes.

Complementary initiatives

"Separate analyses by the Commission and the European Investment Bank (EIB) identified the same groups as critical to improved innovation performance," says Marc Verlinden. Over the next three years, the EIB's Innovation 2000 initiative will mobilise up to €15 billion, partly for the creation and development of ILOs, incubators and venture capital funds investing in early-stage technology projects. The Commission's action, meanwhile, addresses the 'soft' issues involved in such development, and will help to build the network infrastructure needed

to maximise its impact.

"There is huge potential for synergy," says Marc Verlinden. "Through the network, for example, a new incubator fund will gain access to the experience, methods and contacts of existing incubators across Europe." For new ILOs and venture capital funds, as well as new incubators, pan-European networking should greatly reduce the time taken to achieve full effectiveness.

Each of the four networks will be co-ordinated by an experienced and well-respected player in the field concerned. "Their job will be to promote and manage the networks, to recruit members, and to channel membership benefits to them," he explains. "By supporting transnational co-operation, the networks will increase the capacity and professionalism of all four groups of actors."

Common targets

In addition, the Commission is implementing a series of measures designed to support and interconnect the four networks, and to maximise their impact.

"The new networks can join national groupings, as well as

existing European networks like I-TEC, CREA and Eurotech Capital⁽¹⁾, for instance, and will integrate related Commission services such as LIFT⁽²⁾ and the IPR-Helpdesk⁽³⁾," says Marc Verlinden. "But we also want to link the four networks together. They have much to learn from one another, share common needs, and serve the same target group of high-tech companies."

Integration is expected to take place under the new brand of Gate 2 Financing (G2F). A central website will provide a meeting-place for the exchange of experience between the networks, as well as delivering information of interest to all of them. It will also offer entrepreneurs a comprehensive on-line business planning and business growth toolbox, and services such as project-investor matching. A parallel series of entrepreneurship seminars and investor workshops will be offered in universities around Europe both to network members and to entrepreneurs, in partnership with the European Venture Capital Association, using providers such as the Antwerp Management School.

High-tech directory

A database of Europe's high-tech start-up companies will be developed as a further service. "The absence of any pan-European listing has been a real handicap," says Manfred Schmiemann. The new database, which will be run in part as a commercial directory, will perform three functions – as an information source, as a reference label for the listed companies, and as a tool for the statistical analysis of patterns and trends.

The Commission is confident that the integrated G2F networks will quickly benefit their members by accelerating the flow of client entrepreneurs from universities and business schools to incubators and venture capital funds. From the perspective of European entrepreneurs, meanwhile, G2F will link and extend a number of pilot services to cover the entire range of their business development needs. ●

(1) Three networks of seed and venture capital funds supported by the European Commission. For information about I-TEC, see 'Innovation = (Technology + People) + Capital', edition 6/99.

(2) Linking Innovation, Finance and Technology, see this edition, page 16.

(3) See 'A Personal Service', edition 3/99.

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Europe's Infor Society – Access



For Europe's Information Society policy-makers and Conference and Exhibition is a key event. It provides a assess the most promising results emerging from the programme, and engage in debate about the future of the



*A rapid leap forward –
Nicole Fontaine, President of the
European Parliament, opens IST 2000.*

1. Over the Rainbow

The spectrum of social needs addressed by the IST programme was reflected in the current projects which exhibited at IST 2000.

The substance of the debates at IST 2000 – which drew more than 3,000 delegates from over 70 countries to Nice – took place in four parallel strands. These dealt both with applications, including participative democracy, education, health, transport, e-commerce, the workplace, the environment, crime, international co-operation and more, and with specific technologies such as imaging, broadband, micro-optical networks and security.

In addition to the 20 winners of the IST prize (see 'Megabits and Megabucks'), a further 70 projects from the IST programme mounted stands at the event, grouped into four clusters:

- 'E-economy for all' covered the workplace and security as well as e-commerce
- 'Technology for all' included nanotechnology and robotics
- 'Vision for all' addressed interactive entertainment and multimedia
- 'Open access for all' dealt with health, accessibility, education and administration

A French pavilion displayed a further 30 projects, while international participation included stands from Brazil, Canada, Australia, Israel, South Africa and China, as well as from the EU accession countries. Transnational organisations such as Eureka, TEN-Telecom, the International Telecommunications Union, and Commission services such as the Intellectual Property Rights and LIFT (innovation financing) Helpdesks, were also presented.

It was Nicole Fontaine, President of the European Parliament, who summed up the importance of the new information and communications technologies to today's and tomorrow's citizens: "Neither the discovery of fire in primitive times, nor the invention of the wheel, electricity, the telephone or radio caused such a rapid leap forward in civilisation. And this new type of economic activity, based on the exploitation of knowledge, is not the preserve of a few educated people, but open to all."

Erkki Liikanen, European Commissioner for Enterprise and Information Society, took up the theme from the point of view of the producer. To realise the huge potential of the new economy, he pointed out, Europe needs to build an adequate infrastructure, to learn the necessary skills, and to adopt a new state of mind: "The era we are entering is one of

intense creativity and innovation," he said. "Economic success will depend on our success in promoting the spirit of enterprise at all levels of industry."

This change of speed requires a corresponding change in the way European policy is conceived and in the way support is delivered in the Sixth Framework Programme (FP6). "Research financed by the successor of the IST programme must encourage risk-taking and adopt a longer term approach. Its resources must match the importance that information and communication technologies now have, both in the development of our economy and in all areas of research. Finally, to make the programme compatible with the rapid life cycle of the technology it addresses, we must develop faster, more flexible procedures," said Mr Liikanen.

mation All Areas

*innovators, the annual IST forum in which they can
European Union's IST
EU's Information Society policy.*



The three 2001 Grand Prize winners: (left to right) Ronald Vuillemin of Xitec, Maurice Mulkenny of Mine-It and Georgios Sakas of the Fraunhofer Institute.

EUROPEAN IST PRIZE

Megabits and Megabucks

The European IST Prize is designed to stimulate competition and give the very best new ideas a flying start. IST 2000 saw the announcement of the three 2001 European IST Grand Prize winners.

This prestigious contest, worth a total of €700,000 each year, is open to information technology products created in any of the 31 participating countries. This year, there were 200 applications from 26 countries. The 20 shortlisted projects each won €5,000 and the chance to compete for one of three grand prizes of €200,000.

"Our criteria are technical excellence, innovative content, market potential, job-creating capacity and social benefit," says Alain Mongon of Eurocase, the non-profit association which runs the contest. "The quality is improving each year, so winning is becoming more difficult." Karl-Heinz Robrock of the European Commission points out that through the Prize the IST programme gives recognition to groundbreaking innovative products in the IST domain irrespective of whether these result from the Programme's direct support for RTD and Demonstration projects. "Large and small firms are involved, but around 80% of applicants are SMEs," he adds.

Digging for gold

Medical applications won two of this year's three Grand Prizes – a portable three-dimensional ultrasound scanner for third-world use

and a 'flight simulator' for surgeons.

The third went to Mine-It, a young Belfast company that has developed a valuable marketing tool for electronic business people. Website owners can use Easy Miner to build up a picture of how people use their site. It can tell them how many people visit which pages, for how long, and in which order. By analysing usage patterns, internet marketers can work out how to design more attractive and effective sites.

"Lots of sites actually deter purchases, and 80% of electronic purchases fail," claims Maurice Mulkenny, Chief Executive of Easy Miner. "The product is based on artificial intelligence and data-mining technologies, and the marketing innovation is to wrap these in an easy-to-use wizard-driven interface. The idea is that you should not need a PhD in statistics to use it."

Mine-It grew out of the MIMIC project, a European collaboration between France, Britain and Ireland. Mulkenny himself was a lecturer at the University of Ulster in Northern Ireland, and created the spin-off company in late 1998. Mine-It now has 20 employees and plans to have 50 in six months. "We expect the publicity to be worth millions of euros to us," he says.

Could the company's digital detective

threaten users' right to privacy? Mulkenny says not: "We are tracking crowd behaviour – we don't care who the individuals are. For instance, we can look at the velocity of the click streams and work out whether people actually take the time to read a page, or just click through. We adhere to the European Privacy Directive – unlike most of our American competitors, who use cookies to compile individual usage data."

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The deadline for applications for the 2002 European IST Prize is 15 May.

The three Grand Prize winners:

• <http://www.mineit.com>
• <http://www.igd.fhg.de/teleinvido/>
• <http://www.xitact.com>

...

2. Framework for the Future

Should the IST programme concentrate its five-year budget of €3.6 billion on long-term strategic development, or should it follow the market trends? IST 2000 heard differing views.

Looking forward to FP6, Robert Verrue, Information Society Director-General, summed up the status of FP5's IST programme at its midpoint. Worth a total of €1.6 billion, 1,050 projects have so far been selected, with small and medium-sized enterprises forming over a quarter of the participants.

The IST programme, he said, linked the strategic initiatives of eEurope and the European Research Area, but in helping Europe to build an information society adapted to the needs of its citizens it faced a number of significant challenges:

- how to focus efforts on the key questions in order to achieve critical mass
- how to address long-term objectives, where risks may be higher
- how to apply relatively small EU resources to amplify larger investments made by industry and Member States

- how to link the EU's regulatory and research functions more closely
- how to simplify the programme and keep it flexible

Looking back, looking forwards

The results of a five-year assessment of the EU's information technology programmes (1995-2000) were presented by Professor Alain Pompidou of the Cochin Medical Faculty⁽¹⁾. The expert panel concluded that IST was well-managed, was oriented towards industry, and was good on exploitation with significant indirect impacts on skills and co-operation capacity. The merger of the EU's ICT research activities into a single IST programme had been a good idea, but the Commission had underestimated the difficulties, had not learnt some lessons, and needed to re-examine the programme's Key Actions.

In FP6 (2002-2006), the panel recommended streamlined administration including defined 'service levels' covering, for example, the speed of proposal evaluation, contract signature and payment. The programme should provide better support tools and tolerate a higher level of risk, especially in the case of SMEs. Finally, it should be better marketed to a wider range of users, and should draw up a formal communications plan.

In place of Key Actions, introduced in FP5 as a way of bringing multi-disciplinary resources to bear on specific problems, Pompidou proposed a 'bow tie' design. This would concentrate on selected core technologies (such as artificial intelligence and displays) which feed into integrated enabling technologies (such as e-commerce and internet) and produce applications (for instance in health and administration).

Parliamentary perspectives

"Research is already global, and FP6 must recognise this," said Erika Mann, MEP, noting that researchers from any country can already take part in Framework Programme projects, even though taxpayers' money is rightly restricted to those countries which contribute to it financially.



CASE STUDY

Work – the Movie

The IST Tower project will enable you to fly through your organisation's filing system.

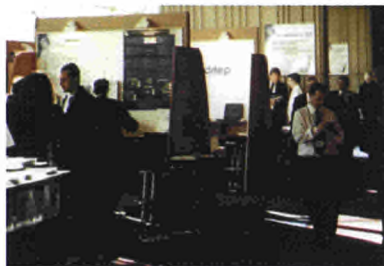
In the film *Fantastic Voyage*, doctors use a miniature submarine to cruise the arteries and veins inside the body. In the same way, IST Tower will offer a work team a visual representation of a shared filing system, helping its members to keep track of what each is doing. This will mean that jobs can be shared much more easily – even across world-wide networks.

A filing system is represented by a town, and individual files by houses. Documents that belong together are laid out in 'streets', and clusters of files are colour-coded. When any member of the team is consulting a document, an 'avatar' – a virtual person – is present in the relevant house. Any team member can easily see who is working on what document, and who is working close by.

Dr Wolfgang Prinz of the GMD Forschungszentrum Informationstechnik, in Sankt Augustin near Bonn, explains Tower's commercial potential. "A company might visualise its website, to see who is visiting each page," he says. "It could then telephone a user and say, 'We see you are interested in a certain product. Can we help you?' Tower will transform the internet into a multi-user application."

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*The IST Prize Village
at the IST 2000 exhibition.*

"The research policy of today is the social policy of the future," said Paul Rübig, MEP and member of the Budget Committee. For him, Europe's RTD effort should focus on five objectives:

- networking and co-ordination of Member State research
- SME participation in research – a 'fast track' for small firms should be administered by Member States

- a strengthened research infrastructure
- more mobility and better career prospects for Europe's young researchers
- better links between science, society and citizens – "Ensuring a healthy old age for Europe's citizens should be a priority," he said.

Chips in everything

The IST Advisory Group (ISTAG) recommends a focus on 'ambient intelligence' – information technologies which can be embedded in houses, cars and other consumer products – as the programme's sole priority for 2001, its chairperson, Professor Angelo Airaghi, told the conference. This field will open up tremendous opportunities for industry, the group believes. The current president of the EU Research Council, Christian Pierret, French Secretary of State for Industry, stressed the need to define a European model for the information society. Europe needed secure networks with free access to encryption, and it should make every effort to remove barriers to research progress.

The world is ever changing, that much seems certain. Nobody seems to be quite sure whether the speed of change is a good thing or not, but whatever the answer, change demands a response. We cannot just accept change, we have to outrun it. We have to control change rather than be controlled by it. This means we have to be in control of the innovations, rather than the passive consumers, or victims, of them. The IST programme is giving us the tools to take control of the innovation process. ●

(1) The five-year assessment of the IST programme is available at http://europa.eu.int/comm/information_society/evaluation/index_en.htm

CASE STUDY

Power of the Mind

Don a special helmet, concentrate hard, and move mountains without lifting a finger. The JRC's Adaptive Brain Interfaces (ABI) project is developing a machine that translates thoughts directly into action.

ABI is the fruit of a collaboration between the European Commission's Joint Research Centre at Ispra, Helsinki University of Technology, Fase Sistemi and the Santa Lucia neurological hospital. It relies on the fact that different types of activity are controlled by different parts of the brain. It can already reliably distinguish three different actions which can be chosen by the user.

"The idea is to enable people to communicate through conscious control of their thoughts," says project co-ordinator José del R Millán of the JRC's Institute for Systems, Informatics and Safety (ISIS). "If you concentrate on a single task and keep it in your mind for a few seconds, the system will recognise it as different from other tasks. We have developed a portable unit which picks up electrical signals from the brain, processes them digitally and sends them to a neural network. This recognises the task and transforms it into an action such as typing on a keyboard, playing a computer game or steering a wheelchair."

system to work as naturally as possible, with the user in total control, Millán stresses. "But speed is less important than correct interpretation. If the machine is slow to respond, this tells the user to concentrate harder."

The goal of the Esprit project⁽¹⁾, which ends in September 2001, is to give physically disabled people who cannot speak a chance to take part in the Information Society.



Thinking cap – concentrate hard and the subject can control the computer – without lifting a finger.

Voice for all

At present, ABI can reliably distinguish three mental tasks chosen by the user – for example, relaxing, imagining moving a hand, visualising a rotating cube, or mental arithmetic. Cognitive or motor-related tasks of this kind activate the outer part of the cortex, whose electrical fields can be picked up relatively easily with scalp electrodes.

Each user chooses three tasks, and trains the machine to recognise them. "We want the

(1) Esprit project 28193 – Adaptive Brain Interfaces (ABI).

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CASE STUDY

Measure to Manage

"The largest assets of most major companies are not being actively managed."

This was the startling assertion of Clark Eustace of Mantos Consulting, chair of the European High Level Expert Group on the Intangible Economy, in his introduction to the IST 2000 workshop on intangibles.

The growing importance of knowledge and information as productive assets raises many new issues. Increasingly, value is added by the way individuals use their personal knowledge. Much more sophisticated ways of managing people are necessary, with knock-on effects from education and recruitment to employment law. There are also effects on disciplines such as accountancy, because market competition demands the reliable valuation of companies, which today implies that the value of their knowledge is accurately quantified.

Conventional rules for valuing physical assets, and more recently brand names, fail to

explain the difference between an enterprise's balance sheet and the value of its shares. So-called 'market-to-book ratios' of more than 5:1 are no longer unusual. In such cases, company reports therefore only deal with one-fifth of the enterprise's value.

The assets that power economic growth have to an alarming degree escaped the mechanisms intended to control them. Much of the United States' recent economic growth is

attributable to investment in intangibles, for example, while Europe has allowed itself to fall behind. To understand such differences in performance between sectors and countries, getting to grips with intangibles will be essential.

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For HLEG report and further information see: <http://www.eu-intangibles.net>

CASE STUDY

Growth Market

One entrepreneur plans to rent out management software over the internet – an idea that may create the next wave of 'dot.coms'.

We are creating affordable enterprise resource planning (ERP) software for SMEs in the horticultural sector. We will run application specific programmes (ASPs) on a central computer server. Customers connect to it via the internet, and choose which modules they want to rent," explains Lieven Callewaert.

It all started when Callewaert was stuck in traffic on the Paris Périphérique. The driver of another car saw his number plate and asked for a lift to Brussels. He was an MEP, and their conversation led to a successful Esprit application. The Hopliccs project was completed in 1999, and has been followed by a Joint European Venture (JEV) project.

Callewaert formed Hortica Partners Inter-

national along with OM Partners International, which owns the supply chain software, La Graine Informatique, which provides the administrative shell, and ASP One Europe which operates the portal. It has attracted €100,000 of seed capital and is currently testing the software on the ASP portal.

"Flowers are a growing and e-aware market – Europe has 500,000 horticultural producers and 10,000 of them turn over between €1 million and €25 million per year," Callewaert says. "We expect to be in profit after three years and to have annual sales of €12 million within five years. But to do that we need €2.5 million in working capital. That is why we attended the Forum."

Hortica is now in negotiations with in-



Lieven Callewaert, MD of Hortica Partners International.

vestors from France, Belgium and Denmark. Callewaert is confident, but Nice taught him an important lesson – venture capitalists like big projects. "€2.5 million is not enough to interest most investors. We have combined our various agro-ERP projects, and are now trying to raise €4-5 million."

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Fifty of the Best

Each European Investment Forum puts 50 business proposals before potential investors – and one-third of them usually succeed in raising money.

Raising finance can be a terrifying process, however, and even the best investor proposals need to be presented with conviction and professionalism. The Forum's high success rate is due to the thorough preparation offered at the Venture Academy.

"If Metcalfe's Law is right, and the value of a network is proportional to the square of the number of its nodes, then the European Investment Forum is one of the most valuable networks there is," said Rosalie Zobel, Director of the Information Society DG responsible for new methods of work and electronic commerce. There is certainly no shortage of applicants for the Forum. Because it offers the coveted opportunity to make a one-minute 'elevator pitch' and a full 12-minute presentation to 400 investors ready to pounce on the next big idea.

The first European Investment Forum took place in 1996. The event in Helsinki in November 1999 proved such a success that it was repeated in Berlin in April 2000 and again in Nice in parallel with IST 2000. It is planned to continue the six-monthly pace.

A year ago, 239 firms applied, 44 made pre-

sentations, and 15 raised money – in total €63 million – while four more are still talking to investors. "Since the dot.com crash, venture capitalists are putting greater emphasis on people than on technology – and this makes face-to-face contact even more vital," says William Stevens of organisers Europe Unlimited. "The Forum is not just about connecting technology and finance, but about connecting people."

Since 1999 Europe's venture capital market has matured. The stock market slump in internet companies means that investors are now considering a broader range of propositions. This year's successful applicants have found that the choice of partners is broader, and the investment decisions more rational, now the internet bull market has abated. In fact, the worry now is that venture capitalists are being too cautious.

School of hard knocks

At the preparatory Venture Academy, selected young entrepreneurs present their business plans to their colleagues and to

sponsoring financiers, and get expert feedback. The process of putting themselves in the investors' shoes gives them a much better understanding of the effect they need to achieve. They also benefit from concentrated coaching and advice from more finance experts than they would normally meet in a decade.

One testimony to the effectiveness of the method came from Riku Autio of Dome Information Services, which grew rapidly after he founded it in 1991. "I was able to make an exit much earlier than I had expected," he recalls. "The Venture Academy was brilliant. It enabled me to prepare a very focused ten-minute presentation – and also encouraged me to step back from day-to-day matters to think about what sort of profitability and growth I should aim for. I received an offer within one hour of approaching some likely investors, and had sold out in under a month."

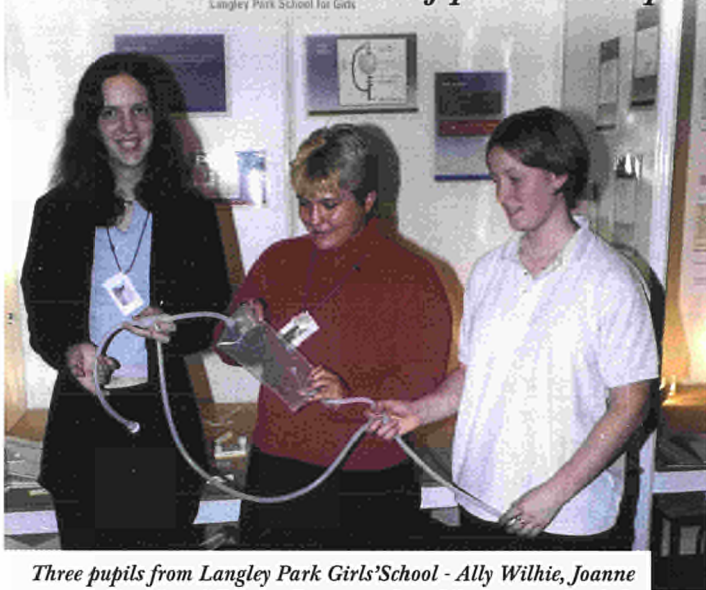
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The next Forum will take place in Milan on 25-27 April 2001. Venture Academies will take place in Barcelona on 22-24 March and Hamburg on 29-31 March.

Tomorrow's Innovators

It is vital for the future of European research that more young people are attracted to careers in science. Offering a transnational springboard for talented schoolchildren, the European Union Contest for Young Scientists also helps to raise awareness of patents and patent issues.



Three pupils from Langley Park Girls' School - Ally Wilhie, Joanne Daniel and Gemma Dawson - shared the honours for their prize-winning disposable cell sampling device.

Eighty-five young science students from 35 countries participated in the 12th such contest, which took place in Amsterdam from 20 to 23 September 2000. The annual event serves as a showcase of the best of European scientific achievement at high-school level, bringing together the winners of national contests held each year throughout Europe and beyond.

Part of the EU's Improvement of Human Potential (IHP) programme, managed by the European Commission's Directorate-General for Research, the contest gives participants a taste of the international science environment. The aim is to encourage young people to pursue their interest in science and embark on a scientific or engineering career. "The experience of many former contestants shows that the competition does act as a springboard for future careers in sci-

ence," notes Graham Blythe of the Research DG.

This year, students not only had the opportunity to present their projects to an international jury of 12 scientific personalities, but were also able to discuss their work with four Nobel laureates. "The participation of these internationally renowned scientists, and the interest they showed in the work of the contestants, was an exceptional source of inspiration," says Blythe, who hopes that this will become a regular feature.

And the winners were . . .

Three first prizes, worth €5,000 each, were awarded to a Polish student for the investigation of dinosaur tracks, a British trio for the design of a disposable device for sampling cells from fermenters, and a Georgian student for an innovative bat protection plan. In addition to three second

and three third prizes, a number of contestants were also offered the opportunity either to represent the EU in forthcoming international events, or to join research teams to work on projects in prestigious international laboratories. For the first time, the European Patent Office (EPO)⁽¹⁾ and the European Space Agency also awarded prizes.

Raising patent awareness

For the EPO, which has been participating in the EU Young Scientists Contest since 1997, the contest provides an ideal platform for promoting awareness of patent issues. "It offers a golden opportunity to reach a relatively small number of technically and scientifically gifted people – contestants and organisers, as well as all those involved in the national contests," says Grant Philpott of the EPO. "We hope to create long-term awareness of patents, so that when they are confronted with a real-life patenting issue, they deal with it appropriately."



Grzegorz Niedzwiedzki, a 20-year-old student from Poland, tracked down a first prize with his dinosaur project.

The EPO is also keen to encourage contestants to consider filing for a patent before making their inventions public. Many do not realise that under present European patenting law, it is impossible to patent an invention once it has been made public. This means that contestants must file applications before attending their first contest. The EPO offers advice to national contest organisers, and has prepared a patenting advice sheet for national contest organisers and schools, which is distributed in all EU languages. ●

(1) The 'EPO Prize for Originality' was presented for the first time in 2000 to students from the United Kingdom, Slovenia and Hungary.

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Aerotech Europe 2001

1-2 March, Swindon (UK)

Both a conference and a technology transfer event, Aerotech will bring together companies from across Europe to explore innovation, technology transfer and diversification in the aerospace and related sectors. There will be opportunities for formal one-to-one meetings between potential collaborators, as well as informal networking to discuss business co-operation, technology offers and requests and joint ventures.

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Environmental Technology Transfer days at PROMA 2001

1-2 March, Bilbao (Spain)

The Innovation Relay Centre for the Basque Country, SPRI, and the Cluster Association of Environmental Industries of the Basque Country, ACLIMA, are organising a brokerage event for companies and organisations dealing with production or services in the sectors of industrial and municipal water, waste assessment, recycling, waste treatment, contaminated soils, air pollution and acoustic pollution. Interested organisations will have the opportunity to meet potential partners from all over Europe to explore strategic partnership opportunities such as licensing, transfer of know-how, joint-venture and R&D agreements.

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E-Procurement transnational technology transfer day

15 March, Friedrichshafen (Germany)

The event offers users and purchasers of e-procurement technologies and solutions the opportunity to view the latest developments made in this field in the Bodensee Region and neighbouring areas. Providers will have the opportunity to present their new and innovative technologies to an audience interested in using their technologies, and to find out which products these companies want to acquire in the near future.

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RTD benchmarking conference

15-16 March, Brussels (Belgium)

The European Commission's Directorate-General for Research is organising a conference to look at the contribution of European socio-economic research to the benchmarking of research and technological development policies in Europe. This is in response to a request by Europe's research ministers in June 2000 for the benchmarking of Member State's research policies in the areas of human resources, public and private investment, scientific and technological productivity, and impacts on competitiveness and employment.

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Agoral technology transfer event

28-29 March, Dijon (France)

A conference and workshops are organised each year for the food industry by the seven main food engineering French universities. This year's conference will be accompanied by a parallel brokerage event run by the IRC France Centr'Est, designed to bring together enterprises (SMEs in particular) and technical or research centres for technological exchanges or partnerships and transfers of technology or know-how.

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Measurement of innovation activities

28-29 March, Pretoria (South Africa)

This seminar aims to make OECD countries' experience in the measurement of innovation available to a broader range of countries with technological capabilities, and to facilitate exchange of experiences between OECD countries and those non-OECD economies which have embarked on conducting innovation surveys. It will bring together participants from Central and Eastern Europe, South Africa and Latin America, and is open to experts on the measurement of technological innovation from government agencies, national statistical offices, universities and international organisations.

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From Eco-Efficiency to Overall Sustainability in Enterprises

15-16 May, Düsseldorf (Germany)

Organised as part of Envitec 2001, this conference will bring together people involved in sustainable enterprises to discuss common approaches for the development and implementation of sustainability. Areas to be addressed are energy efficiency, water efficiency and resource efficiency. High-profile speakers will present entrepreneurial success stories, and one session will deal with social aspects of eco-efficiency – the so-called corporate social responsibility of enterprises.

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Envitec IRC Brokerage Event

15-16 May, Düsseldorf (Germany)

Zenit, which hosts the IRC North Rhine-Westphalia, is organising a two-day partner mediation event in parallel with the international environmental fair.

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Report on implementation of the Action Plan to Promote Entrepreneurship and Competitiveness

Commission Staff Working Paper,
SEC(2000) 1825 vol. I-II

This report monitors policy developments across the European Union in six fields related to entrepreneurship and competitiveness, as part of the BEST Action Plan. It highlights good practice and points to areas where more work is needed, with examples ranging from educational programmes promoting an entrepreneurial outlook among children in Luxembourg and Spain, to improving the visibility of support services to SMEs in Portugal.

Contact

The report is available in electronic form only, at http://europa.eu.int/comm/enterprise/enterprise_policy/competitiveness/index.htm

Spin-off technologies from Community research

NB-NA-17-027-EN-C,
ISBN 92-828-8175-X

A new publication which shows how Community research has benefited Europe's technology sector has been published by the Innovation Directorate of Enterprise DG. It examines the competitive support actions (CSA) carried out under the Fourth Research Framework programme (FP4), which were mainly conducted as collaborations between

European companies and research centres. The projects include the demonstration and testing of optical sensors, and risk analysis in buildings and industry.

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EU Science and Technology Key Figures 2000

KI-NA-19-396-EN-C, ISBN 92-828-9755-9

This booklet presents a quantitative and statistical analysis comparing the short- and long-term research and development efforts and performance of the European Union, its Member States, the US and Japan. It addresses five major areas:

- growth, employment and competitiveness and the contribution made by research, technological development and innovation
- investment in knowledge - research and development expenditure, education, software and venture capital
- human resources in science and technology, and mobility
- scientific and inventive 'output', innovation and high-tech trade
- patterns of co-operation in innovation activities between European companies

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Note

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Sixth report of the European observatory for SMEs

CT-22-99-200-EN-C (EN, DE, FR); €53

The European Commission has published the latest report of the European observatory for SMEs, which was established in 1992 to improve monitoring of SMEs' economic performance. The independent report employed a telephone survey of 8,000 European SMEs, as well as national statistics and input from experts. It provides information on six key areas which may influence forthcoming enterprise policies.

Contact

An executive summary of the report, in 13 languages, may be downloaded from http://europa.eu.int/comm/enterprise/enterprise_policy/analysis/observatory.htm

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