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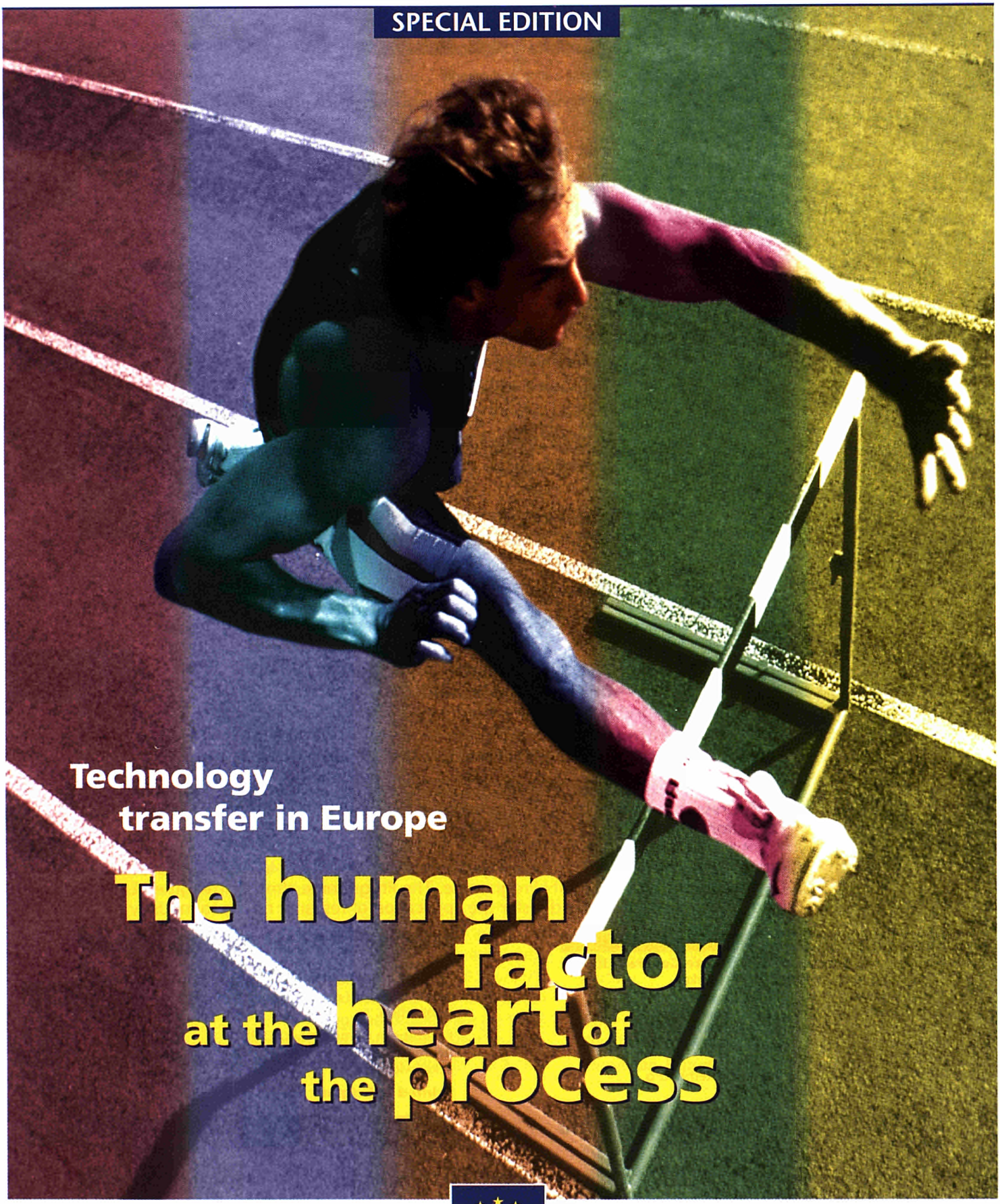

Technology transfer in Europe

The human factor at the heart of the process

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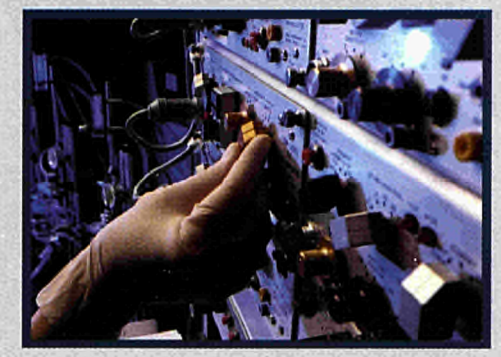

INNOVATION & TECHNOLOGY TRANSFER

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Stimulating technology transfer on a European scale

To increase their competitiveness, win new markets and create jobs, European enterprises need to innovate: to integrate the best technologies and the most effective management practices. Technology transfer, a key factor in growth and employment, is one of the best ways to make enterprises innovative and internationally competitive.

Too often technology transfer involves only the largest companies. This is why European small and medium-sized enterprises (SMEs), which are a major source of employment, must become increasingly involved in trans-national technology partnerships.

But technology transfer, as the articles in this special issue of Innovation and Technology Transfer show, is a complex business. It is not enough merely to bring together a supplier of technology and a potential end-user. Many other factors, not least the human dimension, need to be taken into account. The technology validation and technology transfer projects supported by the European Commission are highly instructive in this respect. Analysis reveals a number of opportunities for new action, but also some obstacles.

Opportunities arise because Europe has a wealth of knowledge, know-how and technology. In every Member State the need to innovate is a daily reality for thousands of enterprises. Many problems which seem insurmountable in one region can find existing techniques and practices in other parts of Europe which could provide a solution. This experience and accumulated expertise are key resources from which Europe must profit.

Obstacles exist because the diverse nature of Europe often makes the creation of technology transfer consortia a complex and delicate affair. Differences in culture, traditions and legal systems, the wide range of training and professional qualifications, imperfections in the single market and the absence of a Community patent structure all hinder the spread of technologies and the formation of partnerships between European entrepreneurs, researchers and inventors. Removing these barriers to greater cross-border co-operation between enterprises is a challenge; its realisation will lead to substantial growth .

At the start of the last year of the Fourth Framework Programme for Research and Technological Development it seems appropriate to sum up the INNOVATION Programme's achievements in technology transfer.

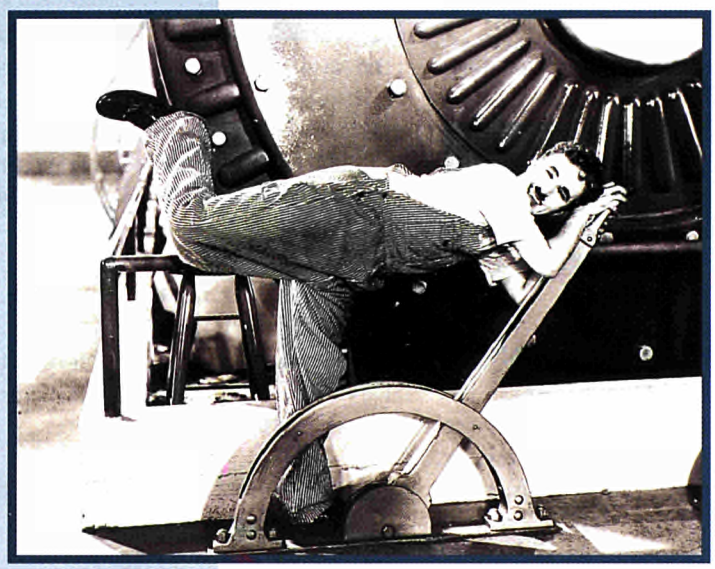
INNOVATION Programme projects in validation and technology transfer provide a "test-bed" for identifying and studying obstacles. More importantly, they are an aid to understanding the conditions for success. Many "best practices" including the formation of consortia, sharing industrial property rights, day-to-day communication, project management, leadership, prototype launches and the definition of commercial strategies have been gleaned from the experience accumulated in successful projects.

These lessons will be of great value as the Fifth Framework Programme's actions on Innovation and Participation of SMEs develop. They will enable a new generation of technology transfer projects to be defined, and by helping the success of these projects they will create new jobs.

The studies which have resulted from the technology validation and transfer "test-bed" will also facilitate the continuing exploration of the mechanisms of technology transfer. They will help to infuse individual research programmes – starting with the Key Actions of the Fifth Framework Programme – with the culture of innovation which Europe needs so much.

Edith Cresson,
European Commissioner responsible for Research, Innovation, Education, Training and Youth

The challenge at the heart o



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On the eve of the year 2000 anyone in charge of an enterprise must be convinced of the need to grow and to innovate. Growth is an obligation, and there is a fast-track way to provide it: technology transfer, a process which can strengthen the core of an enterprise's productivity, its technological capital.
But there are many pitfalls, and there is more to technology transfer than simply a desire to achieve it. Research has shown that technology transfer is a complex subject with many interrelated aspects. The practical experience that the Commission has acquired is extremely valuable in this respect.
One important fact has emerged: without people, without the human factor, there is no technology transfer. This in itself presents challenges at the local, national and European level. These challenges face every decision-maker in economics and politics, every engineer, every educator – indeed every European.

# of competitiveness
f technology transfer

At the heart of competitiveness

There are many routes to growth: from financial optimisation to human resources management and increased marketing effort, or from re-engineering to outsourcing. Technology transfer can be a vital link between all these strategies. Introducing a new technology can in itself be a way to become more competitive, but the adoption of new technology is also closely linked with every other aspect of the enterprise. There is an intricate mixture of human factors and technology, and the balance of this mixture is crucial to the enterprise's capacity to innovate, compete and grow.

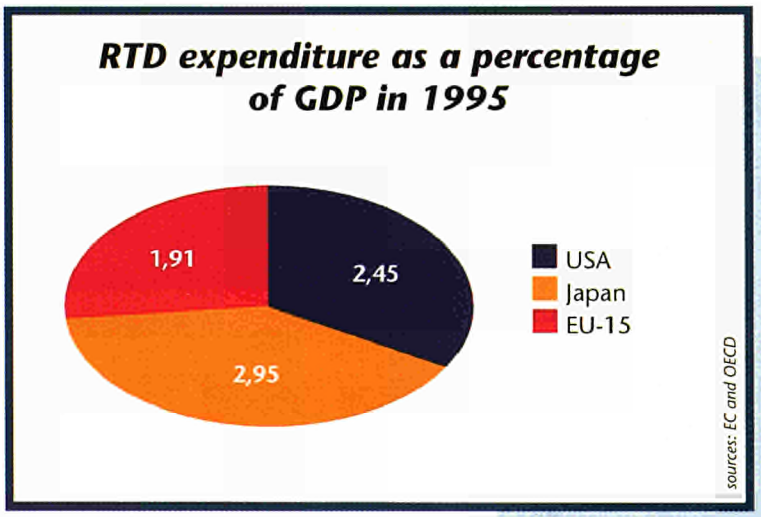
What is technology transfer? Let us stick to the simplest definition: the adoption of a technology by a company in an area where it has not previously been applied. To take a historical example, what would the Industrial Revolution of the 19th century have achieved without the adoption of Watt's steam engine throughout European industry?

Today, from information technology to biotechnology, economic growth continues to be based largely on the incorporation of new technologies by every sector of the economy and by every business. This is why it is so important to understand and manage technology transfer.

Innovation and technology transfer

The "European paradox" - the gap between the effort put into research and its economic impact in terms of concrete innovations - is well known, particularly following the publication of the European Commission's Green Paper on Innovation.

A brief reminder of the situation: Europe spends nearly the same amount of money on research as the USA, with equivalent results in terms of scientific publications per million ECU invested. Japan is lagging a little way behind, according to this measure of scientific success. But when we look at indicators closer to the market, such as the increasing number of patent applications, Japan equals the USA; Europe comes far behind. Even in the countries of southeast Asia, whose research performance is vastly outmatched by that of Europe, more and more patent applications are introduced.

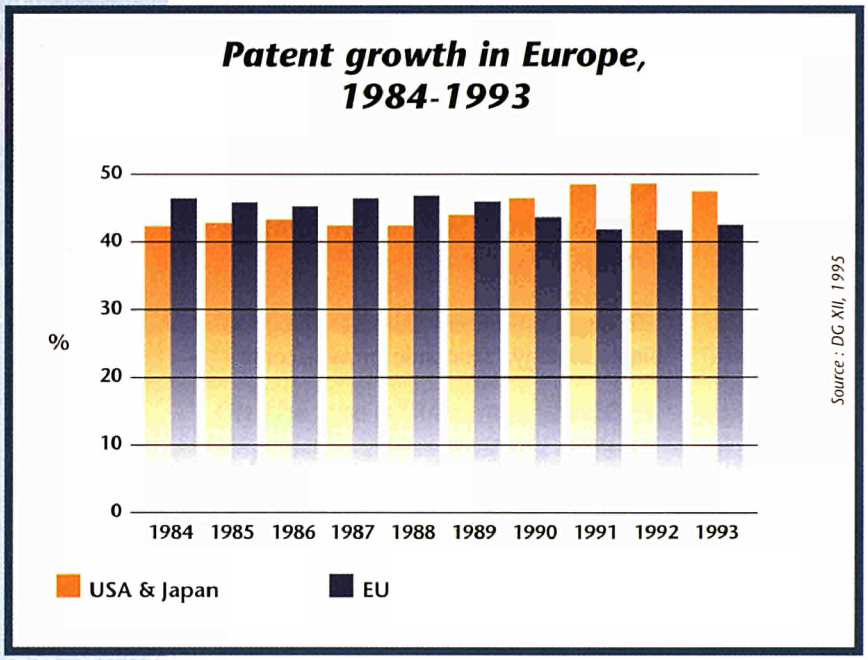


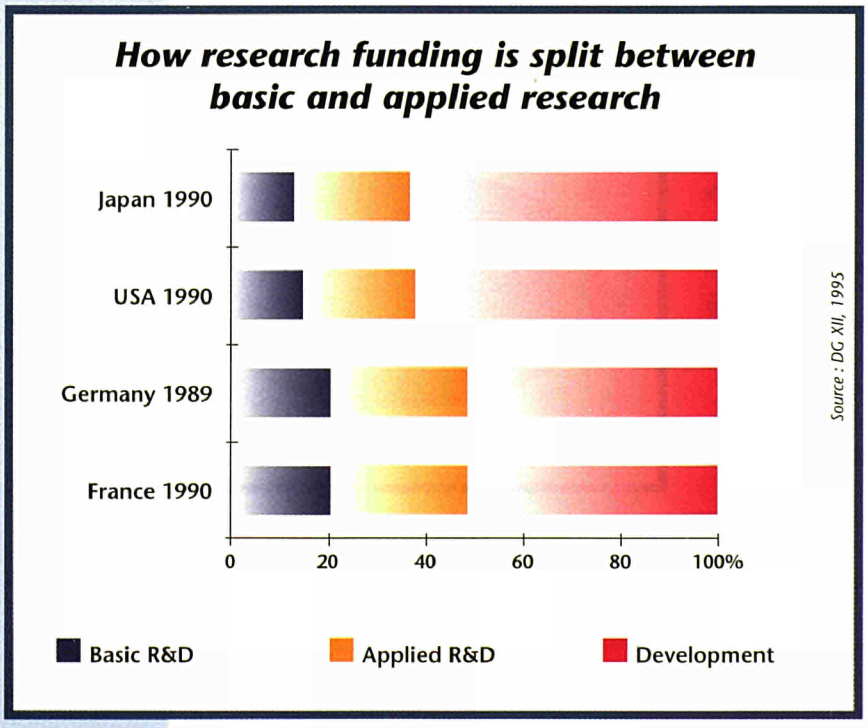
Checking the state of the art

Is it possible to innovate without going through the patent system? According to a survey carried out several years ago, two-thirds of enterprises which invent fail to protect their research results. At first sight this does not seem very prudent, though a second indicator suggests that some "innovations" are not protected because they are not actually innovative.

Actually, these statistics are more worrying than they appear, some experts believe that 75% of all technological information is publicly available in intellectual property publications.

One of the consequences, if researchers do not check the patent literature carefully, is the risk of duplicating research and development work.





The direction of research

Research should not be confused with innovation. While many research results never lead to industrial innovations, many innovations have no need of specific research effort. When we look at how RTD budgets are split between basic and applied research, it seems that the dynamic economies of the USA and Japan are satisfied with lower levels of funding for applied research than is the case in Europe.

However, Europe is convinced that the amount of technological change needed will require a particular effort to encourage applied research targeted at new needs. The Fifth Framework Programme too, by opening up to increased participation from industry, will encourage strategic interdisciplinary research, particularly under its Key Actions.

Chips and pedestrians

Every month a thousand people die as a result of road accidents in the EU, and nearly one third of these are pedestrians. With traffic volumes expected to double over the next 20 years, there is a danger that the toll of human lives could grow still faster. We need to reduce the risks to pedestrians crossing roads, particularly elderly and disabled people.

Many accident black spots for pedestrians are at traffic lights, where pedestrians often have difficulty in crossing within the allotted time. At the same time it is unreasonable to hold up a queue of traffic when nobody is waiting to cross. A project known as Watchbird aims to solve both problems by developing traffic lights equipped with a "seeing eye" to monitor vehicles and pedestrians. The project is funded by the INNOVATION Programme, and if it is successful it will constitute a technological advance that will improve road safety in Europe.

The project aims to test a video detection chip within the traffic light itself. This chip, created by the Inter-University Microelectronics Centre (IMEC) in Leuven, Belgium, is currently being adapted by Traficon, the world leader in video monitoring systems for road traffic. A camera built into the light records images of the roadway and the pavement, and controls the lights according to what is within its field of vision. Companies in the UK and Germany are currently testing prototypes to be incorporated into their own traffic control systems. The Flemish Regional Government's transport ministry is monitoring developments in national and European laws to ensure that the technology can be readily exported across the continent.

"As well as research on traffic law, we are studying how traffic systems have developed in various European countries," says Jo Versavel of Traficon. "We think there will be plenty of export opportunities for Watchbird. The system will be demonstrated at trade fairs and seminars."

Innovation: a European priority?

Technology transfer can only flourish in a culture of innovation. This is the reason for the success of the Innovation Action Plan, which itself sprang from the favourable reception given to the Commission's Green Paper on Innovation. Under the Fifth Framework Programme innovation has become a structuring factor: it is the objective of one of the horizontal programmes (Innovation and Participation of SMEs), but it is also one of the objectives of the thematic programmes.

A shoemakers' adhesive reaches the commercial sticking point

A group of European research centres has invented a revolutionary system for sticking soles to uppers in the shoe industry. The group, based in Spain, Portugal, Germany and the UK, developed a prototype whilst operating under the European Commission's CRAFT programme, which supports SMEs. The INNOVATION Programme is now helping the partners to demonstrate their patented technology on an industrial scale as they prepare to provide information on the system world-wide.

During the CRAFT programme, the researchers succeeded in producing a non-toxic adhesive with a high capacity for strengthening leather. The new adhesive is applied to either the sole or the upper, rather than both, as at present.

"The new process greatly simplifies assembling the shoe, and makes a considerable improvement to the quality of the end-product," explains the project's co-ordinator, Mariano Almela of Inescop, the Spanish institute for footwear research.

"The new method reduces gluing time by 35%, lowers production costs by 5% and increases productivity by 30%," Almela claims. "The European companies that know the results of the project did not believe that such an outcome was possible. But when we showed them the details, they were very interested. Our market research shows that there is a very large market for this product, which is why we have patented it. We also hope to patent the technology outside Europe, particularly in the major shoe producing countries of Asia, the USA and Brazil."

The European Commission is currently drafting a proposal for a Directive which aims to drastically reduce solvent use in manufacturing. The footwear industry is one of the industries that will be affected. The new procedure developed by this project offers European shoe manufacturers a good way of conforming to the new Directive while at the same time reducing the costs of raw materials and assembly time, and lessening the risks of solvent storage and transport.

Promoting an innovation culture

The Innovation Action Plan aims to relaunch Europe's dynamism. It can be that organisations are sometimes more concerned with preserving their stability and security rather than with creativity and risk-taking. An innovation culture is needed and will only be achieved through education and training, by stimulating life-long learning, language learning and mobility. The media, too, have a major role to play. They can help to spread the message of innovation, best practices and assist organisations in finding partners to solve new problems.

Attracting capital

Europe has no shortage of capital, but the targeting of investment towards innovative SMEs is poor.

The European Action Plan for Innovation identified four ways of improving the funding of innovation:

- encouraging the investment of venture capital and personal funds;
- developing a trans-European market in capital for innovating enterprises;
- improving contacts between those involved in innovation; and
- promoting access to long-term funding by banks.

The Commission will provide information and assistance to participants in the Fifth Framework Programme through a new Innovation Financing Helpdesk. The Helpdesk will offer information to potential investors on current projects, and help enterprises and researchers obtain easier access to private capital. Since 1997 a scheme known as I-TEC, developed in co-operation with the European Investment Fund, has provided incentives for venture capitalists to invest part of their holdings in new technology-based companies.

Making research more strategic

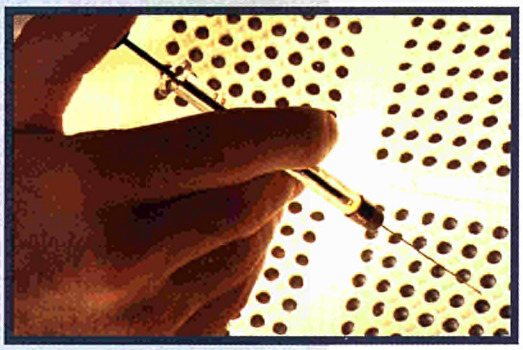
The Innovation Action Plan calls on those involved in RTD – universities, research centres and industry – to work together to spread the innovation message through society. Socio-economic factors will be given greater importance in the selection of research projects, and this will help SMEs participate. Another benefit is that research results should find an easier path to applications and the market.

However, the research efforts of the Framework Programme account for only around 5% of European publicly-funded research, the majority being managed at a national level. Despite this low figure, the European Community's policy does have greater impact on consciousness-raising, experimentation and the spread of best practices than the raw expenditure figures suggest.

The INNOVATION Programme

Stimulated by the importance of the innovation process and by earlier successes in technology transfer, the European Commission's INNOVATION Programme set itself three independent objectives:

- promoting an environment in which enterprises are encouraged to innovate and to absorb new technologies;
- encouraging the emergence of an open European innovation area for the dissemination of technology and knowledge; and
- providing the appropriate technology.



Supporting the enterprise culture

Through validation and technology transfer, the INNOVATION Programme brings together those involved in the innovation process, including enterprises, universities, research centres and technology transfer bodies. For those organisations involved in these transnational projects, the Community dimension adds real value.

As the debate about the Innovation Green Paper in Europe has shown, other factors in addition to technology are important to the innovation process. It has been the Commission's responsibility to select technology transfer projects which highlight these other factors, and to identify key parameters, original solutions and new methodologies through real case studies. The projects supported by the INNOVATION Programme are not limited to promoting or sharing a particular technology: the target is the whole innovation process which enables an existing or emerging technology to develop in the marketplace.

On a limited scale, the work of the SPRINT and VALUE programmes had already proved successful in developing the basis of an innovation culture within the Framework Programme. This has been extended and broadened in the INNOVATION Programme.

By acting in this way the European Commission has not had to resort to textbook examples. It has shown, through supporting a wide variety of projects, that technology transfer and innovation rely on collaboration between the provider or inventor and the user from day one of the project. The Commission has also shown that interaction between the partners is an essential condition for accelerating procedures, maintaining quality and limiting risks. It also appreciates the complex non-linear nature of technology transfer in supporting a new generation of projects.

The best recipes for innovation

"The major hurdle faced by European SMEs is moving from a comfortable and familiar manufacturing process to a new innovation management state of mind," explains Carolyn Hall. "In most cases they modify their traditional management practices to take account of the new innovation process, and then apply them in a more or less ad hoc fashion, rather than starting afresh by developing and implementing new procedures."

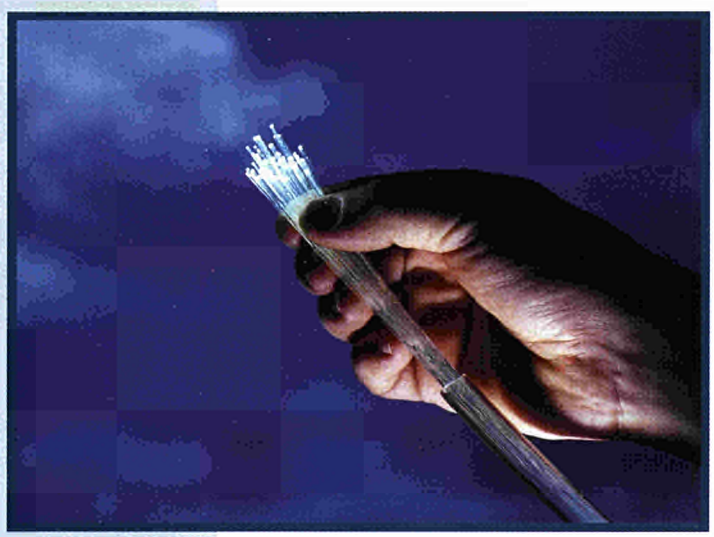
European inventors are among the most innovative, but their companies are often not well placed to develop their ideas. A project funded by the INNOVATION Programme in five countries shows that European SMEs commit too little time and too few resources to launching new products onto the market. The project showed that only 10% of SMEs were up to the task, and of that 10% only one in four managed to make a commercial success of an innovation.

These weak results led the Commission to support initiatives that could advise SMEs on how to profit from innovative ideas. The Promise project, which runs until 2000, is drawing up product development plans and management procedures for six pilot companies. *"As soon as the plans are put into action we will pass on information about them to 500 SMEs in Europe,"* announced Carolyn Hall, the official in charge of Promise.

The six pilot companies, in Ireland, Italy and the UK, operate in the areas of transport, information technology and furniture. The organisers of Promise, which has a budget of ECU 1.4 million, have set a target of 5% growth in sales for each company during the lifetime of the project. This should increase their total turnover by ECU 2.5 million. Project leader Carolyn Hall also estimates that companies should be able to reduce their overheads by a tenth, shortening the time to market for new products and developing lower-risk strategies. The use of resources, the definition of priorities, cost forecasting, simultaneous rather than sequential execution of tasks, staff motivation and long-term product planning are just some of the issues tackled by Promise. The project has also developed a prototype assessment and diagnostic system.

Classification and criteria

One of the main aims of the INNOVATION Programme is to *"encourage the expansion of technology and knowledge across Europe"*. Technology transfer, together with the development of Innovation Relay Centres and other innovation services, is seen as one of the best way to achieve this objective. Technology transfer is therefore an important staging post on the road to a single market. Mr Parajon Collada, Assistant Director-General in charge of the INNOVATION Programme at the Commission, explains: *"Europe has to be capable of capitalising on the effects of the completion of the single market and the forces which it has liberated."* The free circulation of technology is as important as the free circulation of goods. Europe will have fulfilled its economic potential only when every enterprise has access to the best technology for expanding its activities.



A few typical elements

For a fast-track expansion of technology and innovation to be effective, economic, legal, regulatory and intellectual property barriers need to be dismantled. This dismantling process should be supported both in organisational and human terms. Information also plays a vital role. A general classification has been drawn up which explains the typical technology transfer scenarios to help people understand the many ways in which technologies circulate. All the following different types of transfer have been identified, within the INNOVATION Programme.

Sectoral transfer: There is no reason why discoveries or inventions should be restricted to the sector in which they were made. On the contrary, solutions to problems in one sector are often innovations useful and applicable in other sectors. Practical experience shows that the technical content of a process is very important in cross-sector applications. The closeness or otherwise of the original sector to the new application is relatively unimportant.

Sectoral transfer can operate from one high-tech sector to another. For example, a sensor developed for aeronautical purposes might prove very useful in nuclear engineering. The sophisticated research work carried out by drug manufacturers occasionally uses knowledge gained from traditional medicine. The example of the beechwood project (see page 15) demonstrates such "historical" transfer. More often it is high-tech sectors, with their large research budgets and capacity to generate innovations, which can provide technological innovations to enterprises in traditional or low-tech sectors. Sector-to-sector technology transfers are quite common but they can have their share of problems, including many that are not related to technology (see examples).

Regional transfer: One of the prime objectives of the European Union, reflected in sizeable budget allocations, is social and economic cohesion. The EU has a strong commitment to support the less well developed and marginal regions of Europe.

The European Structural Funds' "Objective 2" regions – regions in industrial decline – have an urgent need for technology transfer. These regions, once considered to have an industrial tradition, have undergone radical de-industrialisation. For more than a century their economies were dominated by steelworking, mechanical

When will the silent exhaust pipe become a reality?

The silencing of internal combustion engine exhausts is hardly cutting-edge technology. In fact, the technology has hardly changed in 75 years. Noise is the main type of pollution that Europeans complain about as an everyday problem – from road traffic, building sites, heating plants, factories and airports. Better solutions do exist, but they rely on technology which has proved to be slow and difficult. The aim is to replace "passive" silencers, currently used on equipment like diesel engines, with "active" silencing, a technology that is now well developed.

The passive silencer is the familiar steel box filled with glass wool. An active silencer incorporates a small passive silencer to suppress high frequencies, but for lower frequencies it uses an "anti-noise" system. This has sensors to detect the noise, electronics to convert the noise signal to anti-noise, and transducers to play back the anti-noise. Although this is an electronics-based technology it is reliable and cheap. Unlike passive silencers, an active silencer will work with a wide variety of engines with no need for modification. The active silencer also saves energy because, unlike conventional equipment, it does not cause back-pressure on the engine and consequent loss of power. So why is this technology not used more often?

The problem lies in encouraging the use of an advanced technology in a sector where the traditional system – although it performs poorly – is well-understood and universally used. Through the Active Noise Control project, the INNOVATION Programme is supporting a technology transfer project for Active Industrial Silencers (AIS). The Austrian company KEBA has licenced the technology for use on stationary plant, and will work on this project with DMT, a

German consultancy company. Dr Reinhard Bassier, president of DMT, says that: *"DMT has a great deal of know-how in all areas of technical noise and vibration control and has carried out research and consultancy on noise control for a number of years. We have tested AIS technology and we are convinced that it is ready for practical applications. The strategic alliance with KEBA will enable us to advise our clients at the highest technological level."*

Dr Bassier's opinion is based on the Definition phase of an INNOVATION Programme project whose aim was to show that the AIS system performs better than traditional methods for controlling low-frequency sound. The advantages of AIS include lower gas emissions, lower cost, performance that can be adjusted by simple reprogramming, and adaptability to most engine speeds. The success of this project has given KEBA a key to a reluctant and highly conservative market. Gunther Krippner, vice-president of KEBA, is clear: *"The European Commission's support is important to the technical efforts of KEBA's anti-noise system division, and the project facilitates the take-up of our AIS products by European industry."*

engineering, shipbuilding, textile production and mining. These industries are slowly being replaced.

To survive or recover, these regions need to embrace modern technologies. Businesses need the right environment to establish competitive working practices and a workforce that can adapt to modern management methods. It is generally in these regions that the public authorities have shown themselves most willing to create structures such as innovation support networks, training centres, and cross-industry groups to stimulate technology transfer.

Transfer from research to enterprise: In earlier times, technology transfer was seen as a simple process of moving research results from research to business – sometimes through an intermediary and with some adaptation. As there are now many methods of technology transfer, and partnerships between diverse industries, the process has become more complex. For example, an inventor might have to deal with a large enterprise and this may cause problems with the balance of power. A large laboratory may hesitate to pass its discoveries onto a small business, preferring to deal with a multinational instead – not always the best move. These examples highlight the cultural difference between public and private sectors that can lead to friction. Many scientists and industrialists have, however, overcome these problems to work together on multi-partner projects.

Defining criteria in a complex field

The INNOVATION Programme does not only select projects for support using the classifications explained. It also needs to establish criteria to select the most promising projects, those which seem to be both harmonious and dynamic, with the best candidates, upholding the strongest partnerships and encouraging the most stable consortia. Within the INNOVATION Programme, the setting of these criteria is an important task. The selected projects must, in addition to being innovative, provide practical lessons on which the EU can draw.

Even with the accumulated experience of DG XIII, this task is not a simple one. Professor Tsipouri of the University of Athens remarks: *"Innovation is a non-linear process. Every stage, from basic research to industrial validation, interacts with the others and is equally important for economic development. As a result, the traditional distinction between the suppliers and the users of technologies is no longer relevant. In a good project the supplier of technology learns as much as the user."* However, any break in one of these links may be enough to cause a project to fail.

Technology itself has three elements:

- "Materialised" technology such as products, machines, equipment, electronic components and new materials. Each of these components can be at a different stage of development, from the initial concept, through development and prototyping, to production;

- Technology comprises know-how. This know-how is codified and documented using published reports or research results, and confidential documents such as patents;

- Technology involves expertise and acquired skills. This knowledge is either presented in the form of manuals, training programmes, databanks, and codes of practice, or is stored in the minds of the experts who developed the technology.

Successful technology transfer relies on the proper application of all three of these components, whilst remembering that the ultimate goal is the marketing of the end-product. □

Complexity and simplicity: axial impregnation of beechwood

This project aims to change the treatment of beechwood to make it as stable as the best tropical timber. Although the project appears simple, it demonstrates how many layers of technology transfer can work together.

Europe's beech forests are being used less and less, both as a source of fuel and for making traditional domestic goods like brooms and butter churns. Beech is a very hard wood which could be a good alternative to the tropical hardwoods which now dominate the market. Unfortunately beech is dimensionally unstable and it is also vulnerable to fungal attack.

Traditional methods of treating beechwood using an autoclave do not cure these weaknesses. To make it useable for manufactured goods, beechwood must be stabilised so that it does not crack or deform during the drying process. The wood must also be made resistant to fungal rot, which would otherwise destroy any wood that comes into contact with soil.

An apocryphal story tells how the project was sparked off by the rediscovery of a patent registered in 1838 by a man named Boucherie. He discovered that a freshly-felled tree could easily be impregnated with a fungicide or other treatment. The action of the tree's circulatory system, which has up to 10 000 capillaries per square centimetre of wood, pushes the fungicide up the trunk at a rate of one metre per hour, regardless of the size of the tree. This axial impregnation process compares favourably with radial impregnation using an autoclave, which is difficult to achieve and penetrates only to a depth of 2–3 cm.

Given the context, the project also needs to be environmentally sound. This is achieved by replacing the highly toxic chromium salts used in the autoclave with a new treatment based on copper sulphate, which is relatively harmless in environmental terms. The waste product of the impregnation process is glucose, a natural material.

Wood treated by the new process is certified as class 1, the most stringent classification of the European Committee for Standardisation (CEN) for wood in contact with soil, such as fence posts. The treatment also reduces the wood's tangential and radial movement by nearly 40%, which means that treated beech is more stable than Dark Red Meranti, a tropical timber widely used for external applications such as doors and window frames. The project's promoters have now applied for European Technical Approval, a standard that is the key to a larger market.

This project also demonstrates the "do-it-yourself" element of technology transfer. One obstacle to the new treatment process is that trees to be treated can only be felled during a few months of the year, and the impregnation process needs to be completed within a few weeks of felling. A mobile treatment unit towed by a small all-terrain vehicle was therefore developed. This can be used in the deepest of forests and treats the timber at the point of felling.

Finally, the decision to award the co-ordination of the project to the Thiérarche timber training centre in France will help to persuade many of those involved in the timber industry to adopt the new process. This well-known centre has been involved in several of the project's major developments, including the manufacture of various items of street furniture and external woodwork such as doors and window frames.

The human fac
the key to

The human factor is essential in the integration of new technologies into an enterprise. A "social consensus" amongst the workforce is needed to overcome the resistance of employees who see their traditional working practices challenged. Training and organisational changes are vital. To this end intermediary structures such as trade associations, trade unions and training establishments play an important role in technology transfer. This aspect of innovation, which has long been under-estimated, is particularly valuable in projects within the INNOVATION Programme.

Taking up the cultural challenge

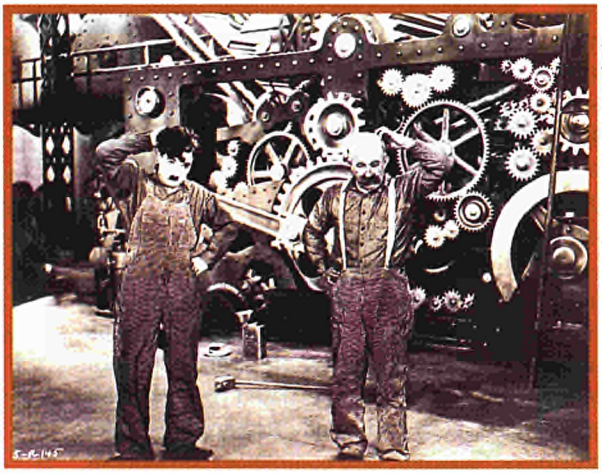
Texans and Bostonian are different, but they can work together thanks to their common language and their shared participation in the American way of doing things. The European model, if it really exists, is not as widespread or standardised as its American or Japanese counterparts. Linguistic and cultural differences between European partners can seriously hamper the progress of technology transfer.

Familiarity with individual and collective styles of management and national traits can help to avoid these setbacks. The INNOVATION Programme has produced a package, available as a booklet and a diskette, showing real examples of cross-cultural difficulties and ways to defuse them. The package also gives examples of methods for evaluating one's own and other peoples' management styles, as shown in the example overleaf.

tor - technology transfer

Is the co-ordinator the boss?

A project aimed to develop a new bio-monitoring instrument for assessing the quality of lake water. A prototype was developed in a pilot study in Germany, and the partners hoped to develop an instrument that could be marketed world-wide. The Greek, Italian, French, British and Swedish partners agreed a detailed set of objectives for the first year. These objectives included an assessment of the value of the instrument under different conditions, identifying specific markets and potential sales prospects. The co-ordinator then suggested a common format for compiling evaluation reports from each partner. He quickly brought them to a consensus on the objectives, and all the participants were happy with the easy and efficient way in which the decision had been taken.



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However, when the co-ordinator received the end-of-year reports, he was surprised with the results. Some of the reports were late. One partner submitted a very brief report, scarcely more than a list, and another was long and convoluted. Only one report met the co-ordinator's expectations. He then wrote a detailed letter to each of the participants with his comments and suggestions on how to make the reports conform to the pattern to which all had previously agreed. Although he felt that he had reacted in a constructive way, he was severely criticised at the next meeting for his rigid approach. He reacted angrily, complaining about the disorganisation of some, the ivory-tower mentality of others, and the egocentricity of everyone. This group that had worked well in the beginning lost its capacity for dialogue and mutual understanding, to the extent that the next stage of work was in jeopardy.

The participants' initial enthusiasm and respect for each other had deteriorated into suppressing or neglecting the interests of their partners. Because these problems were not dealt with at an early stage, later conflicts of interest and misapprehensions led to prejudices which threatened to cause insoluble differences. These differences at a national and inter-business level show how easily disagreements can slide into prejudice.

**DG XIII-D1 has produced a video called "Working together" which shows in a real situation how to improve the understanding of cultural differences. A booklet entitled "Innovation across cultural borders" is also available to explain cross-cultural influences on technology transfer.*

Matching the transfer to the business

The ability of a business to produce technological innovation naturally depends on its attitude towards a range of technologies. The Green Paper on Innovation proposes that enterprises can be classified in three ways according to their approach to technology. These classifications make it easy to draw conclusions about a company's suitability for involvement in technology transfer.

The first category, "machine enterprises", are basic technological trades with a rigid and centralised management style. Enterprises of this type, popular across Europe (France and Germany in particular), were very successful during the last century and in more recent times until after the Second World War. Although these enterprises make good use of information technology, they tend to focus on their core businesses in a traditional way.

The second category comprises "portfolio" enterprises, more typical of North America and to a certain extent Italy. This type of enterprise manages technology principally at the level of R&D, while business operations are driven by financial and market information. Short-term management models may be a determining factor, and these can damage well-conceived technological efforts.

Finally there is the "network" category of enterprises, represented by the Japanese model. Network enterprises rely on an overall strategic vision which is based on technology – in particularly technological information and communication systems.

The advantages of network enterprises

The open style of network enterprises and their ability to detect suitable technologies for transfer gives them a superiority over other kinds of enterprises. The creativity and flexibility of the individuals and services involved in network enterprises allow them to respond to the continual demands of competitiveness. The number of network enterprises is growing in Europe, but there are still far too many machine enterprises.

Pierre Théry: from inventor to sales force trainer

After spending 15 years developing thermal flux sensors in his role as professor of instrumental physics at the University of Lille, Pierre Théry turned to business to increase the sales of his invention. He took charge of the transfer of a technology which he had largely developed himself, and for which he was sure there would one day be a huge market.

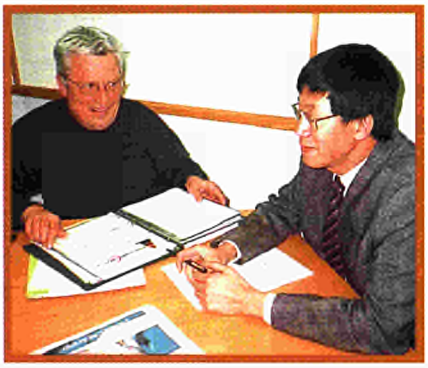
A thermal flux sensor (fluxmeter) is a fast and effective method of measuring temperature that is relevant to 90% of industrial temperature measurements. By measuring temperature differences rather than absolute values, the fluxmeter can form the basis of sensitive and responsive temperature control systems.

The fluxmeter is a set of thermocouple arrays (thermopiles), each consisting of a 25 µm-thick strip of etched metal (constantan or chromel) on a 0.2 mm-thick flexible insulating support (Kapton or Mylar). The fluxmeter is portable and can be mounted anywhere near the object to be checked. The possible range of applications for the fluxmeter is enormous. It could be used to test domestic appliances like toasters, irons and ovens, and in many industrial settings: controlling the setting of concrete in the construction industry is just one example.

Théry founded his company, Captec, in February 1995. He began by developing prototypes for public research centres keen to assess the new technology. Later he signed a contract with the European Commission, under the INNOVATION Programme, and was able to move on from building laboratory prototypes to serial prototype production.

The Commission's support enabled Théry to convince a venture capitalist, Finorpa, to help Captec secure a bank loan of ECU 130 000 and to increase the company's capital to ECU 100 000. He was then able to invest almost ECU 200 000 in building an experimental plant to manufacture sensors made up of more than 3000 thermopiles on a surface area of 100 cm^2.

Théry next concentrated on his primary aim: to establish a network of users in many different sectors. This



plan was supported by an expansion strategy from the European Commission, and focused initially on two areas: air conditioning for land transport, and energy consumption monitoring. *"An essential characteristic of this technology,"* he explains, *"is that it has multidisciplinary applications in most areas of activity."* The human factor, however, is the main obstacle to successful technology transfer. *"Potential users generally lack the necessary training to apply the technology. To enable us to expand effectively we set up a service covering quality control of the products, on-site installation and customising them to the needs of the user,"* says Théry.

As the project developed, two respected academics with 15 years' experience in an associated area of technology were recruited, along with a secretary. In his contract with the Commission Théry has two partners: the Spanish company Infrarojo y Microelectronica, and Soprano, a French manufacturer of air conditioning systems for trains. Captec has also involved other companies in various ways on a non-investment basis.

Through its involvement with Captec, a Parisian company, ICMC, has been granted a licence to manufacture sensors using thin-film technology. There are manufacturing and marketing agreements with the German firm DTS, near Halle, and the Swiss company SIS, in Lausanne. Negotiations for exclusive licences are under way with a manufacturer of electrical appliances, and a feasibility study with a car component manufacturer will soon be complete.

Pierre Théry is now concentrating on distributing his sensors. Technical and commercial agents are undergoing training in Germany, Italy and Japan, and he is preparing to break into the medical instrumentation market. Although this example of technology transfer cannot be applied to every case, much can be learned from it. Particularly important is the way in which Pierre Théry has taken great pains to personally ensure the transfer of his technology to those who can guarantee its success.

Transfers in search of an intermediary: the role of the IRCs

The spread of technologies is a key component in economic growth. Suppliers and end-users of technology must be urged to increase the flow of technology by venturing out of their own spheres. It is outside their usual fields that they may find partners, opportunites and markets to provide additional growth. Older, tried and tested methods, however excellent, will not sustain growth.

Heads of companies, laboratory directors and technology intermediaries need to break with their customary routines. It is normal for people to be nervous when venturing outside familiar surroundings,

A gold medal for an INNOVATION project

Mr H. Rump, director of the company ETR GmbH of Dortmund, Germany, has a gift for innovation. Together with other accolades, he has received the Diesel prize in recognition of his many inventions over the last 20 years. However, Rump does not work alone in his laboratory. He is aware of the need to be in contact with other organisations, to the extent that he was one of the initiators of the IRC in his region, (Zenit GmbH at Mülheim, Germany).

When Rump was looking to increase the applications and outlets for a new sensor, he looked to Zenit for assistance. Zenit helped him to draw up the application which won him Community finance to take the sensor from the drawing board to development.

The sensor is designed to protect agricultural workers who drive vehicles used to spray pesticides. There is growing concern about the health of these workers, as studies show that there are significant risks of serious illness associated with breathing air saturated with insecticides. The filter systems in many tractor cabs are not satisfactory, partly because they are difficult to clean. Rump's sensor controls tractor cab ventilation systems and ensures that the filtered air is always fit to breathe.

To obtain support from the INNOVATION Programme ETR teamed up

with two French enterprises. SP Défense a company specialising in filter technology, and Buissard a tractor builder based in Normandy. During the project, called AGRASENS, the partners developed and tested a prototype cabin with an integrated sensor and filter system. Buissard exhibited it in November 1997 at the SITEVI trade fair (Salon International des Techniques et Équipements Viti-Vinicoles et Arboricole) in Montpellier, France, where it won a gold medal for excellence. The consortium is anticipating an annual turnover of ECU 5 million for this sensor.

It is worth noting that this project has many features which make it a model project. There was no RTD involved, only some work on adaptation. The project also made use of technologies which had already been tested in other sectors (the high-tech automobile and military sectors), and transferred them to the agricultural sector. It satisfies the important health and environmental criteria and it relies significantly on intellectual property rights. Although the project was not commercially viable to begin with, it now has a great future throughout Europe.

and this is particularly true of company chiefs. They are constrained by time, which must not be wasted, and by their responsibilities. Both these factors inhibit risk-taking.

Most SMEs are not big enough, or think they are not big enough, to invest in research outside their own spheres. Research programmes and other activities outside their own sectors can help them take up the opportunities for innovation that they need.

Innovation Relay Centres: open to all

Most enterprises find the technologies and scientific know-how they need at regional level. Many Member States have set up national and regional bodies to enable businesses to make better use of existing technological resources. It would be an improvement if the whole range of European technology were made available to all enterprises. Although the Single Market has helped in this respect, it cannot ensure the effective spread of technology without further support.

One of the measures of this support was the creation by the European Commission of 53 Innovation Relay Centres covering all the regions of Europe. The IRCs act as intermediaries in the spread of technology. They help local enterprises to adopt new technologies that are usually not available in their own regions. The IRCs also provide ways in which enterprises can make contact with suitable partners and help to organise joint research. IRCs help their clients to set up trans-national technological co-operation projects. These activities are also known as technology transfer projects, demonstration projects, research projects and mobility projects.

The IRCs also exist to provide advice to enterprises on the negotiating process involved in technology transfer. They provide up-to-date information on technological trends and the various European programmes. During their first 16 months (October 1995–January 1997) the IRCs signed up 183 technology transfer agreements. They also helped 668 enterprises to obtain European aid for research, representing a quarter of the total cases submitted.

Networks of networks

The networking approach has far-reaching effects. "Sub-networks" known as Thematic Groups have been set up within the IRC network. Focusing on a specific sector of the economy, Thematic Groups work together to promote a targeted approach in the search for partners, in responses to calls for proposals, and in technology transfer. To achieve these results, Thematic Groups strengthen the links between research institutions and universities, and between large enterprises and SMEs. The first Thematic Groups to be set up specialise in car components, the environment, fishing technologies, materials, medical technologies and the timber industry.

The IRCs are not the only intermediaries involved in technology transfer. Many bodies, both public and private, can provide such services. A recent study financed by the Commission's European Innovation Monitoring System (EIMS) identified 336 technological intermediaries in Europe, all capable of providing a complete service.

Mécaprotec's surface treatments

With the active support of the Innovation Relay Centres, SMEs can find the right path to innovation with new partners.

Backing technological invention

Mécaprotec, a company specialising in surface treatments, likes to try different approaches. The company took the unusual step of encouraging its current factory manager to experience life in a university laboratory, and also recruited teams of ambitious engineers to boost its innovative capacity. Mécaprotec had decided that it was not prepared to continue with the cyclical risks of the aeronautic and space industry, the company's original markets after it was founded in 1985.

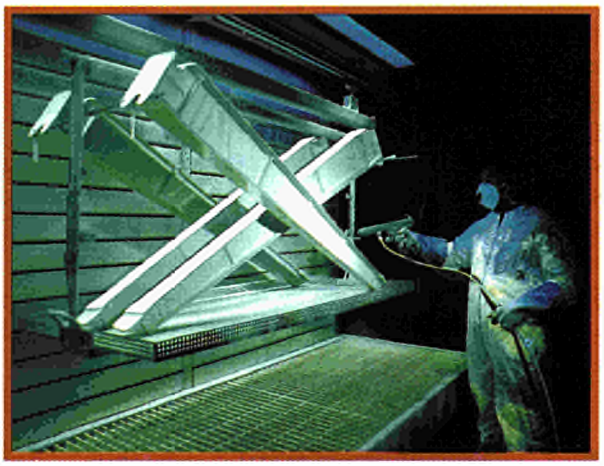
"Between 1991 and 1993 our turnover fell by half, which forced us to make almost half of our staff redundant," explains Thierry Cotelle, the company's factory manager. *"So we looked for something innovative, to introduce new treatments. I suggested that we should take a close interest in research."*

Cotelle became personally involved in research, spending two years in a university laboratory. The eventual aim was to set up a research and development department at Mécaprotec. Today the company has an R&D service that can provide continuous training, technical assistance and a test bed for new surface treatment solutions. The service is managed by a young engineer, Nicolas Orance. As a result, this SME is now at the centre of a collaborative network that includes both research bodies and industrial partners. Mécaprotec now co-ordinates the MEC3 project, supported by the INNOVATION Programme and now in its Definition phase.

Indispensable support from the Innovation Relay Centre

Jean-Philippe Mounier, head of the Midi-Pyrénées IRC, has done much to support Mécaprotec's efforts to set up the MEC3 project. The project's aim is to replace a surface hardening treatment for aluminium known as hard anodising.

The economic stakes for this idea are very high. If this technology can be developed, the cost of treating items will fall and different items destined for different industries could be treated at the same time. For instance, pulleys and looms used in the textile industry, automobile parts, turbine rotor blades and cabin components for the offshore or aeronautic industries could all be treated under the same conditions.



A search for partners was undertaken through the network of IRCs across Europe. *"We had to identify non-competing entrepreneurs operating in markets other than aeronautics,"* says Mounier, who managed the approach strategy. *"I didn't mention the name Mécaprotec at first. I filtered potential partners to build the bones of a consortium without large groups, to avoid future complications over patent rights."*

A fortnight was long enough for various interested groups to come forward. An Italian company, Gaser Ossido Duro, became involved straight away. For the Milanese firm, a specialist in hard anodising, this was an opportunity to protect its place in a rapidly-changing market. The company was also actively searching for contacts and experts to develop a more effective process for moulded items.

"We were lucky that DGXIII issued a call for proposals for Technology Validation Projects at the same time," adds Mounier. *"Our project matched the planned procedures exactly. Setting it up required a major investment, at least a month of work for me and half as much again for Nicolas Orance."* It is true that taking part in this Community programme meant a lot of work. Before starting, a schedule was needed to identify the work to be completed over a two-year period. Budgets had to estimated, and the company needed some idea of future market demand by assessing interest from potential clients.

The market and social needs

Although the criteria for choosing projects are complicated, one criterion outweighs all the others and should act as the main guide for decision-makers. Technology transfer should provide the answer to a need or a problem identified by the user, rather than originating with the developer.

A social phenomenon

As demonstrated, technology transfer can involve a large number of people and entities, both from within the enterprise and also at the economic, political and regional level. If an innovation culture is to become inherent in the European economic structure, it must reach groups other than decision-makers and engineers. However skilled these people are, they do not represent society as a whole and cannot motivate that society by themselves, at least not permanently.

For this reason the INNOVATION Programme has always tried to involve all sectors of society in technology transfer projects. Later in this Special Issue the important part played by training organisations will be examined. One example is the project on axial impregnation of beechwood (see page 15). What better way of encouraging the acceptance of new ideas than by including them in basic vocational training programmes?

Trade unions too have been keen to take part in the projects supported by the Commission. Printing unions have played a major role in introducing non-toxic products in various printing operations covered by the SUBSPRINT project (see page 44). Similarly, the European federation of building workers in Brussels is an active partner in the SUMOVERA project. This project aims to replace mineral-based oils, harmful to workers and the environment, with vegetable oils as release agents for concrete.

The Commission is also urging local authorities to become actively involved in technology transfer projects as well as introducing policies in support of innovation. Wastewater management projects

(see page 45) are a good example. The local authorities involved with these projects have made a real, although not risk-free, leap forward. Change of this kind is exactly what the Commission intends, and it is consistent with the vision of an innovation culture playing a growing role in European society.

Create awareness

In 1994 the INNOVATION Programme launched an original initiative called EASW, or European Awareness Scenario Workshop. The purpose of this initiative is to give direction to choices of technology, to encourage innovations with a positive impact on society, and to ensure that the concept of sustainable development is maintained. Its aim is to explore ways of fostering a social environment which favours innovation.

Between 1991 and 1993 Denmark experimented with a new way of encouraging the participation of its population –citizens, trade unions, professional organisations, local authorities and uni-

versities – using a programme called Barriers to Urban Ecology. The programme was based on thematic workshops aimed at involving more people in the process of directing and evaluating choices in technology.

The Commission asked the Danish Board of Technology, with the help of Dutch experts from the TNO (Centre for Technology and Policy Studies) to apply this method more widely. Using the central theme of the urban environment, these experts and the Commission tested the effectiveness of the EASW method in four towns across Europe. More than 200 people from the towns of Ede (Netherlands), Corfu (Greece), Mulhouse (France) and Preston (UK) took part in these local workshops. □

How should citizens be consulted?

An EASW workshop is a structured meeting that takes place over two days and brings together around 30 people. These people include local residents, technology experts, political representatives from various public authorities and representatives from the private sector. The aim of the workshops is a structured debate on themes or scenarios that evaluate technological options. Participants become real experts who are familiar, at a local level, with the possibilities and limits of change. Above all they understand that change depends on them, and on their choices for the future.

So far 50 towns have organised, or plan to organise, EASW workshops. Some local initiatives have even been launched by groups that are independent of the Commission. In the Italian town of Orvieto the authorities set up a programme to make its citizens and schoolchildren more aware of technologies for recycling and re-using waste. The authorities in Orvieto looked at the town's existing policies and information on the subject, and revised the system of charges for waste collection. They are now organising an EASW workshop to discover which strategic and technological options are compatible with the wishes of the local people.

Positive reaction to this initiative has led many Member States to organise training seminars. Experience gained from these initiatives has also made it possible to launch a second generation of projects. Some of these are in areas other than waste recycling, including sustainable development, transport, mobility and information technologies. Other projects tackle the publication of best practices in the social aspects of innovation, helping to raise the awareness of all participants.

These programmes, called Training and Dissemination Schemes Projects (TDSP), emphasise aspects of training and dissemination within the context of lifelong learning. They also show how to make the best use of the possibilities opened up by new information technologies.

These initiatives have made it possible to identify partners, including local and regional authorities, NGOs and trade unions, who are instinctively innovative in their own environments, but are not traditional partners. Apart from their participation in future actions and projects, their point of view is valuable in defining the shape that the action will take. Their contribution to a future Innovation Forum or an Innovation Observatory could be invaluable.

Innovation in the face of globalisation

Over the last decade the more than 50 000 SMEs in the European ready-to-wear garment sector have encountered competition from low-wage countries. They soon realised that the only way to remain competitive was to adopt an attitude of continual innovation.

The Italian Centre for Textiles Information in Emilia Romagna (CITER) was one of the first organisations to develop a computer system to aid fashion and knitwear design. More than 30 local SMEs in the ready-to-wear sector now use the system. In 1992, convinced that the computer software could help other European companies in similar circumstances, the directors of CITER applied to the European Commission for support in adapting the system. The project, named Citera Plus, led to the formation of an association linking textile centres in Spain and Portugal, which was joined in 1995 by Great Britain and Belgium.

The development strategy of Citera Plus was based on SMEs. The Citera Plus software helps small companies respond quickly to the ever-changing demands of the fashion industry, while keeping their prices competitive.

Designers cannot work in isolation. They need to collaborate with others in testing colour ranges, sketching designs, communicating with customers and suppliers, producing presentational material and catalogues and even programming knitting machines. Citera Plus helps with all these tasks, for instance by letting designers sketch their ideas directly onto a computer screen, and providing image banks and other records of fashion past and present.

The role of the textile centres was to adapt the original Italian software to national standards, which still vary widely from one country to another. They also provided training and advice to eight pilot companies. From the start of the project, dedicated workstations were installed as demonstration sites for the project to show its technical advantages. Analysis of these installations has allowed Citera Plus to be fine-tuned and has identified new roles for the project. This analysis also highlighted the need for user-friendly interfaces, since designers have an artistic training, not a background in computers.

The whole programme now runs on a standard PC and the system can be bought for about one quarter of its 1992 launch price. 50 companies are already using it, a further 1500 have been contacted, and the next phase of Citera Plus will target another 2000 companies throughout Europe. Software for 3D mapping developed at De Montfort University (UK) has been distributed free to companies connected with the project.

"One Italian company now puts on around 15 shows a year for its Japanese clients using this system," says Marco Gianfranchi, the project co-ordinator. Commercial arrangements for new user support have been developed in Spain and Portugal, and manufacturers of sportswear and furnishings have also expressed an interest in this technology.

INNOVATION Programme

Jean-Noël Durvy (fourth from left) and the team responsible for the follow-up of transfer and validation projects

The INNOVATION Programme (1994–98) is directed by the European Commission's DGXIII-D, based in Luxembourg, under the third activity of the Fourth Framework Programme. The 4th Framework Programme makes provision for "Technology Transfer and Validation" projects (DG XIII-D1) through which large numbers of enterprises from all the Member States have been able to evolve and implement new approaches to technology transfer.

Action at two levels

The projects making up the content of the INNOVATION Programme were selected following three Calls for Proposals. All projects were concerned with the validation, transfer, or both of technology or knowledge. "Technology" and "knowledge" are here defined together as research results, know-how, methods or techniques which, regardless of their origin, can be adapted and used in new applications.

Each project was carried out in two phases (Definition and Implementation), financed separately by the Commission. Progression to the Implementation phase is not automatic but depends on a positive "project review" at the end of the Definition phase. Only the most promising projects receive finance for the second phase. The total timescale of each project (both phases) is around three years.

The Definition phase must not exceed six months. The Commission contributes 75% of the overall cost (and 100% for any additional expenses), with a ceiling of ECU 75 000. It was expected that between 50% and 75% of projects successfully completing the Definition phase would go on the Implementation phase.

The Implementation phase takes a shared-costs approach. It is the more important phase, and usually lasts about two years. The work involves generally between 3 and 10 man-years.

The INNOVATION Programme has also provided resources for accompanying measures (less than 10% of the total budget) to support organisations which were involved in past programmes (such as SPRINT and VALUE), current INNOVATION projects and other projects from the specific programmes under the Fourth Framework Programme. The Community contribution does not exceed 75% of the total eligible cost of these accompanying measures.

Why two phases?

- to limit the risks associated with the innovative nature of the projects;
- to ensure the formal involvement of all the partners;
- to analyse the potential difficulties and risks;
- to respect the project's original concept, scope and conditions for success;
- to compile all the information which increases the project's feasibility;
- to identify aims, deadlines, responsibilities, financial planning etc.; and
- to share the experience with all the partners of an international project.

Projects

The Definition phase

Because the Definition phase must be completed quickly, the Commission has drawn up simplified model contracts. These reinforce the role of the project co-ordinator, to manage his partners in an effective way.

In this way candidates wishing to set up an international consortium (always a delicate matter, since SMEs often fail to communicate effectively across national frontiers) benefit from support in organising and establishing partnership contracts. During the Definition phase partners get to know each other, they learn to work together as a partnership in a project which, because it involves working across national frontiers, provides experience of multi-cultural co-operation. It is also at this stage that the partners should consider how to protect their innovation by developing intellectual property rights (IPR) and marketing strategies.

More generally, the aim of the Definition phase is to improve communication and understanding (see Goal Oriented Project Planning, page 30), to make the consortium aware of the use of IPR (see QUICK SCAN, page 31) and to co-ordinate the development of the proposal for the main Implementation phase (see PMS Tool, page 32).

The Final Report of the Definition phase required by the Commission is much more than a traditional report of the work carried out; it is a detailed plan for the project's Implementation phase and further funding. It must demonstrate the project's technical feasibility and economic viability, as well as the consortium's ability to manage it successfully. It must also show that there is a real demand for the innovation in question, using either specific market research or the contracting parties' pre-existing data on the potential target market

This will enable the panel of independent experts assembled by the Commission to review the report and make recommendations about the project and whether it should receive support for the main Implementation phase.

A project may start well but ...

Even the financial help provided by the INNOVATION Programme is not in itself a guarantee of commercial success. A project may proceed chaotically or fail, even if the product is unquestionably innovative and useful, and the transfer of technology going well. This was the experience of an company which arrived with an extraordinary new invention: an air filter that absorbs unpleasant smells from abattoirs, breweries, farms, paint shops and fish processing factories. The company went into liquidation a year after the start of the project.

The biological filter was based on grape seeds and grain husks from brewing. In tests it was five times better than previously-tested types, and cheaper both to buy and to use. Officials in charge of the INNOVATION Programme immediately saw its potential for reducing the nuisance endured by the many communities who live close to factories emitting nauseating odours. Technology transfer to farms all over Denmark was planned, as well as to factories processing potato chips and fish in the Netherlands. The French vehicle manufacturer Renault also wanted to try the filter in its paint and varnish workshops.

"We were working on the transfer of this technology in the Netherlands, but the company which invented the filter went bankrupt in the meantime" explained Ferdinand Hager of Techno-Z GmbH, the Austrian agency charged with managing the project by the Commission.

"The problem was that the company had only one product, the filter, and it had to be widely marketed. It's a pity, but the Commission had no option but to stop the finance. Two Swiss companies are now negotiating to buy the manufacturing rights to the filter, and we have not excluded the possibility of a future revival of this technology transfer".

The Implementation phase

Nothing is more difficult to arrange, more dangerous to manage or less certain to succeed than the introduction of new things. For this introduction will be vigorously opposed by everyone who is doing well under the present arrangements, and given but weak support by those who would do well under the new.

Machiavelli "Il Principe", chapter VI

Leading a multinational team

A project that has reached the implementation stage can finally begin its most important phase. The INNOVATION Programme continues to provide support, and for those projects using the PMS tool, this now becomes a valuable planning and reporting aid.

The task of the co-ordinator (generally the project leader) is a difficult one. A project may have anything from 2 to 15 participants (the average is five partners). The co-ordinator must be fully committed, must understand the problem completely, and have strong project management skills. New ideas are greeted only reluctantly, and face many obstacles before they are accepted.

A project is often launched amidst shared enthusiasm, but then meets with problems of communication when further commitment from partners is needed. Even the best planning cannot avoid these difficulties. Technology transfer is first and foremost a matter for individuals, and the co-ordinator has the responsibility of maintaining a climate of confidence between the partners.

At this stage Moderated Planning Workshops or GOPPs (see page 30) are an invaluable tool for improving communication between the partners, who each have their own distinct interests in the project's success. The co-ordinator must make sure that he takes these distinctions into account whilst giving priority to areas of common interest.

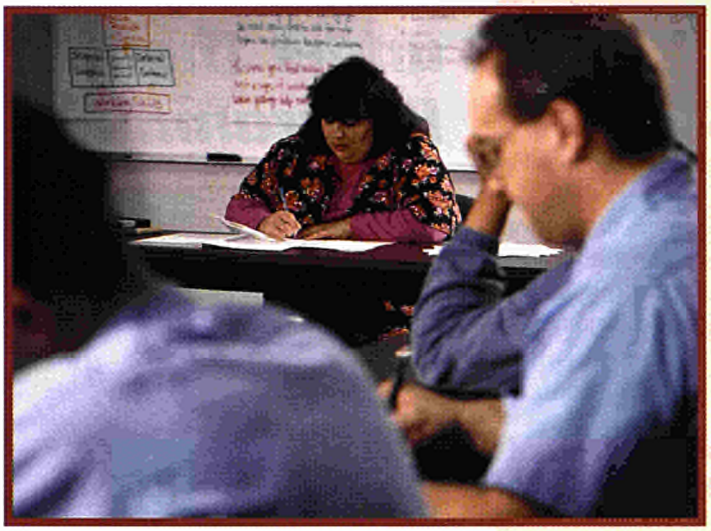
Even when the partners begin with open minds, it sometimes happens that stereotyping and an instinct to preserve existing advantages reappear during the project. The co-ordinator must gather his partners, possibly organising additional meetings or workshops, and create a better climate of understanding in the project team.

Talking, meeting, communicating

It may seem simplistic, but the mere fact of drawing up a detailed communica-

Innovation across frontiers

The INNOVATION Programme has developed a booklet and accompanying diskette specially designed to help project leaders manage international projects. The material looks at six cases of crucial cross-cultural incidents in which communication across national borders came unstuck. The booklet gives possible explanations for the breakdowns in communication, while the diskette provides opportunities for self-evaluation. The package enables a project leader to classify both the profile of the whole project and his or her own management style, and to compare the latter with those of the other partners. There is also a questionnaire to help in comparing the actual environment and management techniques with those of an ideal project.



tion list gives a project a much greater chance of success than if contacts remain bilateral and informal. Care must be taken to keep everyone's contact details up to date and to pinpoint the key personnel. Mail, Web sites and exchange of data via the Internet are useful tools.

Even more important are direct contacts between partners: visits, seminars and workshops. It is not sufficient to just send reports; partners must meet, discuss their difficulties, revise timetables, incorporating new technical or commercial data, go through the legal procedures for patents, react to market changes and take decisions of common interest:

The Commission has put forward a model agenda for these progress meetings. The aim is to allow all the partners to express their differing points of view. Where appropriate, end-users, financiers, venture capitalists, trade unions and other organisations relevant to the success of the project are invited to take part.

Organising meetings on a rota basis can help to stimulate an innovation culture allowing everyone to become familiar with the other partners' working conditions and business environment.

Regular updates

The official appointed by the Commission may attend some of the meetings. The Commission also requires six-monthly progress reports throughout the project. Here too the INNOVATION Programme offers help, in the form of guidebooks and the PMS Tool (see page 32) for producing standardised reports. The PMS electronic format is not, of course, compulsory, but it is certainly convenient. The PMS Tool allows users to create a new report by updating the previous one, making it easy to produce a consistent series of reports.

Anticipating problems

A strong consortium is important to avoid later problems. Friction may occur if the allocation of tasks and finance between partners is not clear. Partners must also agree about rights to royalties, sales agreements, licences and other legal instruments relating to intellectual property rights. In practice, with expert help the partners will be able to draw up a general agreement when the consortium is set up. This agreement should outline how the results will be exploited, and avoids difficulties at a later stage.

Promoting results

Essentially, the Commission seeks to have the partners to make the results of a project available to the widest possible audience. Apart from the restrictions agreed to protect intellectual property rights, all projects are encouraged to publicise their results, and specific promotion measures exist. Help is also available from the Commission's own resources such as the CORDIS centralised database and the network of Innovation Relay Centres in Member States.

Projects are encouraged to make use of all methods of communication to publicise their products or services to potential customers. Typical methods include press releases, visits, exhibitions, newsletters, leaflets and other publications.

Several projects have also used external observers as part of the publicity process. Factory visits by observers who are not involved in the consortium can help to pave the way for the international marketing of new technology. These observers can act as "ambassadors" for the project when they return home. More importantly, experience has shown that they can serve as catalysts to the development of the product.

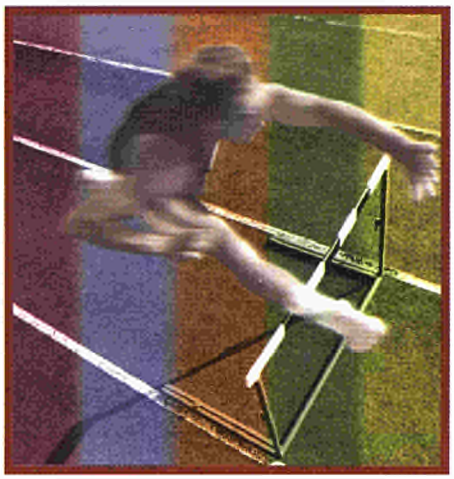
The five pillars of a project under the INNOVATION Programme

The chances of success for innovative technology can be judged from five main factors: protection, accessibility, assimilation, dissemination and management.

1) Protection of intellectual property rights

QUICK SCAN is one of the various accompanying measures offered to projects in the Definition phase. The technical and innovative background of the proposals are subjected to a novelty check and compared to the state of the art. QUICKSCAN is a collaboration between the Commission and the European Patent Office (EPO) in the Hague (NL).

The Search Division of the EPO has 2000 multilingual experts and access to databases with more than 30 million documents. Its services are considered to be a major source of authoritative advice when researching INNOVATION projects.



Using a comprehensive classification system with 120 000 subdivisions, the EPO searches the prior art and originality of the proposed innovation. Analysis of the search results provides information on technological trends and the competitive situation. Besides requesting a high quality of patent analysis from the EPO, the European Commission was keen on a "quick" search. Only in this way can QUICK SCAN become a real decision aid rather than an additional bureaucratic obstacle.

2) Providing technologies

In the context of the INNOVATION Programme the word "technology" is used in its broadest sense. This includes aspects of technical management and many non-technical factors. Because the aim is to develop applications quite close to the market, it is necessary to be sure of the maturity of the technologies in question.

A project may concern transferring technologies from one sector to another. Equally, it may involve the validation of new research results, in which case there

Goal Oriented Project Planning

Goal Oriented Project Planning (GOPP) is an innovative tool for project management in which planning workshops involving all partners in a project together with an external moderator are held at different points in the project lifecycle.

It is most beneficial at the start of a definition or main phase to co-ordinate the work of the partnership around a common goal.

GOPP aims:

- to improve communications and co-operation by giving participants an opportunity to reach a consensus;
- to make the project more coherent and transparent by clarifying the responsibilities of each partner;
- to improve quality and efficiency by defining indicators for project follow-up and evaluation.

The GOPP method

Known as the "logical framework", the method by which GOPP workshops are organised consists of organising logical links between the elements available, the anticipated results, external factors, and appropriate indicators for follow-up and checking.

A successful GOPP session needs a skilled and independent workshop facilitator or moderator. The method also makes intensive use of visual materials to keep discussions on course and to make sure that all the participants are properly involved in reaching decisions.

A GOPP workshop on an INNOVATION project generally takes place in four stages:

- a detailed discussion of the partners, their needs and expectations, and all other aspects of the project;
- a critical examination of the problems and risks inherent in the proposed innovation;
- a critical examination of the initial plan of work in the light of these problems and other factors external to the project;
- preparation of an action plan bringing together all the previous information and establishing activities, milestones, deadlines, responsibilities and outputs.

** DG XIII-D1 has produced two videos, "Building Successful Multi-partner Projects" and "Working Together", and a booklet called "Moderated Planning Workshops", to explain the GOPP method.*

will usually be a prototype phase. Sometimes it is even advisable to make a test batch of a product to fine-tune the manufacturing process or sound out the potential market. Standards and certification such as ISO 9000 quality assurance may be an important factor to ensure the competitiveness of the new product or service.

Finally, some projects depend on existing technologies for their success. In this case it is important to define the selection criteria carefully, particularly for users and SMEs, since the choice of technology often determines the company's whole strategy.

3) Assimilating technologies

Even if the technology concerned is adapted to new uses, introducing it into pilot production sites or to the end-user presents risks which must be studied carefully.

Experience has shown that it is essential to bring the users of technology together with the suppliers at the very beginning of a technology transfer project. The problem is – and this is the real meaning of innovation – that the "new" technology will disturb existing methods, organisation and management. In many cases detailed training and restructuring will be necessary.

Where innovations are being introduced into existing products (a new lubricant for machinery, for example), those involved must be certain that the pilot end-users concerned (in this case machine manufacturers) will accept the innovation. Information must flow in both directions. Mechanisms for control and follow-up must be organised with all partners, including the end-users, to aid the assimilation of the technology.

Finally public opinion and consumer preferences have to be taken into account whenever they are crucial to the social acceptance of an innovation.

The scenario workshops developed by the INNOVATION Programme (see page 24) in parallel with technology transfer projects have shown the value of involving different types of organisation when choosing technologies for applications of public interest. Such projects include public-sector management of water projects involving municipal authorities and the environment.

4) Disseminating technologies

Dissemination is a very important aim of all INNOVATION Programme projects. Projects, particularly those involving innovative new products and processes will need, with the help of market analysis, sales forecasts, and feedback from pilot end-users, to gather reliable information and comments on the proposed technology as a basis for further marketing activities.

The INNOVATION Programme focuses on projects that are demand-led. But innovation is not restricted in its role to supplying new technologies. In some cases, a vaccine, for instance, or a new environmental technique, it is not possible to talk in terms of a purely economic demand; these types of projects must be able to demonstrate the socio-economic benefits of the technology.

Projects will include, within their overall workplan, activities to raise awareness of their innovation to a wider audience through information campaigns, articles and advertisements in the media, demonstrations and exhibitions.

5) Project management

The INNOVATION Programme provides a range of support measures, the PMS tool, handbooks, etc. to support the important task of project management.

The project co-ordinator will plan specific project management activities, regular review meetings and, when necessary, arrange workshops where partners, independent experts and the Commission official responsible for the project can meet. The INNOVATION Programme is keen to ensure that the whole project, from the first to last, is managed in a professional manner.

Quick Scan

Objectives

- to raise awareness of the patent protection system and intellectual property rights;
- to raise awareness for the patent information system;
- to avoid duplication of research and wasting of funding resources;
- to provide added value for the Commission contractors.

Results

In spring 1996 experts at the EPO had assessed 87% of the 100 selected INNOVATION projects.

One third were classed as novel projects, but in 57% of the cases the novelty of the project or parts of it were questioned. In at least two cases the QUICK SCAN search results have led to a complete redirection of the project.

The requested amount of funding of these two projects alone was more than the costs of the complete QUICK SCAN activity thus showing the economic validity of this approach. In a few other cases QUICK SCAN provided valuable information on possible competitors, pointed towards interesting prior R&D work , or possible end-users for the new technology.

PMS Tool: helping to draft the project

The Commission has created a project management system especially for technology transfer projects. Its aim is to ensure transparency and harmonisation, and to help spread good practices from one project to another. The method enables managers to draw up a list of workpackages, activities, milestones and all other important factors concerned with managing the project.

The PMS Tool (Project Management Support Tool) simplifies the co-ordinators' work and helps avoid errors in completing the documentation, drawing up a work plan, describing the technology or setting up the consortium. Even better, it has proved to be an excellent way to prepare for the second phase of the project, by allowing projects to be presented in a standard format for review.

The PMS Tool is a computer program that runs under Windows 3.1. It has minimal hardware requirements (a 486 processor with 16 MB of RAM), and includes extensive online help. It provides standard terminology, suggests ways of structuring projects, indicates the appropriate level of detail to provide and objectives to aim for, and makes suggestions for putting together work plans and timetables.

Project managers do not have to use the PMS Tool, but experience shows that those that do usually have a better chance of obtaining second-phase funding. A project which has used the PMS Tool but which fails to obtain second-phase funding also stands a better chance of finding alternative sources of finance, because the project structure as documented by the PMS Tool makes it easy to draw up a business or investment plan.

BETTI: a tool for benchmarking

Benchmarking is a process in which companies keen to improve their performance compare themselves with the best performers in comparable businesses. Benchmarking is an important way for European SMEs to become more competitive.

Beerenschot, a Dutch consultancy company, has developed a promising new benchmarking tool known as BETTI (BEnchmarking Tool To Improve production performance). BETTI is based on HOPE (Human-Oriented Production Engineering), a previous project under the Brite-Euram programme. 15 pilot companies tested HOPE and restructured themselves successfully as a result.

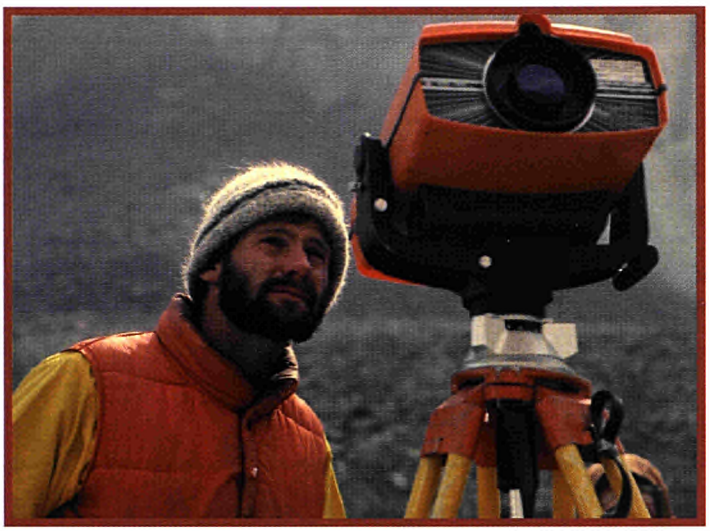
BETTI, which came to an end in June 1998, has assessed 100 companies in ten European countries. The sectors concerned are mechanical and instrument engineering, machinery construction and metal fabrication. The aim was to identify the weaknesses of the companies concerned and to raise their techniques to the level of their best competitors.

"The comparison is carried out using productivity criteria (input and output indicators), production costs, time taken to transform raw materials, reliability of distribution systems and work quality. The variety of product types and the level of repeat orders are important. In general, the fewer production phases, the greater the likelihood that a product will be delivered on time," explains project co-ordinator Maurits Verweij.

One manufacturer of mechanical components tried the BETTI method and found that its production rates were below average for its business sector. Analysis showed that this was mainly due to problems with external supplies, even though the use of these supplies was linked to less than 10% of manufacturing time. With improved communications between the company and its suppliers, decentralisation of quality control, more appropriate use of machinery and stricter controls on assembly, the company achieved a marked increase in productivity and added value per employee.

"The companies that have already received their benchmark results – almost 50% of the total – have all assessed the experience positivity. We thus regard the technology transfer as a success," says Verweij with enthusiasm. *"The INNOVATION project has reached its end, but the BETTI evaluation service is now fully operational."*

Updating "good practices"



Innovations already developed through projects financed under the Fourth Framework Programme will generate profits, create jobs, open new avenues, strengthen commercial positions and relaunch the spirit of enterprise in the regions, all within a European context.

The feedback from these projects gives rise to many good practices and answers which is improving our understanding of the mechanisms of technology transfer and validation. An analysis of the lessons learned is of great value in setting future development strategies.

Sharing good practices also makes the most of Community investment. The value of the INNOVATION Programme is its ability to make the situation comprehensible through clear structures, a methodological approach, and at the same time flexibility to encompass the variety of project scenarios.

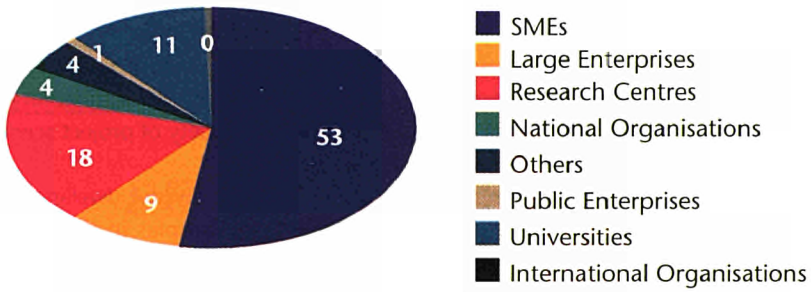
Without dwelling on the intricacies, the examples in this Special Issue show that an overall vision, coupled with an individual approach that takes full account of human factors, provides a successful route for promoting technology transfer in Europe. This is true even if a project fails to achieve all its commercial goals. In these cases the project has still helped sow the seeds of a new innovation culture, increased cross-border ties and given a novel idea a stimulus – three benefits well worth having. □

Summary of the three Calls for Proposals

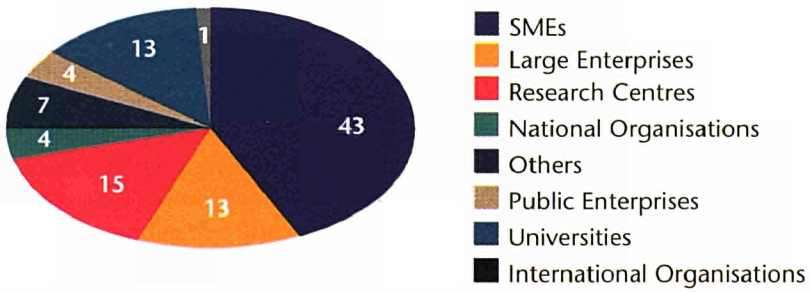
Call	Proposals	Definition phase	Implementation phase	Accompanying Measures
1	503	100	56	
2	314	84	17(*)	12
3	245	44		
Total	1062	228	73	12

(*) January 1998

Distribution by co-ordinator's organisation type



Distribution by organisation type



Distribution by country (number of projects chosen)

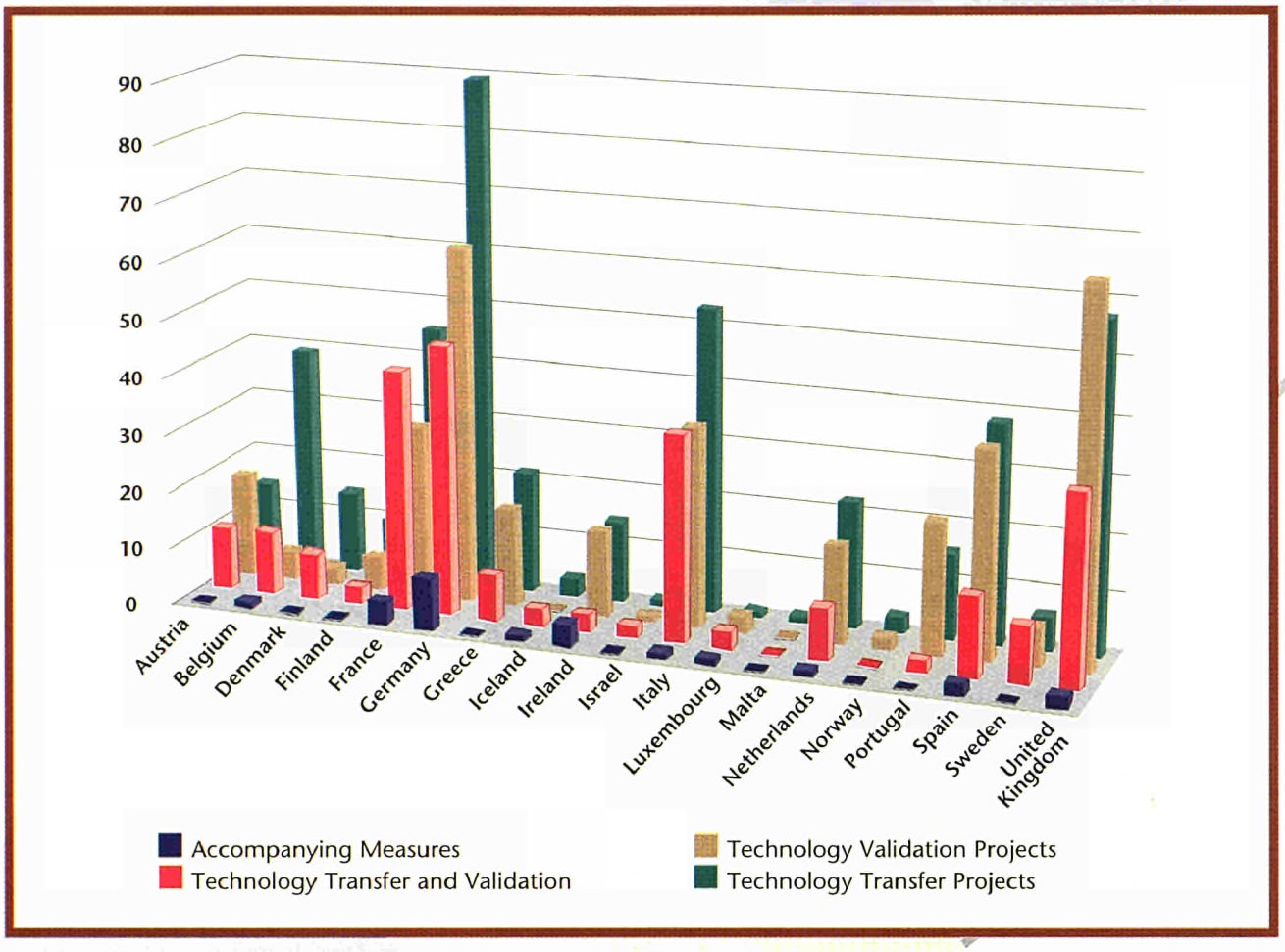
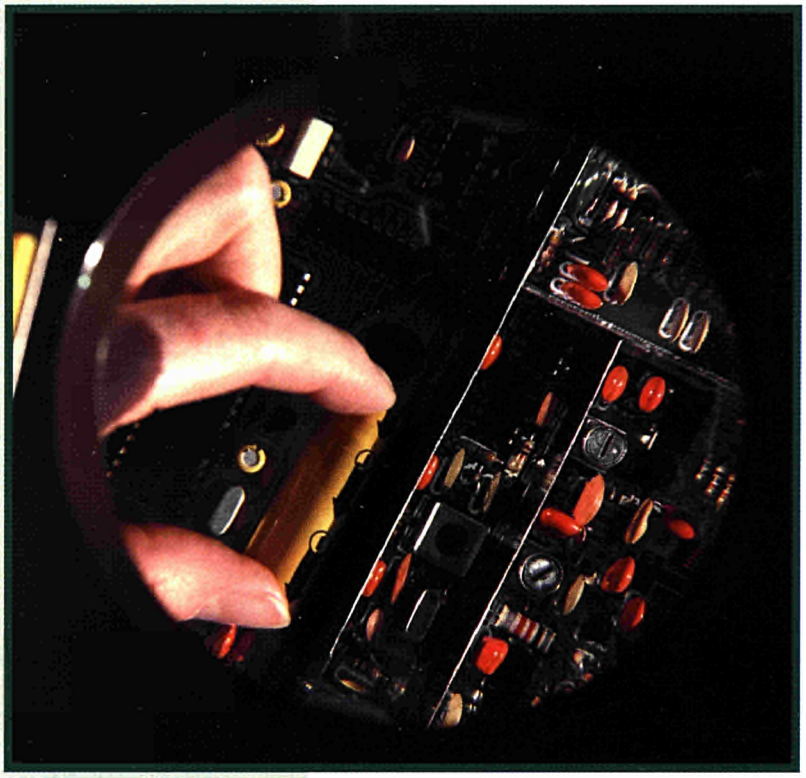


Table of international partnerships in INNOVATION projects

		AT	BE	CH	DE	DK	ES	FR	LI	GR	IT	IE	IS	IR	LU	NO	NL	PT	SE	FI	GB	XX
Austria	AT	50	14	13	140	20	21	32	0	29	56	8	1	0	4	4	29	9	33	11	34	4
Belgium	BE	14	130	2	111	20	65	166	1	64	135	78	3	7	7	25	86	61	8	15	145	8
Switzerland	CH	13	2	0	25	1	5	18	0	3	11	5	0	0	1	3	12	3	8	2	19	2
Germany	DE	140	111	25	543	103	284	274	4	127	315	58	4	49	24	49	221	173	118	65	258	6
Denmark	DK	20	20	1	103	52	33	45	0	52	57	10	8	5	1	5	27	11	51	9	61	1
Spain	ES	21	65	5	284	33	452	188	0	149	252	17	1	4	1	9	38	219	63	19	253	2
France	FR	32	166	18	274	45	188	342	0	70	313	51	8	11	12	19	104	91	39	19	248	10
Liechtenstein	LI	0	1	0	4	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0
Greece	GR	29	64	3	127	52	149	70	0	173	136	49	1	0	6	3	28	86	18	16	218	9
Italy	IT	56	135	11	315	57	252	313	1	136	411	74	1	14	7	23	104	82	95	29	293	10
Ireland	IE	8	78	5	58	10	17	51	0	49	74	73	1	5	1	13	18	58	14	19	169	0
Iceland	IS	1	3	0	4	8	1	8	0	1	1	1	5	0	1	4	4	0	3	1	5	0
Israel	IR	0	7	0	49	5	4	11	0	0	14	5	0	18	0	0	7	2	0	0	11	0
Luxembourg	LU	4	7	1	24	1	1	12	0	6	7	1	1	0	3	2	3	0	1	1	4	0
Norway	NO	4	25	3	49	5	9	19	0	3	23	13	4	0	2	30	30	10	12	6	17	1
Netherlands	NL	29	86	12	221	27	38	104	0	28	104	18	4	7	3	30	145	28	37	22	159	6
Portugal	PT	9	61	3	173	11	219	91	0	86	82	58	0	2	0	10	28	155	17	7	171	3
Sweden	SE	33	8	8	118	51	63	69	0	18	95	14	3	0	1	12	37	17	90	34	146	3
Finland	FI	11	15	2	65	9	19	19	0	16	29	19	1	0	1	6	22	7	34	40	73	0
United Kingdom	GB	34	145	19	258	61	253	248	1	218	293	169	5	11	4	17	159	171	146	73	388	7
Others	XX	4	8	2	6	1	2	10	0	9	10	0	0	0	0	1	6	3	3	0	7	1

Integrating tec
a state of



We can see that the search for the best technology demands that enterprises step outside their current environment. But within a company, too, the absorption and incorporation of new technologies demands flexibility and creates challenges.

Innovations in automation, computerisation, safety and environmental protection all have their attendant difficulties. The hierarchy of jobs and priorities, division of labour, and the use of processes, plant and materials may all need to be re-examined when incorporating new technologies. Several of the projects supported by the Commission show how this re-examination process can be made easier, and how important it is for success.

Enterprises have difficulty in absorbing the ever-increasing quantity of technology-related information and in identifying which techniques will fulfil their needs for productivity and competitiveness. Similarly, many SMEs continue to feel marginalised by the issue of technology transfer, no doubt believing their production processes, suppliers, sales and administration are good, even excellent. But in a competitive environment, no position can be held indefinitely. Whatever we have achieved will sooner or later be improved upon by our competitors.

This calls for a constant search for new ways to improve competitiveness, and a willingness to adopt new technologies.

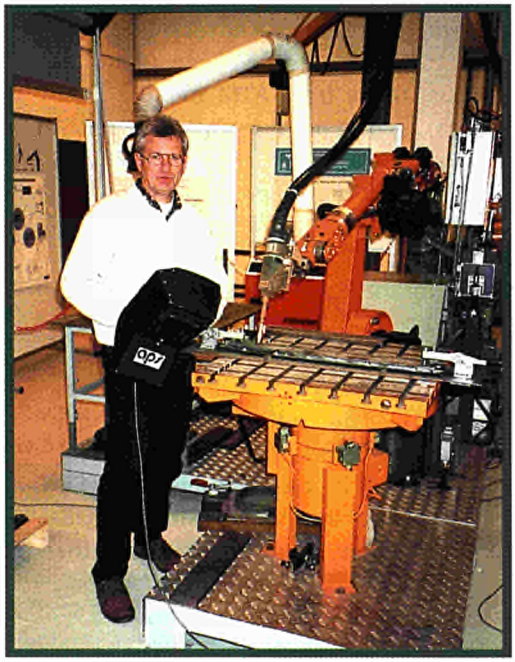
hnologies:
mind and methods

A welding robot within reach of all

Robots are now a common sight on assembly lines. They can work faster than human operators with fewer mistakes, they also free workers from repetitive tasks. The problem is that only large companies can afford robots and the programming skills needed to run them. SMEs who manufacture in small quantities, perhaps five or ten units at a time, consider robots uneconomic. The SME market can therefore be seen as a market opportunity for robotics.

This has led a German robotics company, APS Mechatronik (Aachen) to develop a new type of robot control system aimed at SMEs. The new system lets SMEs enjoy the benefits of the precise and high-quality assembly work associated with robotics. Under the European Commission's Brite-Euram and Esprit projects, APS developed a new computer-aided design system linked to robots for welding in small production runs. The INNOVATION Programme has now supported the adaptation of this German technology for use by small companies in other countries.

With the new system a welder directs the robot from a computer screen. The computer holds a database of welding techniques, which is periodically updated, and software to assess the type and thickness of the material to be welded. The welder can carry out a computer-based simulation before proceeding to the actual work, so that fine adjustments can be made. This reduces the wastage of material, which is a significant cost in small-scale production.



"A Greek enterprise, for example, is using this system to weld transformer boxes, which are made in quantities of around 20," explains Dr Günther Starke, research director at APS. *"The type of work is almost always the same. The operator can select the previous job and simply specify the change in dimensions. In this way the programming time can be reduced by 50–60%, which makes the system suitable for small-scale production."* The operator can also prepare the next job before the current one is finished, minimising the amount of unproductive time. APS is now working with industrial automation companies in Greece and Portugal, and hopes to transfer the technology to SMEs in other countries.

Computerisation: combating customer anxiety

No enterprise, however small, can hope to stay competitive for long without equipping itself with information technology (IT). Computerisation is thus a technology transfer experienced by almost all businesses, and like any other technology transfer it needs good management.

Finding the right solution from the many information technology systems available can be expensive – and the wrong purchase can ruin a small business. SMEs are not as resilient as large enterprises, whose structures enable them to correct strategic gaps; whilst correcting mistakes in an SME, distracts staff from production, which is essential for survival. SMEs also rarely have all the skills necessary to install and maintain their IT systems efficiently. This means that they depend on external expertise, which is sometimes difficult to find and often too expensive.

In 1991 a proposal which foresaw a way to help SMEs get the best from their investment in IT received Commission support. This proposal became the CHECKLIST project under the supervision of ASTER, the technological development agency for the Emilia-Romagna region in Italy. 11 pilot companies were connected to six technology centres charged with helping them to identify the best computer systems for their requirements.

The CHECKLIST project developed a set of numeric indicators so that at each stage in the decision-making process the needs of the enterprise could be compared with the characteristic of the software. The result was a system that works for any software, in any industry. However, the method works better if the people carrying out the evaluation are experts in both IT and the business area of the company concerned.

After a successful Definition phase, the next stage of the project involves 25 enterprises from different sectors. Most of the companies are in France and Italy, but some come from Ireland, Spain and the UK.

User feedback

Gentech Electronics of Limerick (Ireland) operates in the highly competitive electronics sector, where it is vital to satisfy customer demand for high-quality and rapid service. *"We wanted to be sure that our procedures fitted in with our customers' needs,"* explains Matt Kavanagh, the technical director. *"We decided to computerise our quality control system, but we did not know where to start."* Gentech used the CHECKLIST method with technical assistance from ATM Ireland. *"The process gave me a step-by-step approach to taking a decision. It gave me the confidence to chose the right software,"* Mr Kavanagh concludes.

Gentech made contact with the British and Italian companies in the pilot study to help evaluate the power of the new system in making IT decisions. The solution they chose improved stock and inventory control, and made it possible to integrate quality control into the information management system. This reduced the amount of data to be copy-typed during the quality control process.

Another satisfied customer in Ireland, Galtee Wood and Veneer, makes high-quality wood and varnished products for kitchens and bathrooms. Because most of its products are made to order, the company needs to be flexible enough to adapt to a constantly-changing work plan. *"The company,"* says quality supervisor Jimmy O'Shaughnessy, *"badly needed software that would enable it to review all the current contracts with a single keystroke."*

In Birmingham the KAJ Consultancy helped two companies, Leslie & Co and Robinsons, produce plans for managing materials and stock. The British partners were able to improve the performance of CHECKLIST whilst extending the scope for their application of IT. The two manufacturers used CHECKLIST to help select a new computer system and feel that as a result they made the right choice. According to KAJ, more than 15 British companies, in sectors ranging from banking to textiles, have expressed an interest in this method of specifying computer systems.

By the time it ended in 1996 the project was a clear success. The CHECKLIST method is now used throughout Europe. A further advantage is that the project has always relied heavily on local intermediaries and consultants, who have made decisive contributions to its success.

Even after the most appropriate IT system has been selected and installed the technology transfer is not yet complete. The organisation's staff still need to be trained to get the best use from it. The level of automation that is acceptable to production staff needs to be determined before the start of the project (computerisation for management and marketing is much more advanced). In some cases a fundamental redefinition of the production process is necessary to optimise the links between staff and machinery and to meet material, economic and human constraints.

Automation, backache and technology

A technology transfer project in the ceramics sector provides a good example of the need to take the human factor sufficiently into account early. Faced with fierce competition world-wide, the fine ceramics industry has come up against an internal obstacle to the introduction of automation.

Technology can often eliminate repetitive and laborious tasks at the same time as it increases productivity. Workers and technicians, however, often see only jobs lost and skills downgraded. This is the case even for thankless tasks like manhandling heavy items. In factories making sanitary ware this manhandling brings no added value (particularly when it is simply a matter of getting a piece from one production stage to another), and causes high levels of accident-related absenteeism.

© Roy Export Company Establishment

However, workers are more conscious of the psychological drawbacks of being "helped" by a machine than of the laborious and even dangerous aspects of their jobs. To improve this situation the INNOVATION Programme supported the French Industrial Robotics Association (AFRI) in a project to carry out a study of automation in the production of fine ceramics.

At the start the project involved seven European companies, who were later joined by three sub-contractors. The challenge for the consultants was to put forward flexible automation technologies that would allow production to be adjusted rapidly to meet customer demand. Sanitary ware and crockery alike must be available in shapes, colours and materials to suit customers' changing tastes. At the same time the proposed automation had to improve product quality and be acceptable to the workforce.

With these constraints in mind the technologists decided to concentrate on four operations:

- working culinary porcelain;
- enamelling stoneware sanitary ware;
- enamelling porcelain sanitary ware; and
- handling sanitary ware.

Several solutions were developed for the culinary porcelain process. These ranged from the creation of an entirely automated workstation to a complete re-think of materials flow during the manufacturing process. A similar process re-organisation was also the result of the project on enamelling stoneware sanitary ware, in a factory which dated back to the beginning of the century.

The factory used for examining the production of porcelain sanitary ware was too new to benefit greatly from radical modernisation. However, the study showed that it is possible to develop robots for universal applications in this sector.

Finally, the project on handling sanitary ware showed all the advantages of using specialist external expertise. A universal robot was developed to reduce the amount of manual handling, which in turn has cut both absenteeism and the number of damaged parts.

This success was only possible, however, by taking individuals' working methods into account. The psychological factor in automation is so great that if a machine is to take over tasks performed by a man the overall manufacturing context, not just a single stage, needs to be changed. From a global viewpoint, automation has had an impact on every production line in the ceramics industry. It has thus brought about a complete re-think of the ceramic workers' trade as traditionally practised. From an economic perspective this modernisation has shifted managers' main concern from wage costs to technical skills and the renewal of know-how.

A European winner for electronic components

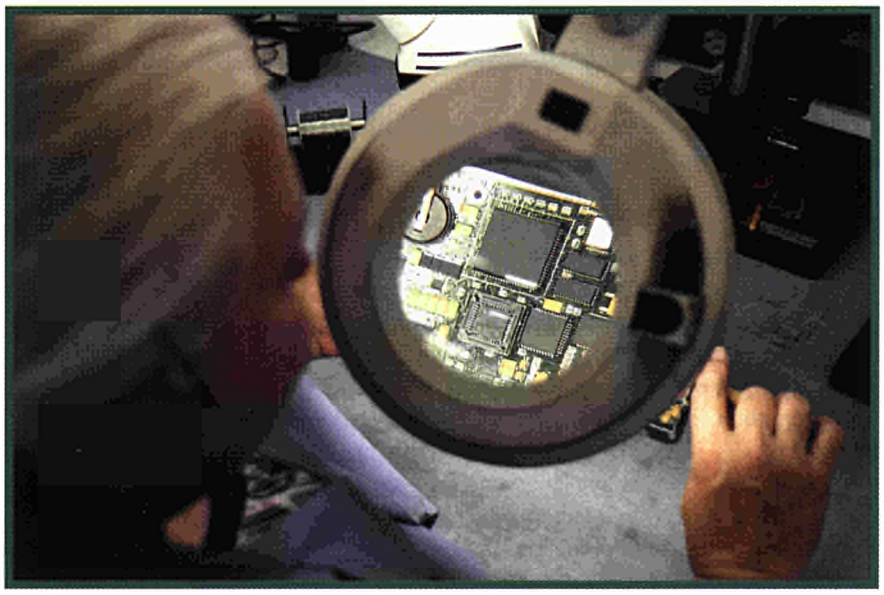
Domestic and industrial appliances are increasingly making use of "intelligence" in the form of electronic memories and microprocessors. The pressures of competition demand devices that are powerful, fast, small and cheap.

The INNOVATION Programme is currently supporting a promising new European product that is likely to make a major impact on the world market for electronic components.

Dr Jan Van Houdt, researcher at the Inter-university Microelectronic Centre (IMEC) in Belgium, has discovered a new way to make "flash" memory, the fastest-growing sector of the electronic memory market. Flash memory made in the new way is more efficient, quicker to program and more reliable than conventional memory, whilst using less energy.

Using a new "split-gate" approach, NVM (non-volatile memory) cells could reduce the dependence of European customers – makers of smart cards, mobile telephones, video cameras and cars – on manufacturers of flash memory from Asia and America. *"The cell requires little in the way of investment for its development, which makes it particularly interesting for the new range of embedded memory systems coming onto the market,"* explain Dr Van Houdt. *"Europe could become a serious contender in the market, even though the process of integrating the flash function into existing technology – or on a smaller scale – is not a simple task."*

The INNOVATION Programme is supporting the pre-production phase of the new memory cell. Van Houdt says that the technology is now ready to be used by the German chip maker Thesys, which will provide world-wide sales and marketing support, and that modules could be introduced in silicon wafer form. MS2, a French software company that develops applications based on flash memory, is making a prototype circuit to demonstrate the technology to interested companies.



Innovate to protect the environment

Our growing concern for the environment also has repercussions in the world of technology transfer. Products, processes and services now have to demonstrate their environmental as well as technical and economic performance. This may be a matter of complying with the law, or it may be simply good business: an "environment-friendly" label helps sales.

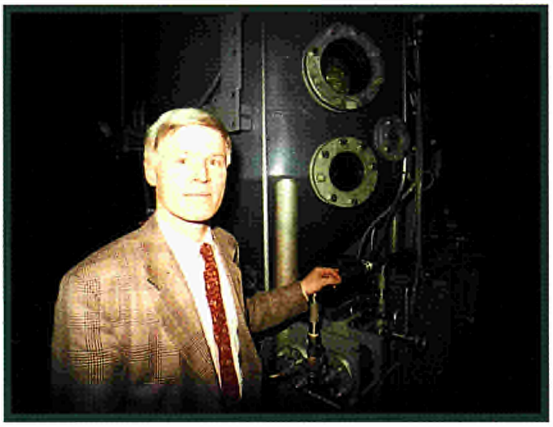
There is thus a strong trend towards incorporating environmental concerns into the economy, and this has a direct link with technology transfer. Making a business "green" often entails replacing a standard process with a more environmentally sound one. Since businesses are rarely in a position to develop their own environment-friendly substitutes, they search out alternative technologies that are more environmentally acceptable.

Recycling used water

The pulp and paper industry is one of the major polluters of rivers and the sea. Water discharged from factories bleaching paper pulp contains chlorine residues which harm the environment.

Now a Finnish company, Hadwaco, has designed an evaporator which removes the toxic residues as an easily-managed solid, enabling the cleaned water to be reused within the factory in a closed cycle. The particular feature of the Hadwaco evaporator is that it is made of plastic instead of metal, thus avoiding the serious corrosion problems caused by chlorine residues in traditional evaporators. It also consumes much less energy than previous designs, making it very economical in use.

This is an exceptional invention which could lead to a new generation of effluent-free paper and pulp factories. Before it is marketed the system must undergo full-scale tests to eliminate all possible risks. The INNOVATION Programme is supporting a three-year project in Sweden to carry out the necessary trials, and a consortium of companies from Finland, the Netherlands, Spain and Sweden has been formed to test the technology in other manufacturing industries.



The co-inventor of the evaporator, Leif Ramm Schmidt of Hadwaco, hopes that during the course of the project a new label, TEF (Totally Effluent Free), can be introduced for pulp and paper produced in this environment-friendly way. *"The project could have a major environmental and economic impact on manufacturing processes throughout Europe,"* he says. *"There are applications for recycling based on the evaporation of wastewater not only in the pulp and paper industry, but in most industries which use water."*

Schmidt believes that his technology would transfer easily into the food and chemical industries, textiles, metal surface treatments and electricity generation. Landfill sites in Italy, Spain and Finland have already taken out licences to build Hadwaco evaporators to treat their effluent. The production of drinking water from sea water and other polluted sources has also been considered as a possible application. *"The global market for this technology could be of the order of ECU 15 billion over the next decade,"* Schmidt adds.

Putting the environment into innovation

Software developed under the INNOVATION Programme's CAEMIS project enables all kinds of enterprises to carry out environmental audits.

The story started when an Austrian firm, LMS Environment, developed software to help enterprises reconcile their economic and environmental aims through the management of data on dangerous substances, emissions, stock control and legal requirements. LMS was capitalising on the 1993 Directive on voluntary company eco-audits, which was followed in 1996 by the publication of ISO 14001, the standard for environmental management. At the same time, market pressures were increasingly encouraging enterprises to see environmental protection as a business opportunity.

LMS's new software encouraged both large and small enterprises to adopt an integrated approach to environmental management, not only taking account environmental factors as a whole but incorporating them into every aspect of the enterprise's operations: manufacturing, services and administration.

The LMS/U1 system was designed for service departments, particularly for employees collecting follow-up data on emissions and compiling statistics. Unlike their colleagues in commercial departments, these environmental specialists had previously had to carry out the work manually.

The system comprises a client-server suite of four modules: management of materials (both hazardous and non-hazardous); production (safety and emissions); inventories (of operations as well as products); and organisational questions (regulations, authorisations and ecological audits). At the heart of the system is a relational database containing environmental, production and management data for the four modules. The database also controls system security and manages the interactions between the commercial departments' systems and production planning. Access to information is via the SQL language, using a local area network (LAN) to connect desktop personal computers to the database.

The software was tested in three organisations: SKF Austria, who used it to help in adopting an ISO 14001 environmental management system, BMW Motors, and a waste management centre operated by pharmaceutical company Novartis. The success of these pilot schemes persuaded the European Commission to support the wider dissemination of this technology through the INNOVATION Programme and the CAEMIS (Computer-Aided Environmental Management and Information Systems) project.

LMSE also produced a CD-ROM to complete the LMS/U1 system. The CD-ROM contains the texts of almost 260 Austrian laws relating to environmental protection and industrial safety. All the entries have hyperlinks to more information on the background to the legislation, with graphics and diagrams. More information on LMS Environment is available on the company's Web site at http://www.lmse.com/.

Recently LMS has begun working with customers and consultants from other Member States. The aim is to produce standardised software that can be used throughout Europe to reduce the impact of industry on the environment and strengthen the EU's economic position in the global market. In creating an industrial standard for advanced computer-aided environmental management solutions, Europe will confirm its position as a leader in environmental protection.

From technology consortium to international network

After a successful first stage, the CAEMIS project for information and environmental management software moved into a truly European phase.

For the enterprises using it, the CAEMIS software provides a complete solution to the problem of incorporating the environmental dimension into management.

Developed by the Austrian company LMS Environment in response to Austrian legal requirements, the software is currently being translated into English, Spanish and Danish whilst being tested and adapted for a dairy in Ireland, a pharmaceutical company in Spain and a rail transport maintenance company in Denmark. In all three cases an environmental consultant within the country concerned who is a member of the network has played a crucial role.

The software makes it possible to optimise the environmental performance of an enterprise. It also makes it possible to manage European eco-audit certification and the ISO 14001 standard. The software provides a complete solution, covering hazardous substances, waste management, mass and energy review, compliance management, European Management System documentation and health and safety management.

After identifying joint strategic aims, members of the CAEMIS consortium decided to set up an international network offering products and services throughout Europe. By sharing their environmental knowledge and continuing to explore the possibilities of information technology, CAEMIS members can operate internationally from local centres of expertise. They can serve multinationals as well as the smallest enterprises. The official launch of the network took place at a conference in Vienna in June 1998.

Replacing pollutants

Many companies have found that the use of polluting detergents to clean production machinery weighs heavily in the ecological balance. "Green" detergents, however, are more expensive, more difficult to use (being less effective above certain temperatures) and more difficult to store. The enterprise therefore has a difficult job in assessing the green detergents on the market, deciding how to change its cleaning procedures and generally weigh up the advantages and disadvantages of changing to a green alternative.

The increasing number of problems of this kind led the Commission to support a project known as SPHERE+. This aims to provide general lines of action for substituting hazardous products with products which are more acceptable environmentally – and also for workers' health. For instance, attempts are being made to find replacements for lead, cadmium, other heavy metals and some pesticides, and to replace traditional paint with water-based types.

SPHERE+ found some of its answers in the many national substitution trials already under way. The Commission has for several years supported two such projects: SUBSPRINT, in the printing sector, and SUMOVERA in construction. SUBSPRINT and SUMOVERA are already part of SPHERE+, and six to eight other projects of the same type will shortly be added to provide a representative sample of "green" substitutes.

The most important lesson to be drawn from SPHERE+ is how to present substitutes in a favourable light to end-users or purchasers, and how to create favourable conditions for their use. This is crucial. Substitutes and their associated technologies (in the widest sense) must meet many criteria: they must be economical, technically effective and acceptable both to companies and individual users. This is difficult, but these problems have been resolved in the past, and, by formalising previous solutions SPHERE+ can help this success to be repeated.

Participants in SPHERE+ are of many nationalities, and this has helped to answer the third question faced by the project: how to identify the local obstacles to, and opportunities for, substitution, and how to deal with them. Clearly every product in need of a substitute is different, as is the situation in each European country. There can be no universal solution. The links between regulation, public policy, market conditions and the organisations involved – such as companies, government agencies, trade unions and employers' associations – vary a great deal from one State to another, and between different sectors. This produces both obstacles and opportunities, which companies must be prepared to manage.

SPHERE+ will try to prepare managers involved in substitution for this task. The project will also establish who should take the leading role in a substitution project, what assistance should be involved, and how the measures should be organised.

Bring on the substitutes

SUBSPRINT

Each year the printing industry uses almost 300 000 tonnes of volatile organic compounds (VOCs) to clean machinery. Many of these VOCs are toxic and polluting.

Between 1991 and 1996 the SUBSPRINT project, part of the INNOVATION Programme, helped prepare the ground for replacing many of these harmful substances with safer vegetable-derived alternatives: blends of vegetable oils and fatty acid esters.

SUBSPRINT sought the help of intermediary bodies in 13 countries (11 EU members plus Iceland and Norway). These are non-profit organisations: trade unions, employers' associations, research laboratories, groups involved in environmental issues or workplace health, academic institutions and printing schools. Their task was to persuade each print shop, one by one, to give up the usual solvents and replace them with vegetable based products. The promoters of the new products (and the technologies associated with them) had to be commercially neutral if the users were to be convinced.

SUBSPRINT made it possible to carry out all the technical work necessary to persuade new users that vegetable products can perform effectively. This also allowed the suppliers to fine-tune the compositions of their products, and to adapt existing cleaning methods to work with vegetable products. A life-cycle assessment showed the environmental advantages of the new products, while a technical study checked that they would not damage printing machinery.

With the groundwork in place it was time for a first test on the presses of a major newspaper. The project participants continued to spread the word about the substitute compounds, now armed with all the arguments – both technical and cultural – necessary to confront resistance. Over the five years of the project vegetable-derived cleaning agents gained 5–15% of the market on average, and many new products appeared. Above all, many training centres now include the new cleaners in their teaching, so the spread of these substitute products will continue.

The success of SUBSPRINT has led other sectors to take an interest in "green" cleaning agents. Outside the INNOVATION Programme four related projects have so far been set up. VOFAPro aims to increase scientific knowledge of vegetable oils and fatty acid esters. This will ease the way for their use by industry in general, which currently consumes 2.2 million tonnes of solvents a year; the project will start with the metals, paint and ink sectors. In Iceland a project started by the SUBSPRINT representative is using beef and mutton fat to make a cleaner for removing tar and dust from cars and engines. In the Netherlands, a project is studying how to promote green cleaners in artistic disciplines such as engraving and lithography.

SUMOVERA

The SUMOVERA project was set up in the construction sector to replace the traditional solvents used as release agents for concrete. SUMOVERA brings together German construction co-operatives, research centres and the European Building Workers' Federation, and is co-ordinated by Chemiewinkel, a Dutch consultancy and research centre.

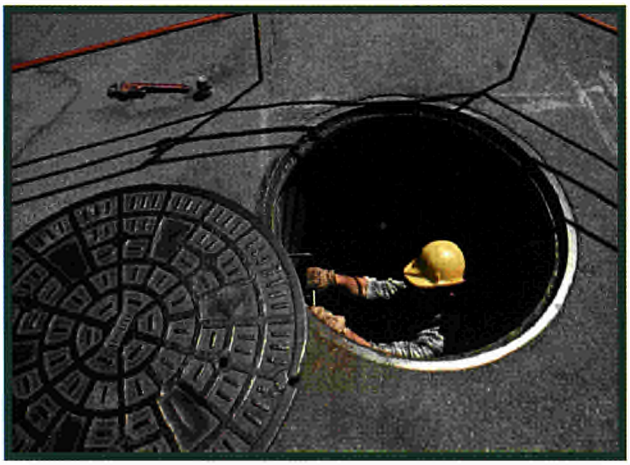
A valuable contribution is being made by the large French group Bouygues, which has agreed to take part in the project as an end-user. Olivier de Gaulmyn, the group's director of corporate affairs, says: *"Everyone is delighted with this co-operation, particularly the workers. We are testing the new products on our sites over a year, so as to check the behaviour of vegetable agents in summer and winter, exposed to wind, rain and snow."*

The cost of the new release agents will naturally be substantial. One of the aims of the Bouygues study is to establish the likely costs by finding out what levels of release agent are needed under different site conditions. There is no doubt, however, that the element of satisfaction among the people working with them will also be important in making the new products popular.

Water, water everywhere...

Europe's local authorities and water companies urgently need to modernise their old sewer networks if they are to comply with the European Union's new environmental regulations. This work could cost them ECU 10 billion over the next few years alone, particularly if traditional methods of monitoring the networks continue to be used.

For this reason, engineers have been looking at alternatives to simply replacing pipes and sewers. One possible solution to Europe's problems could be the use of real-time control (RTC), which computerises the design and control of sewage networks.



An ECU 5 million technology transfer project has been using this technology to control urban drainage and sewage systems in four European cities. Bolton (UK), Copenhagen (Denmark), Vitoria (Spain) and Mantova (Italy) all have serious problems with flooding and sewer overflow.

As a direct result of the project, 20 cases of sewage overflow into rivers around Bolton have been prevented. The Bolton system uses a new intelligent control system, a central control room and seven new storage reservoirs. Sewage flooding of Copenhagen's parks during periods of high rainfall was halted by an integrated system of three dams with centralised control and a large sewage main. Engineers in Mantova have been able to prevent overflow into nearby lakes by storing the water outside the system. In Vitoria the introduction of software for modelling and controlling the sewer system has reduced problems of flooding, pollution and maintenance.

"The project has made a significant contribution to the obvious changes in approach to urban drainage problems in Europe," says one of the project's co-ordinators, Berislav Tomicic of the Danish Hydraulic Institute.

A second project financed as part of the INNOVATION Programme's Accompanying Measures is now publicising these results in order to transfer the technology on a larger scale. The new 18-month dissemination project STEAM (Sewage Technology for Europe – Accompanying Measures) began in December 1997. STEAM will make a round of visits to municipal engineers in the south of Germany, Austria and Switzerland and will be presented at a seminar in Portugal.

STEAM, which is co-ordinated by the Water Research Centre in Swindon (UK), also has the task of developing a multimedia training and distribution package for sewage system managers and consultants, and for a group of system users throughout Europe. *"The user group is trying to establish an institutional framework in which practitioners in this field can meet and exchange information. We hope that this will carry on long after the end of the project. The INNOVATION Programme project helps get it under way,"* explains STEAM co-ordinator Ian Clifforde.

Leaks everywhere too!

Leaks from fresh water distribution networks have become a major problem for the water supply industry in recent years. In some regions of Europe more than half of all treated water vanishes into the ground. For European water companies, both municipal and private, this adds up to hundreds of millions of ECUs down the drain every year.

The Commission is spending ECU 1.6 million on a project which is bringing improvements to five European countries: Greece, Portugal, Spain, Germany and Ireland. The project uses existing techniques based on information technologies, brought up to date and adapted for the water industry. Computerised mapping and mathematical modelling are used to stem the loss of water.

The project has helped the water service in the Irish town of Dundalk to save ECU 200 000 a year. The Greek town of Larissa is saving ECU 150 000 a year.

"The first thing to understand is that there is no package of technological quick fixes for leakage," says Hugh Allen, a specialist in hydrology networks, *"but measures can be more effective thanks to the use of information technology."* Even in Madrid, where the water company Canel de Isabel uses one of the most highly-developed geographic information systems (GISs), Allen and his colleagues have been able to improve results.

"Canel de Isabel did not use information technology in its leakage control programme. In a pilot zone, 70% of losses were stopped, saving 35 litres per person per day. The approach taken in the pilot zones proved to be 30% more economical in terms of cost than the traditional methods," Allan adds. *"There is no doubt that information management is a valuable tool enabling water companies to maximise the efficiency of the measures they take, but it is not a panacea in itself. We have not yet found the Holy Grail. Certainly we will get there, but we will need at least another five years."*

Improving the protection of intellectual property rights

European Patent Office in Munich

Straightforward innovation through R&D is often perceived as a major long-term investment with a high risk. Technology transfer, on the other hand, gives the impression of being a great time-saver. The technology taken on board is already tested, possibly in a different sector. It is thus by definition considered workable, and even profitable.

In reality, the commercial risks involved in negotiating user rights of the technology in question are as large as those involved in starting an R&D project from scratch. *"A bad licensing agreement can cause a company as much trouble commercially as a failed R&D project,"* explains Gearóid Mooney of the Irish public technology transfer agency Forbairt. *"Some negotiations for a transfer of technology are particularly uncertain, and are generally short of reference points, formulas and standards. What needs to be done when taking such an important step?"*

As is often the case, the answer can be found in the method, and first and foremost in careful preparation. We have seen that for projects supported by the INNOVATION Programme, the QUICK SCAN activity (see page 31) has become a vital step in the Definition phase. Studying the intellectual property right situation of a project results in a specific strategy. In a consortium it is invaluable to guarantee the supplier of a technology that he will profit from its supply. While the recipient of the technology may in return receive some other kind of guarantee, such as a preferential user right of use.

The new Community approach to patents

It is regrettable that technology transfer has been held back by the relative weakness of the European system to protect inventions. Each Member State has its own patent office and the Luxembourg Convention of 1989, which could have provided a Community patent covering all the Member States, has not been implemented. The European Patent Office in Munich has suffered criticism for the complexity, costs and delay of patent registration procedures, and for the absence of a single legal framework for litigation.

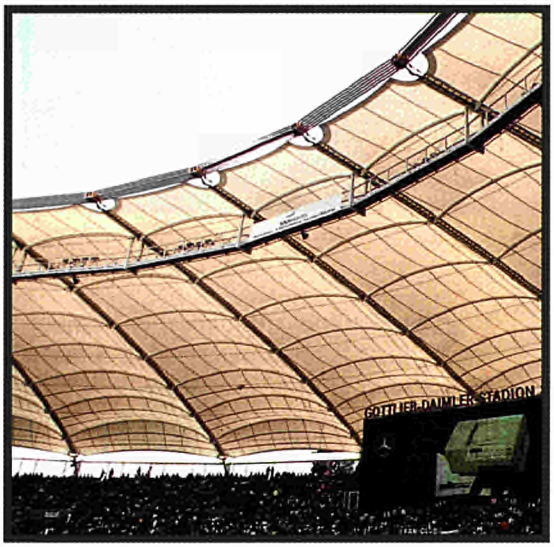
As part of the Innovation Action Plan, the European Commission has relaunched the debate on patents in Europe by publishing a Green Paper which outlines the situation and indicates ways for action. Following the debate the Commission plans to publish a policy document during 1998.

Whilst waiting for an improvement in the legal situation, the Innovation Relay Centres (IRCs), the national and regional bodies supporting innovation and the national patent offices, are all trying to raise awareness in the business community of the need to obtain advice on intellectual property rights (IPR) issues. The INNOVATION Programme is encouraging participants in its projects to increase the number of licence agreements for their own technologies. At the beginning of 1998 the INNOVATION Programme published a call for tender for the establishment of an IPR helpdesk.

TechTextil Innovation Prize 1996

By linking a "small" inventor and a "large" producer, the INNOVATION Programme has given the best possible chance for market success to a brand new system for measuring deformation in flexible structures.

The MESCOME 2 project illustrates perfectly Europe's needs in the marketing of technological inventions. The innovation in question could only have come from a small-scale, high-risk approach, so intervention by an established commercial operator and a support mechanism for technology transfer were both required to give it any chance of commercial success.



Architectural tension structures, in other words those that use flexible materials, are becoming ever more innovative. Much of this development is thanks to the growing range of technical textiles available for building tension structures. Engineers who want to use these new materials, however, face problems.

Qualities such as the fabric's resistance to water and grime can be determined by the manufacturer under laboratory conditions. Its mechanical properties, however, depend on the structure in question and cannot be measured in the laboratory using conventional technology. As a result, tension structures are generally over-designed: a vital precaution, but an expensive one. A niche existed for an instrument that would improve the quality of mechanical design data for these materials.

As part of a Brite-Euram project, the newly-created Texsys company (two engineers, one secretary) developed a new type of sensor specifically to measure deformation in flexible materials. The system, named Optimat, is composed of flexible sensors, plus a data-gathering and analysis system.

The main innovation lies in the invention of sensors suitable for these new materials, which are polymer films, coated textiles or laminated textiles. Compared to other sensors on the market, the Optimat sensors increase the strength of the material only slightly. They have a very low modulus of elasticity and negligible mass (3g) in the context of the structures to be measured, they are mechanically "transparent".

Now a fully-proven technology, Optimat is seeking new applications and markets such as hot-air balloons, inflatable storage tanks, pipework closures, parachutes, hang-gliders and drive belts. An Innovation prize at Techtextil, the main trade fair for technical fabrics, has boosted awareness of this new technology.

The German company Koch Hightex, the European leader in technical fabrics, has joined with Texsys in an INNOVATION Programme project to validate the technology across a wide range of applications. With the aid of Optimat, Koch Hightex plans to offer revolutionary structures, particularly for the Asian market. The new structures will be optimised in their choice of materials, structural design, construction timescale and commercial quality.

As tension structures tend to be one-offs, the ability to gather better data will enable the development of improved design techniques. Using technology such as expert systems, the tension structures of tomorrow will be at the same time cheaper and more sophisticated.

Reassurance for the security sector

Technology transfer in the security sector, such as that involved in the Vein Biometrics project, highlights the need for security in a process – innovation – whose very nature is based on a need to take chances.

Every purchaser needs to be reassured that the product is appropriate, the quality good, the price fair and the after-sales service adequate. The same is also true of technology transfer. Once the technology suppliers feel that market research has confirmed the prospects for their invention, they need to spend time assuring potential users of its adaptability, reliability and economy.

When the product in question is a security system, this concern is doubled. This is one reason why the INNOVATION Programme chose to support the Vein Biometrics project.

Each person has an arrangement of veins that is unique, stable and virtually impossible to copy. By taking a "digital photograph" of the pattern of veins in the hand using infra-red light, the system developed by Aras BV (NL) provides a highly reliable tool for personal identification. Compared with fingerprints or retinal scanning, vein measurement has the additional advantage of not inconveniencing the person being scanned.

The Commission is supporting the validation of this technology and encouraging its use across a range of security fields including airports, banks and universities. The project is initially working on prototypes of access control applications for official buildings and systems for protecting computer data. The results will subsequently be evaluated for more complex applications such as financial transactions.

A preliminary market study carried out during the Definition phase of the project showed, not surprisingly, that false positives are a critical issue for access control systems. Occasional false negatives can be tolerated as long as they are easily corrected. To meet these standards the project will determine the optimal criteria for capturing, pre-processing and comparing images, as well as image data storage formats, access to image databases and human-machine interfaces.

The European market for access control products alone represents more than ECU 3.5 billion a year and is expected to grow rapidly. Credit card fraud, stolen codes and unauthorised use of passwords lead to the theft of billions of ECUs every year in Europe. The three project partners – Aras BV (NL), Pronovus (UK) and the British Technology Group – make no secret of the fact that they expect the market to be enormous. "Banking systems are amongst the first areas that we are targeting. And once we've convinced the bankers, everybody will trust us!" say the partners.

New markets

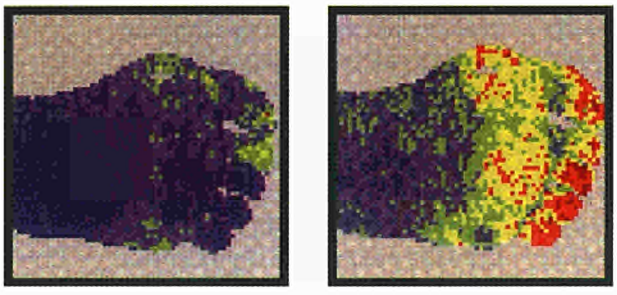
The increased flow of new technologies in the single market has a direct macro-economic consequence: the emergence of new markets "discovered" by new technological combinations.

In theory it should happen the other way round: entrepreneurial analysis of potential markets or social needs should lead to the development of new products or services with greater or lesser technological content to meet a foreseen need. In reality the process works both ways.

The technology transfer projects supported by the Commission provide many examples of new markets, from simple niches to new social trends – as this example from the medical sector shows. □

Innovation under the skin

Whether they are caused by thinning of the ozone layer or by the increase in chemical substances in contact with the skin, skin cancers are becoming more common. Europe's 13 000 dermatologists carry out more than 2 million tests a year on potentially cancerous skin lesions. But the subjective nature of these tests means that they are not reliable, and 20% of the time the dermatologist records the wrong result. A better testing system would find a promising market.



Swedish scientists in the Department of Biomedical Engineering at the University Hospital of Linköping have developed a laser imager to perform skin tests. The technology is economical, objective and reliable. A low-power laser harmlessly examines the skin point by point, and computer processing produces a precise and reliable map showing skin anomalies.

Properly marketed, this new technology could stimulate significant demand, consolidating Europe's traditional lead in the medical equipment market. *"Skin diseases are very serious and can have fatal consequences. Early diagnosis by Doppler laser and effective treatment will have a substantial economic and social impact. It is also expected that early identification of potentially harmful substances in the environment will play a major role in the prevention of illnesses of this type,"* explains Professor Gert Nilsson, co-ordinator of the HIRE LADO project. The seven Swedish, German and Danish participants are working to standardise dermatological evaluation procedures in Europe in order to reduce the number of mistaken diagnoses to an acceptable level.

Under the INNOVATION Programme, a basic version of this technology has already been transferred into a company specialising in medical technology. Lisca Development now holds the exclusive intellectual property rights for further developments and marketing. Patents have already been registered in Sweden, Germany, France, the UK and Japan. The imager may also be useful in manufacturing toilet articles, cosmetics, perfumes and medicines during research, to examine the effects of new products on the skin – a huge potential expansion of the market for this technology.

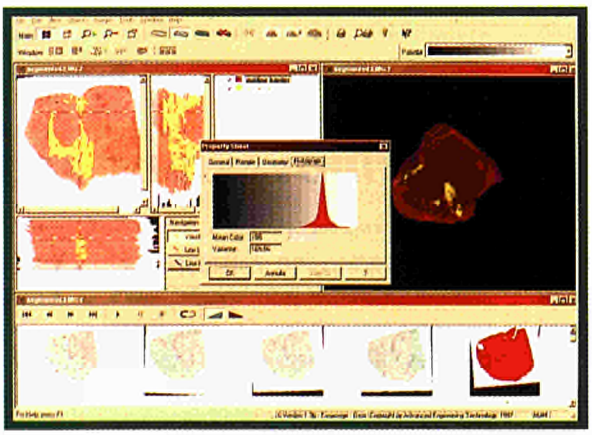
Nasal vaccines

The INNOVATION Programme is supporting a project involving a new kind of vaccine against respiratory diseases. The vaccine is delivered to the patient's mucous membranes via the nose. The English company DanBioSyst UK Ltd., which developed the vaccines, has used the INNOVATION Programme to enable it to spread its "mucosal" vaccine technology.

The project aims to test the vaccines before adapting them for use in humans, and to find the best formula for marketing them. According to the project's co-ordinator, Professor Lisbeth Illum, *"mucosal vaccines, which provoke a response from serum antibodies and those that are secreted locally, should provide greater immunity than today's vaccines"*. Among the routes explored by the project for the medical form of these vaccines is the use of polymer solutions such as Chitosan, prepared from chitin found in crustaceans. This has the advantage of already being in commercial use, in products such as slimming pills.

A PC in the microscope

The TASTY project has many interesting features. Originally the AIM programme (Advanced Informatics for Medicine, 1992–94) co-financed a project called COVIRA (Computer Vision in Radiology). This subsequently led to software capable of producing three-dimensional images from biological tissue cut into thin slices for examination under an optical microscope. For a long time the software remained experimental or too specialised and expensive (around ECU 8000) to reach a significant market.

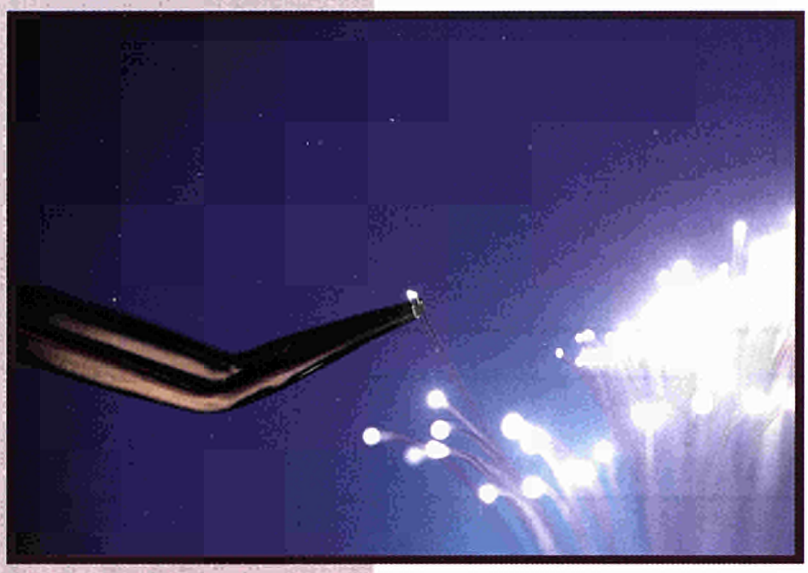


Then the University of Genoa (I) and Dr Franco Fontana decided to set up a consortium to develop a version costing less than ECU 1000. Two companies, Advanced Engineering Technology in Italy and Alphatec in Greece, joined forces with Genoa University, and the University of Thessaloniki came in as a test user.

A study confirmed a market of several thousand potential users, mostly dentists and medical analysis laboratories. At this point the team expanded to include the University of Kent at Canterbury (UK) and another department of Genoa University, both of whom are helping with the trials. The team members are confident that by the end of the project they can market the product for ECU 1000.

A demonstration version of the new software offered on the Web at http://www.aetnet.it was downloaded by fifty potential users in the first week. The research laboratory has finally got through to its market!

The JRC: Europ



The results of research work carried out by the JRC, unlike that of the joint venture projects, belong to the Community itself. Their protection, in the form of patents, copyright and trademarks, is the responsibility of the INNOVATION Programme. This work is also the subject of evaluation, exploitation and technology transfer measures. Research funded as "competitive support activities" is also managed by the INNOVATION Programme (as these three examples show).

TIME: unearthing innovations with potential

In 1997 the Seville-based Forward Studies Institute developed a new methodology for identifying and assessing EU-owned technologies worth promoting commercially. With the support of the INNOVATION Programme this tool was applied to the results of three of the JRC's research institutes.

The TIME (Technology Identification and Marketing Evaluation) model is based on four modules: Technology Description, Technology Watch, Test Market Survey and Scoring Table. TIME facilitates realistic assessments of a technology in terms of market definition, market potential, competition and market trends.

30 technologies from the JRC were screened through the first two TIME modules. 17 of them passed the test, and details of these were sent to 250 European enterprises. Of the 43 companies that expressed an interest, 26 were visited by experts. The result was that 11 of the 30 technologies assessed were judged to stand a good chance of success in the market.

Finally, with the aid of the fourth module the 11 technologies were ranked under four headings:

- the level of development of the technology;
- market potential;
- potential for innovation; and
- social and environmental impact.

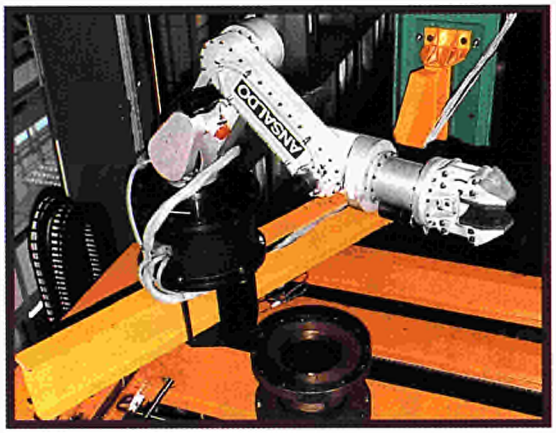
This made it possible to draw up a promotional campaign for marketing the technologies, which included subjects such as materials, specialist furnaces and sensors.

The consequences of this exercise were not limited to the technologies which passed the tests. A much improved understanding of the needs of industry has helped to give the JRC a new commercial orientation, not just for these technologies but for scientific and technical work in general.

ean producer of high technologies

GENERIS: leading the assault on the European market

Using its know-how and experience in advanced controls and robotics, the JRC's Ispra site has developed GENERIS (Generalised Software System for Industrial Robots), an affordable control program that has been adapted to the needs of industry.



The GENERIS applications package is an innovative real-time system which offers modularity and an open structure to control any type of industrial robot.

Entirely platform-independent, GENERIS provides numerous configuration options and levels of programming and calibration, making it suitable for many operating situations. The core control system is based on the multitasking operating system vxWorks (produced by Wind River Systems, Inc.) and can be enhanced by user-provided add-ons or with new functions created using a toolbox utility.

GENERIS has a multi-machine architecture which enables it to control a workshop comprising a number of robots, as well as their peripheral devices such as conveyors and turntables, and to integrate the data received from process sensors. Better still, GENERIS can easily be incorporated into distributed management systems in which a supervisor controls robots remotely. New technologies such as fieldbuses, auto-tuning systems and intelligent actuators are being integrated into GENERIS, which remains under development for use in a broad range of applications.

GENERIS has been tested and utilised with many dedicated robots used for assembly, welding and cutting, and for remote-controlled maintenance robots used in thermonuclear fusion reactors. These applications demonstrate that GENERIS can be used in any industrial sector. Its underlying philosophy is to be, at the same time, reasonably-priced, versatile and powerful.

At present GENERIS has no real competitors, since there are no other products on the market that enable small and medium-sized producers of machines and robots – or integrated systems builders – to develop their own control systems. As a result, SMEs are still over-dependent on costly turnkey solutions. The development of GENERIS is a boost for the competitiveness of European SMEs, which now have an opportunity to strengthen their positions in a market dominated by the USA, Japan and a few very large European companies.

GENERIS is on sale now, distributed by the JRC and its Italian partner ERXA srl (Turin). Together they are organising information and training conferences and preparing a series of marketing activities to increase product awareness in 1998–9.

The JRC, which is to give a public demonstration in Turin in May 1998, is seeking distributors, as well as constructors and assemblers of systems, to give GENERIS full access to the European market.

SYCLOP: the first applications

A patented innovation belonging to the European Union, SYCLOP, a remote system for monitoring human presence in controlled areas, shows off its abilities and its performance with the support of the INNOVATION Programme.

The originality of SYCLOP (Système de Contrôle pour Locaux et Objets par Parabole) lies in its ability to detect variations over time in radiative heat flux. The system detects any change heat flux over a pre-defined area, caused, for example, by a human intruder.

In an experimental laboratory belonging to the SaVeTech unit of the Institute for Systems, Informatics and Safety, JRC researchers have installed a number of SYCLOP surveillance systems as well as new types of thermal flux sensors for testing. But if its considerable potential is to be exploited, SYCLOP also needs demonstrations in real-life applications away from research laboratories.

With the help of the INNOVATION Programme the JRC is now going ahead with three industrial and commercial trials. One application that has proved the system's worth under genuine surveillance conditions is at the Dounreay nuclear site in Scotland. Dounreay stores fissile material monitored by EURATOM inspectors from the Commission, so SYCLOP's success here is encouraging.

Another trial is in a museum, where SYCLOP has been set up to carry out spot checks. This will demonstrate the system's usefulness in the surveillance and protection of public places.

Simple principles + mature technology = reliability

The basic technology of SYCLOP is very simple. The system uses a thermal sensor (a planar fluxmeter 1 cm2 in area and 200 µm thick, giving a sensitivity of the order of 3 mV/W/cm2 and a response time of less than 0.2 seconds), with a parabolic reflector to collect the thermal radiation. The sensor detects any infra-red source with a temperature between –50°C and 5000°C.

The system looks for changes in the total radiation heat flux from the area being monitored. If an intruder enters the area, the heat flux will change unless the average temperature of the intruder happens to be exactly the same as the average temperature of the background area he is obscuring. In practice this is almost impossible, so the system is extremely difficult to trick.

SYCLOP can also monitor an object or a defined volume while allowing people to move freely around it. This has obvious applications in security for museums and art galleries.

Since SYCLOP does not use a lens to focus the thermal radiation, there are none of the usual problems with optical systems, such as poor transmission at certain wavelengths. The sensor does not need to be enclosed to eliminate external noise or for cooling. Finally, the thermal resistance of the sensor is very low, so signal-to-noise ratios are high. This allows the system to work across considerable distances.

INFORMATION

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