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SUSTAINABLE DEVELOPMENT

Johannesburg, capital of the Earth

TRANSPORT

Putting rail on the map

Intellectual property

Towards a 'knowledge' market

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Editorial

Are we all cultured?

The results of the small survey we are publishing at the back of this issue bring some surprises and even raise some doubts. They show that scientific culture or, more precisely, certain aspects of scientific culture, are more developed in our society than we acknowledge.

If this were to be confirmed, it could well provoke a minor cultural revolution in the scientific world. The notion of general scientific illiteracy is a deeply rooted belief – or myth? – in the laboratory world. But how is it possible to defend scientifically such a conclusion without scientific data on the scientific culture of... scientists? And without comparing the average man or woman's scientific culture with his or her knowledge in other fields?

Whatever the case, the data presented is compatible with the notion that science, together with many of its underlying concepts and ideological principles, has permeated widely in society – to the point where some aspects of scientific knowledge are much more generally understood than is usually acknowledged. This is also compatible with the results of the latest Eurobarometer survey (RTD *info*, March 2002) which showed, for example, that Europeans have a good understanding of the role of science in our societies, its contribution to competitiveness and the importance of fundamental research.

If this line of reasoning is pursued, one possible conclusion is that the present problem has less to do with science itself than with the way it is used and viewed by society. This is also one of the messages of the Eurobarometer: Europeans have a negative attitude, not to science, but to certain aspects of scientific activity; so researchers are paying the price of being too close to – or even in the service of – governments.

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europa.eu.int/comm/research

Johannesburg, capital of the Earth

Thirty years ago, a number of high-ranking political and economic decision-makers set up a small, informal group which they decided to call the *Club of Rome*. Headed by Sicco Mansholt, who had just completed a notable term of office as European Agriculture Commissioner, the newly formed *Club* published a report, the title of which sparked immediate controversy: *An end to growth*. The message was certainly Utopian, in many ways impractical and was severely criticised by its many opponents at the time. Over the intervening years as the global economy has developed at breakneck speed this somewhat naive slogan has become a thing of the past.

Yet the furore over this Mansholt Report proved to be extremely useful. For the first time, threats to the global environment become a matter of public debate. Policy-makers and public opinion started to become aware of the problem, giving rise to an increasing research effort by the scientific community as a whole.

In 1987, on the instructions of the United Nations, the World Commission on Environment and Development, headed by Norwegian Prime Minister Gro Bruntland, developed a political concept which would quickly be adopted as an absolute priority: *sustainable development*. Bruntland's genius lies in the simplicity and realism of the stated goal: *to meet the needs of present generations without compromising the capacity of future generations to satisfy their own.*

The concept soon met with worldwide approval and, in 1992, formed the basis of one of the most important international summits in history. More than 120 heads of state and government and thousands of delegates from all over the world met in Rio de Janiero to give shape to sustainable development, in particular by adopting Agenda 21. Rio also marked the start of negotiations which led to the Convention on Biological Diversity and, most significantly, the Convention on Climate Change, otherwise known as the Kyoto Protocol.

A new world summit will be held in Johannesburg (South Africa) at the end of the summer. Some 60 000 delegates, representing governments, NGOs, companies, associations and young people from all over the world are expected to attend. Ten years after Rio (the summit will also be known as Rio + 10), it is time to take stock of progress made and to recognise that the past decade has been marked more by statements of principle than by action programmes.

At the same time, environmental sciences and technologies have progressed considerably, making it possible to confirm the all too real nature of the assault on the environment, to strengthen the foundations – social as well as scientific – for implementing sustainable development, and to propose an integrated approach to the operational measures which are needed. The European Union is playing a very major role in permitting the advance of knowledge and practice in this field, in particular through the support of its RTD framework programmes and the coordination of the European Research Area. Equipped with this essential competence, will it be able to relaunch – as it did in Rio and subsequently in laboriously implementing the Kyoto undertakings – a global dynamic for sustainable development?

Lake Mhrira (Central Tunisia).
© IRD – Jean-Pierre Montoroi

Christian Patermann
'The main obstacle to sustainable development at a global level is the existence of a knowledge divide which threatens to increasingly separate areas where science and technology are continuing to strengthen from those where the urgent need to apply their results is so cruelly apparent.'

Act two in a historic global process which began ten years ago in Rio de Janiero will be played out at the Johannesburg Summit. Europe has had a determining influence on establishing a shared global vision of sustainable development. To understand better how Europe sees the issues at stake at the upcoming summit, *RTD info* spoke to Christian Patermann, director of the European research programme on the environment and sustainable development.

Sharing

You were at Rio in 1992. You will be in Johannesburg this summer. What is the backdrop to this new world summit?

Christian Patermann: Throughout the 1990s there was considerable growth in research and reflection on environmental and sustainable development policy, especially in Europe. More than anything else, Rio sounded the 'alarm'. It was essential to convey the message that threats to the planet are very real. The main success of this first event of its kind lay in winning recognition for environmental protection at global level as an international priority to be shared by the community of nations.

Today, the vision of sustainable development is much broader. In Johannesburg, Europe will be defending the idea that the state of the environment cannot be isolated from other vital issues such as the fight against poverty, the integration of the least developed countries into the global economy, and the fight against major infectious diseases and education. We believe that global problems must be tackled in their globality.

This position was approved explicitly last year in Gothenburg by European heads of state and government. Since then the Commission has summarised this policy in the document *Towards a global partnership for sustainable development*, which was published in February 2002.

The subjects on the agenda at Johannesburg depend crucially on what science and technology are able to offer by way of sustainable solutions. What progress has been achieved since Rio?

Knowledge has advanced a great deal, but the world scientific community is currently facing a problem which goes far beyond the question of advances in knowledge. Equal attention must now be paid to sharing this knowledge.

This is an entirely new dimension and the developing countries have now generally become aware of the fact. The main obstacle to sustainable development at global level is the existence of a 'knowledge divide' which threatens increasingly to separate areas where science and technology are continuing to strengthen from those where the urgent need to apply their results is so cruelly apparent. This knowledge divide leads to a veritable impasse, which threatens to halt the necessary dynamic for a better management of major global problems.

Isn't this knowledge divide gradually closing?

The emerging countries – such as Brazil, China, India, Argentina and part of South East Asia – are now making a considerable effort to join the global knowledge society. They are constantly seeking increased scientific and technological co-operation with the world's major knowledge production centres. The challenge for Johannesburg is to extend this global partnership to the developing world as the risk of exclusion of many poor countries which are facing acute social problems has become a major concern. It is a matter for the entire world community. A major priority must be to help these countries to acquire the necessary infrastructure for education, access to knowledge and the implementation of measures guaranteeing their sustainable development.

What can Europe do in this field?

It must commit itself 100%, and sharing science and technology must become a priority in our relations with the Third World. Europe today is one of the very best laboratories where the scientific and technical tools for sustainable development are being forged. This label of excellence is a formidable opportunity to strengthen the influence of Europe's knowledge.

knowledge

'The state of the environment cannot be isolated from other vital issues such as the fight against poverty, the integration of the least developed countries into the global economy, and the fight against major infectious diseases and education.'

A dialogue between scientists and decision-makers

In making the political preparations for the Johannesburg Summit, right from the start the European Union defended the need to seize this opportunity to give scientists and research programme coordinators the chance to express their views and engage in dialogue with local political and economic decision-makers. This dialogue could shed useful new light on future prospects in a number of key areas, such as:

- the role of science and technology in sustainable development;
- the position of the developing countries in terms of scientific development (capacity building) and partnerships;
- policy-making and networking.

With this in view, the Commission has offered to assist the South African authorities in organising a 'horizontal' forum dedicated specifically to *Science, technology and sustainable development.*

We have a lot to offer thanks to our good practices in the use of resources and the management of tools, technologies and know-how. Over the past four years I have noted a genuine explosion of contacts between our researchers and researchers in the developing countries. They are interested in the results of our research on the city of the future, soil conservation, water management, coastal protection, early-warning systems for natural disasters, best practices for sustainable development, etc.

It must also be stressed that this opening up to co-operation is not only to be seen in terms of North-South relations. There is also North-North co-operation, in the context of the adhesion of the candidate states and, more widely, our relations with Russia and the other independent states of the former Soviet Union.

This further opening up to new partners is moreover laid down in the new Framework Programme which is currently on the starting blocks. There will be no exclusivity, and non-European scientific teams will be able to participate in projects approved for future programmes.

Our stated policy is very clearly to make the European Research Area more attractive to researchers – both young and not so young – who choose to work with us, but also to support researchers in the South working in their own countries. The acquisition of knowledge for sustainable development – in areas such as biodiversity or health where there are huge problems in tropical regions – is a global question which transcends borders.

Is there any rivalry with the United States when it comes to this field of influence?

In many fields we work in partnership with the US scientific community. Do not forget that we are neighbours. The North Atlantic, which separates us, is the site of phenomena which are important for the climate and which we are studying together. But it is also true that there is an element of competitiveness in co-operating with scientists in the South so as to improve our research on global phenomena.

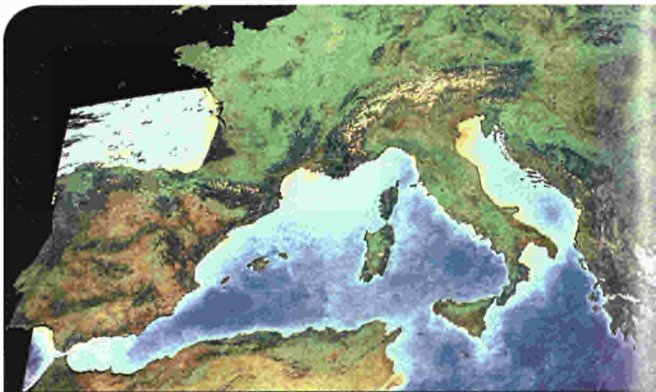
Science and the environment: a gradual awakening

The IPCC

It was just 15 years ago that the world became aware of the serious threat of climate change resulting from human activity. Under the auspices of the WMO and the United Nations Environment Programme (UNEP), a vast observation and analysis network was set up in the form of the *International Panel on Climate Change* (IPCC). The opinions of this intergovernmental research body – which collects all the latest data and models produced by teams of meteorologists, oceanologists, experts on atmospheric chemistry, and economists from all over the world – have since become an essential reference to which policy-makers are paying close attention. The impact of the IPCC's work was the catalyst for the principal policy decisions taken at the Rio Summit (1992) and subsequently laid down in the 1997 Kyoto Convention on limiting greenhouse gas emissions.

www.ipcc.ch/

Interest in the 'Earth Sciences' – and in particular the way the climate works – began in the century of the Enlightenment. But it took the contemporary development of vastly improved techniques of observation and data collection to discover the complexity of the earth's ecosystem – and to realise the impact which human activities can have on this delicate global mechanism.



Envisat's clean image – the melting of ice sheets, the effect of acid rain on forests, the hole in the ozone layer, the build-up of toxic gases in the atmosphere... The environment is now under close surveillance, thanks to the latest and most advanced Earth observation satellite. The pictures it sends to scientists enable them to take the pulse of the planet 'in real time'.
©ESA

At the end of the 18th century, the Swiss scientist Horace-Benedict de Saussure climbed the Alpine peaks to conduct experiments on the effects of the sun's rays. In 1802, the biologist Jean-Baptiste Lamarck expressed the view that 'any good approach to the physics of the earth must combine meteorology, geology and biology'. The mechanisms which control the temperature of the earth's surface began to fascinate a succession of scientists and, in 1896, the Swede Arrenhuis (1903 Nobel prizewinner) was the first to explain the key role of the carbon cycle and greenhouse effect, without which the earth would be no more than a vast uninhabitable ice field.
In 1924, the Germans Wegener and Koppen gave paleo-climatology (the study of past climates) a considerable boost. That same year, the Russian geochemist Vladimir Vernadsky – originator of the biosphere concept – was the first person to raise the question of the potential impact of deforestation on climate. His message went unheeded. Although some scientists were now starting to wonder about man's relationship with his environment, the prevailing ideology, rooted in the first industrial revolution, was that scientific development must serve to harness nature in the service of 'human progress'.

The turning point

Things began to change after the Second World War. The lack of the necessary means to observe phenomena and collect data were the main obstacles to a scientific approach and awareness of environmental problems. The creation of new international research structures, such as the World Meteorological Office (WMO) in 1951, under the aegis of the United Nations, began to make up for this deficiency.

On the occasion of the first *International year of geophysics*, it was decided to set up a global system for earth observation and the measurement of CO_2 levels in the atmosphere. 1957 was also the year when the Russian Sputnik was launched into space, heralding a new era in which man would begin to observe his blue planet from the outside. Since then space has proved an invaluable observatory in the service of the environment.

The key initiative which enabled science to instil upon the world's political community the importance of global environmental issues was the first *United Nations Conference on the Human Environment*, held in Stockholm in 1972. This resulted in the launch of the *United Nations Development Programme* (UNDP), an international structure of growing influence which, 20 years later, organised the Rio Conference and is now behind the Johannesburg Summit.

RIO +10: what's new?

Sustainable development has become a familiar term over the past decade. Reflections by science and society as to the content of the concept – originally quite vague – have also progressed a great deal. Europe advocates and is developing an integrated multidisciplinary approach in this field, one which incorporates an increasingly in-depth study of the natural and physical environment, innovation in clean technologies and the implementation of new principles of equitable socio-economic governance.

The Coroico River in the Bolivian Amazon – deforestation is inextricably linked to poverty. Farmers are clearing high-altitude tropical forest to plant cocoa or maize.
© IRD – André Fatras, Laurence Maurice-Bourgoin

One of the most notable – and instructive – events of the decade since the Rio Summit was the signing, in 1997, of the famous Kyoto Protocol on the voluntary reduction of greenhouse gas emissions (mainly, but not exclusively, carbon dioxide or CO_2). Implementation of this agreement – a laborious process that is still at the discussion stage – shows to what extent the problem of sustainable development introduces an entirely new context. It involves going beyond a uniquely environmental view of global change to embrace, simultaneously, a multitude of political, economic and social aspects.

The North-South divide

After Kyoto the real test lies in implementing the essential measures for global sustainable development and overcoming the divide between the acceptance of the notion by the industrialised countries and the reluctance of the developing countries.(1) The present environmental debate highlights the importance of the future of the developing countries, the key question for the Johannesburg Summit.

The equation is easy to formulate but hard to solve: these countries, especially the poorest, urgently need strong and sustained growth to generate an increase in their living standards in all sectors. Yet, at the same time, their quality of life is under threat: apart from having to meet basic quantitative needs, more than others they are facing major environmental problems with fast-growing populations and chaotic urban sprawl - with all the consequences in terms of pollution, health problems, and the development of adapted infrastructure which are infinitely more difficult to manage than in the rich countries.

Don't repeat past mistakes

The developing countries are also particularly vulnerable to the effects of climate change, such as rising sea levels, increasing desertification and extreme weather conditions. They are partners with a high level of demand for sustainable development – provided they receive assistance.

In terms of catching up on living standards it would be absurd for them to repeat the past mistakes of the rich countries, whose 'bad habits' born of a traditional ignorance of the requirements of sustainability are mainly responsible for the planet's problems today. Developing new 'clean' technologies designed specifically to meet the needs and means of the developing countries is therefore becoming a research priority.

••

In the industrialised countries, the question of sustainable development is posed in different terms. In this case it is a question of redefining needs and lifestyles. They bear an enormous responsibility in this respect and must show a commitment to reform which will not come easy. New sustainable practices require sometimes painful sacrifices in terms of competitiveness, conversion and changes in 'consumerist' behaviour.

Requisitioning science

The expectations of science and technology in tackling this North/South issue – a twofold problem which requires a global approach – are considerable. Efforts have been stepped up as a result, in particular in the approach adopted by European research during the past five years under the *Energy, Environment and Sustainable Development* programme.

Although the basic role of science is to take the real measure of the state and evolution of the environment and report the findings to policy-makers and the general public, science has now been 'requisitioned' to formulate possible adaptations and remedies as a basis for sustainable development. Of course there is the vast field of the creation of clean technologies but, above and beyond the technical measures (rooted in what are sometimes referred to as the 'hard' sciences), there is now a general awareness of the need to better integrate research on economic and social sciences.

The answers which science and technology can bring to environmental problems are coming increasingly to be judged with reference to the changes they bring in society. They impose choices of governance, the impact of which on economic and social groups must be measured in terms of efficiency, the spread of costs and social or regional equity. This is only possible if research also seeks to develop the methodologies needed by such evaluations.

It is on the basis of this kind of holistic approach that Europe intends to defend the argument for sustainable development at the Johannesburg Summit.

(1) The different visions of these two blocs should not be reason to forget the sometimes conflicting approaches amongst their members – such as President Bush's renunciation of US commitments given in 1997.

Johannesburg on the web

- *Official United Nations site devoted to the Summit:*
  www.johannesburgsummit.org/
  www.earthsummit2002.org/
- *Presentation of the Johannesburg Summit on the Europa site*
  > *Environment DG*
  europa.eu.int/comm/environment/wssd/index_en.html
  > *Development DG*
  europa.eu.int/comm/development/events_fr.htm
- *'Global Forum' site of the OGN coalition*
  www.worldsummit.org.za/
- *World Business Council for Sustainable development*
  www.basd-action.net/
- *European Rio+10 Coalition*
  www.epe.be/objective2002/
- *Multi-media presentation of initiatives for sustainable development*
  www.virtualexhibit.net/

A practical guide to Johannesburg

The Earth Summit will be preceded by preparatory meetings at local, national and then regional level within the four main regions of the world: Latin America and the Caribbean, Europe and North America, Africa, and Asia and the Pacific.

Three preparatory 'global' meetings will then try to channel the work of the Summit, identifying specific priority problems and possible solutions. In addition to the many experts, delegates will also have access to a series of reports drawn up by UN agencies. Examples include the WHO reports, the World Bank *World Development report*, UNESCO's *Report on World Water Development*, and the United Nations Environment Programme's *Global Environment Situation.*

During the Summit itself the debates should make it possible to prepare a *Johannesburg Declaration*, an official text setting out global policies seen as priorities for the current decade. This new universal charter should restate - although, crucially, it remains to be seen in what terms - the undertakings of the players in tackling the various aspects of sustainable development, namely pollution, energy, water, education, health, climate, poverty and the role of science and technology.

European excellence

Marine ecosystem

Inventory of practical and biological data on deep-water fish threatened by the fishing industry and whose reduction in numbers is jeopardising the balance of underwater systems.
Developing deep-water fisheries – 13 partners, 10 countries
www.sams.ac.uk/dml/info/staff/jdmg.html

Plant biodiversity

The observation, measurement and comparison of the effects of biodiversity and the consequences of its loss throughout the European continent, in all climates and at all latitudes.
Biodepth – 9 partners, 8 countries
forest.bio.ic.ac.uk/cpb/cpb/biodepth/contents.html

Climate and society

Climate change does not only affect the natural environment. What is the potential socio-economic impact of climate change, especially at regional level? Four scenarios as an aid to reflection (and possibly decision-making) on the interaction between climate change and socio-political functioning.
Acacia – 39 partners, 12 countries
www.pik-potsdam.de/cp/europa/euro_2.htm

Carbon cycle

To reduce greenhouse gases it is necessary to know the real storage capacities of forest ecosystems. But how to measure them? 190 scientists from various fields are developing methodologies and comparing results, in Europe and tropical regions, to permit an evaluation of the phenomenon.
CarboEurope – 69 partners, 15 countries
www.bcg-iena.mpg.de/public/carboeur

Climate change

Mountain lakes do not escape the effects of air pollution. By studying these sensitive ecosystems it is possible to understand climate change and trace developments over centuries.
Molar – 23 partners, 13 countries
www.niva.no

Europe has been a leading player in the vast international movement of the past two decades for sustainable Earth governance. It has been and is continuing to be a motor in the development of global environmental programmes and networks, and in particular in the major negotiations initiated by the Rio Summit and the Kyoto Protocol. This active influence is rooted in a huge and growing effort in the field of legislation and research as a result of which Europe is one of the world's best centres of excellence today in the field of the environment and sustainable development.

This growing concern about environmental issues in the European Union got off to a somewhat timid start in the 1970s. This was the time of the first European directives on subjects such as the quality of drinking water, limits on the polluting emissions of thermal power stations and waste disposal management.

Horizontal spread

Environmental awareness gradually spread to increasingly varied fields, such as agricultural policy, fisheries, transport, energy, enterprise policy, health and consumer protection. An Environment Directorate-General was set up to coordinate an overall vision, headed by a Commissioner with specific responsibility for these issues - at present Margot Wallström of Sweden.

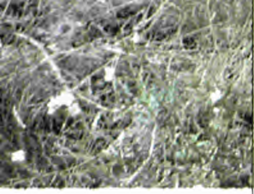
The Environment DG has become an essential element of the Commission, charged with the horizontal management and promotion of the principles of sustainable development policy. It works in co-operation with all the other operational services charged with incorporating the sustainability dimension in their activities.

In the mid-1990s, the Union also set up the European Environment Agency, based in Copenhagen. Its task is to collect and analyse all the data and results of studies on sustainable development in Europe.

Research: a growing priority

Another key dimension of European policy for sustainable development is research. The Joint Research Centre was the first to take the initiative in this field, undertaking valuable work on the use of satellite data.

The Union's science and technology policy, aimed at active co-operation between teams of scientists in the Member States, has also expanded considerably, in particular during the three successive Framework Programmes for research and development during the 1990s. At the same time, the environment came to occupy a place of increasing importance within these programmes.

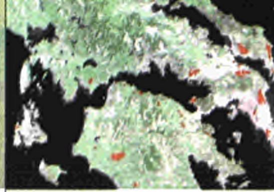


Purifying plants

Many research projects are studying the possibility of using plants in the service of the environment (plants able to break down pollutants, fuel or lubricants of plant origin, etc.). One such project showed that when *Arabidopsis halleri* is planted on sites contaminated by heavy metals it is able to absorb some of the pollutants.
Metallophytes – 10 partners, 6 countries
www.biobase.dk/~palmgren/metallophytes.html

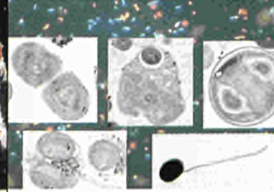
Sustainable energy

The use of renewable energy sources is vital to preserving the environment. But their use must be rationalised and integrated into traditional electricity distribution networks, in particular through models which forecast energy demands.
Care and Morecare – 6 partners, 4 countries
power.inescn.pt/morecare/



Management of natural risks

The combined use of satellite pictures and other data allows researchers to assess the damage caused by natural disasters and to give advance warning. The Ispra Joint Research Centre is looking in particular at floods and forest fires (here, a map of the fires which destroyed almost 100 000 hectares in Greece in 1997-98).
Institute of Space Applications, Joint Research Centre – Ispra
natural-hazards.aris.sai.jrc.it/fires



Ecosystems

Thousands of picoplankton, about which very little is known, make up a large part of plant plankton. These minute organisms - less than 3μ in size - have a 'minimal' genome and should be able to tell us more about the ecosystem in which they develop and even about possible global changes. Here, the epiflourescent picture shows various populations of picoplankton.
Picodiv – 5 partners, 5 countries
©CNRS, D. Marie Roscoff
www.sb-roscoff.fr/Phyto/PICODIV/

Desertification

For the past decade multidisciplinary research groups have been studying desertification in the Mediterranean countries and developing measures adapted to different situations in an attempt to combat it.
Medalus – 30 partners, 10 countries
www.medalus.demon.co.uk/

Humid zones

Europe's humid zones (marshes, peat bogs, deltas) are a unique resource of animal and plant life. By co-operating closely with humid zone managers, scientists are making available knowledge and management tools producing tangible effects.
Protowet – 5 partners, 5 countries.
www1.rhbnc.ac.uk/rhier/protowet/wfarp.htm

The Fifth Framework Programme (1998-2002) allocated a budget of almost €3.1 billion to research under the six key actions of the *Energy, Environment and Sustainable Development* programme, the working themes of which are set out in the table opposite. A total of 1 177 transnational research projects involving thousands of scientific teams have generated a considerable body of knowledge and know-how.

The environmental dimension is lasting and, what is more, is present in many other areas of the Fifth Framework Programme, such as the *Growth and Sustainable Development* programme.

A great many research projects under the *International Co-operation* programme (INCO) also have a significant environmental dimension, as do research actions with Southern countries and the favoured scientific relations the Union is developing with candidate countries as well as with Russia and the former Soviet states which are facing often major environmental problems.

Turning point at Gothenburg

For more than two years now, the European Union has pursued a process of reflection and strategic structuring designed to give a coherent direction to its policies. In June 2000, the Lisbon Summit confirmed the priority awarded to creating a *knowledge-based society*. The Gothenburg Summit subsequently declared a need for all the Union's policies to promote the interests of *sustainable development*.

To ensure this operational strategic option will be applied as quickly as possible, approaches and sectors of a nature able to yield significant results in the field of sustainable development have been identified. All Community policies must in future be based on an integrated evaluation of their likely economic, social and environmental impact (see box *Sustainability Impact Assessment*).

At Union level – and in fields such as industry, agriculture, transport and fisheries – any new economic initiative, technological change or legislative framework must include an analysis of the effects in terms of climate change, the use of clean technologies, the rational use of renewable resources, protection of biodiversity, waste limitation, health protection and social and regional equity.

This European strategy for sustainable development has also become an essential element of the Union's external policy as will be clearly announced at the Johannesburg Summit. Europe is committed to taking into account the specific problems of the developing countries which are often similar to our own, but set in a much more difficult economic and social context.

Sustainable cities

How to make cities viable for all, by combining air quality, employment and economic health, quality and reliability of transport, etc. Research in the field and decision-making aids for urban development.
Spartacus – 5 partners, 4 countries
www.ltcon.fi/spartacus/default.htm

Ozone hole

Since 1991, hundreds of European and US chemistry and stratospheric chemistry experts have worked on research programmes using highly sophisticated instruments to study the 'ozone hole' over the Antarctic.
Theseo – An impressive number of scientists from all over Europe are working in co-operation with teams from the United States on this project.
www.nilu.no:80/projects/theseo2000/

Warming

Could climate change cause melting of the permafrost – the permanently frozen layer of subsoil in mountainous or cold Northern regions? The threat is being taken very seriously by researchers worldwide.
Pace – 17 partners, 7 countries
www.cf.ac.uk/uwc/earth/pace

Tropical forest

Malaysian and Filipino researchers, in partnership with French, British and Finnish teams, are developing forest-care techniques designed to restore the tropical forests. Mycorrhizal fungi, for example, have been introduced into poor soils to favour the growth of Dipterocarps (here, introduction to the roots under nursery conditions).
Dipterocarp domestication and harnessing mycorrhizal symbiosis
5 partners, 5 countries including Malaysia and the Philippines
www.ecology.helsinki.fi/english/research.html

Environmental management

How do the public view climate change? What energy policies do they envisage to live in a more sustainable local environment? What sacrifices are they prepared to make to preserve the place in which they live? The evaluations by human science researchers in seven European towns show the importance of public participation in environmental management.
Ulysses – 10 partners, 8 countries
www.zit.tu-darmstadt.de/ulysses/

Oceanography

Geostar, a complex and highly capable 'machine' with a remote-controlled shuttle, a laboratory station able to remain for one year at a depth of almost 400 metres, and a continuous communication link with the surface, enables scientists to study life under the most extreme conditions.
Geostar – 3 partners, 3 countries
www.ingrm.it/GEOSTAR

Sustainability Impact Assessment

This term refers to a new tool designed to improve the quality and coherence of any policy in terms of sustainable development.

Sustainability Impact Assessment (SIA) systematically measures the impact of a policy on the environment, the economy and the social dimension, and checks that all the latter are developing in a direction favourable to sustainability.(1)

This new methodological approach therefore requires the development and use of the specialised knowledge that is already – and in the future even more so – incorporated in the Community research priorities of the Sixth Framework Programme. Here are some examples:

- Economic research: evaluation of macro- and micro-economic impact, in particular in terms of employment and competitiveness; cost estimation of policies, especially 'external' costs; impact in terms of innovation and the development of clean technologies; repercussions for the market and world trade in goods and services and on prices.
- Social sciences: impact on social cohesion and employment; compatibility with the EU Charter of Fundamental Rights; equal opportunities; improvement of working conditions; progress in reducing exclusion and poverty.
- Environment: potential positive or negative effects of actions on climate change and biodiversity; effect on water, air and soil quality; assessment of sustainability limits beyond which irreparable damage is done to ecosystems; potential harmful effects on health.

(1) The SIA approach is frequently cited by the Union in the positions it defends within the WTO.

European research on energy, the environment and sustainable development

▸ *Fifth Framework Programme (1998-2002)*
europa.eu.int/comm/research/eesd.html
europa.eu.int/comm/research/energy/index_en.html
www.cordis.lu/eesd/src/research.htm

▸ *Fourth Framework Programme (1994-1998)*
europa.eu.int/comm/research/envir1.html
www.cordis.lu/env/home.html
www.cordis.lu/mast/home.html

A selection of brochures on European research and the environment (can be consulted on the internet)

▸ *Environment, Energy Europe (in English)*
europa.eu.int/comm/research/eesd/leaflets/fr/index.html

▸ *The Threat of Natural Disasters (in 11 languages)*
europa.eu.int/comm/research/leaflets/disasters/en/index.html

▸ *Planet under Pressure (in 11 languages)*
europa.eu.int/comm/research/leaflets/changes/fr/index.html

▸ *Endangered Heritage (in 11 languages)*
europa.eu.int/comm/research/leaflets/heritage/en/index.html

▸ *Water: A Vital Resource under Threat (in 11 languages)*
europa.eu.int/comm/research/leaflets/water/fr/index.html

▸ *Case studies – The Path to Sustainability*
www.cordis.lu/eesd/src/mtr_contents.htm

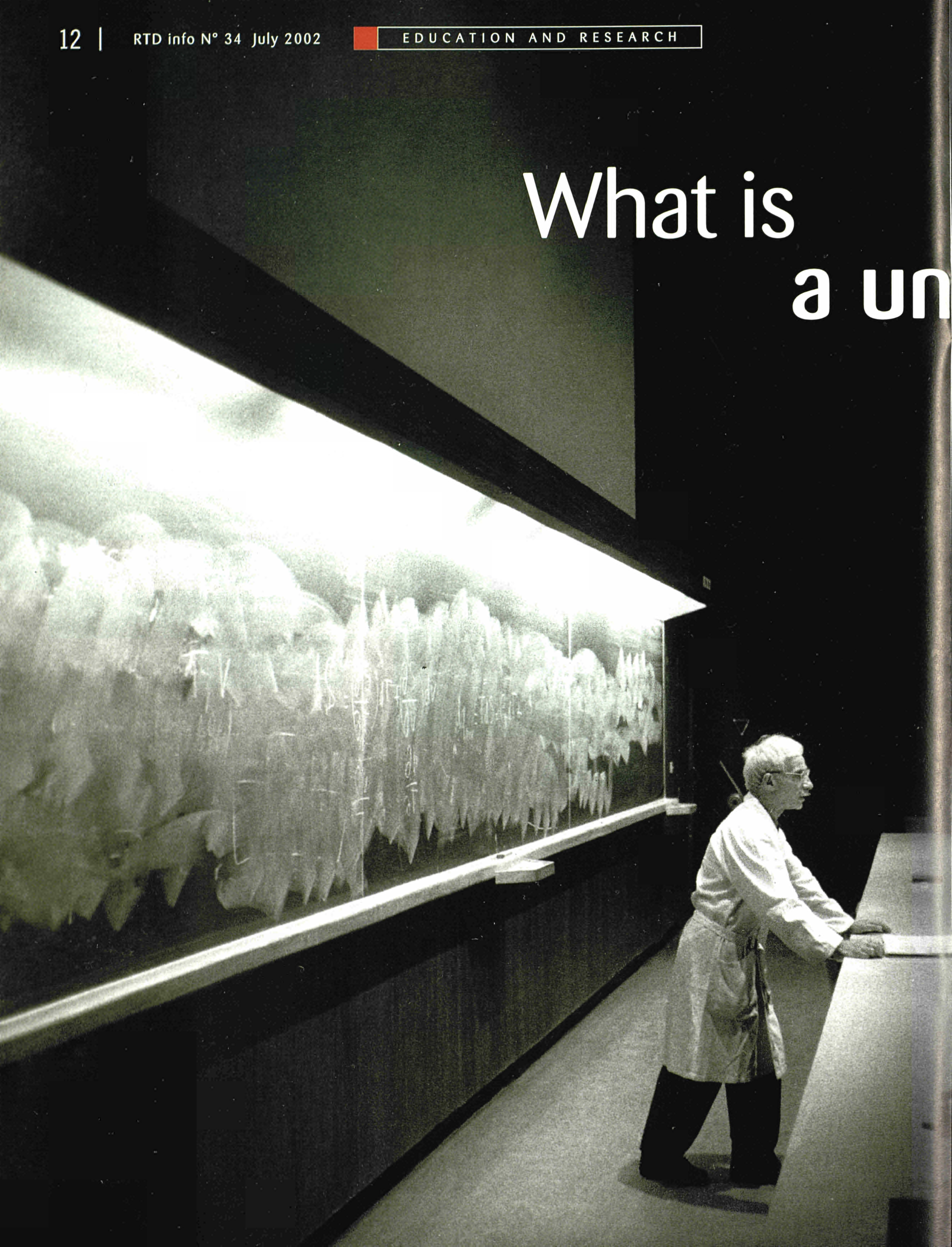
▸ *Sustainable Development in the Cities*
ftp.cordis.lu/pub/eesd/docs/cities_sus_development_en.pdf

▸ *Fuel Cells Powering the Future – Sustainable Power for the European Union*
www.cordis.lu/eesd/src/ev290500.htm#brochure

▸ *Energy Storage – A Key Technology for Decentralised Power, Power Quality and Clean Transport*
ftp.cordis.lu/pub/eesd/docs/db_energy_storage_eur19978.pdf

▸ *Photovoltaics – An Energy Resource for the European Union*
ftp.cordis.lu/pub/eesd/docs/db_photovoltaics_eur20015.pdf

What is a un



There are 1 000 public universities in the European Union, employing more than 1 million staff and attended by around 15 million students. These complex institutions, which jealously guard their traditional autonomy, are accountable to the public authorities that grant their funds and set their missions. In a changing socio-economic context, universities must give value for money - which is why the evaluators keep a close eye on them.

iversity 'worth'?

How can we judge a university? How can we assess the quality of its teaching and research? Should comparisons be made between institutions, countries or disciplines? What constitutes a centre of excellence? What is the role of universities in their socio-cultural and regional context? Should their performances be linked to funding and, if so, which performances? As cultural and educational institutions, as well as providers of values, over the past decade universities have been under growing pressure to supply an efficient service.

Sounding the alarm

'It was computerisation that seems to have first sounded the alarm that all was not always well. When universities had to adapt software programmes to their needs, they became aware of just how many different fields they had to manage – personnel, student education, research, finance, buildings and facilities, insufficient transparency, internal contradictions, and a lack of reliable information and statistical data.' This is the conclusion of Pierre Dubois, professor at the University of Marne-la-Vallée (one of the small newly created universities close to Paris) and coordinator of the Evalue research project, which carried out a major European survey on the subject of evaluation (see box). 'Eleven research teams from eight countries studied very closely the various external and internal methods of evaluation applied to a significant number of European universities. The aim was to try and determine, very pragmatically, the usefulness of audits - very much the fashion at the time – and to judge to what extent they could be a factor for progress.'

The Evalue project

A team of 23 researchers worked on the Evalue project, which was completed in 1998, analysing 31 case studies of evaluations made at public universities in eight countries (Finland, France, Germany, Italy, Norway, Portugal, Spain, United Kingdom). Their main aim was to find out if evaluation could stimulate improvement in university performances. The answer was 'yes' – at least under certain conditions. This resulted in them suggesting an evaluation model meeting four criteria: a *pluralist* approach favouring a participative method; a *contextualised* approach taking into account the institution's specific environment; a *dynamic* analysis focusing on its past, culture and objectives; and a *global* perspective taking into account links between the institution's activities.

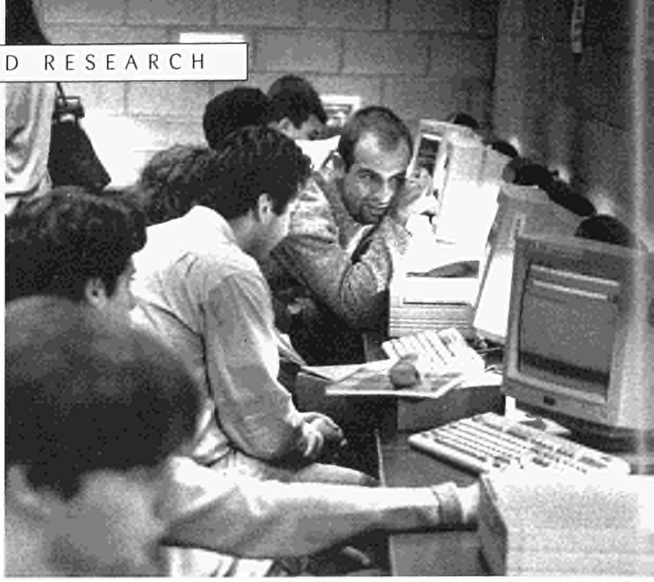
Contact: Pierre Dubois, université de Marne-la-Vallée (F) dubois@univ-mlv.fr

Monitoring AlmaLaurea

Founded at the University of Bologna and supported by the Education Ministry (MIUR), AlmaLaurea is a consortium of 19 Italian universities. Its mission is to monitor continuously the 'efficiency' of Italian universities, in particular the relationship between educational performances and graduate entry to the job market. By operating as a genuine observatory with continuously updated data, AlmaLaurea is a valuable link between the world of the university campus and the world of work – a priority objective being a closer focusing of education policy on the latter. Graduates can enter their CV in the consortium's database of 250 000 CVs, representing 55% of Italian university graduates, which companies can then consult.

AlmaLaurea publishes an annual report entitled *Profilo dei Laureati* which highlights trends in the student population (origin, choice of studies, success rate, career choices, etc.). Other topics are also regularly studied, including teaching quality, student mobility, and professional status at various points in time (one, two and three years after graduating), the latter presented in the annual report entitled *Indagine sulla Condizione Occupazionale dei Laureati*. AlmaLaurea is at present enlarging its activities to make its services available at European level.

www.almalaurea.it



Research

Research evaluation is focusing increasingly on the 'quantitative' aspect by using internationally standardised references, such as the ability to raise funds, frequency of requests for expertise, number of publications, intensity of international co-operation and mobility, number of post-doctorate students, creation of spin-offs, etc. While researchers often accept these criteria with a view to future financing, this does not make them blind to the negative effects, such as a slide towards risk-free research and duplication of publications on the same subject.

Teaching

When it comes to teaching, a programme is not evaluated solely in terms of content, but also organisation and educational environment (libraries, student counselling, etc.), knowledge testing, examination pass rates and career opportunities. Entry selection, the route leading to success or failure, the social and academic characteristics of students and other matters can also be studied.

Education/ Employment

This is a very sensitive field in which the qualifications obtained, economic environment, mobility and competition between universities all play a role. Although few evaluations have been carried out in this field, some practices are particularly dynamic, those of AlmaLaurea in Italy (see box) being one notable example.

Environment

A university is a complex socio-economic infrastructure of teachers, researchers, administrative staff and students with a significant impact on local development in terms of consumption, cultural and social activities, and opportunities for partnership and technology transfers with local businesses.

New missions

This in-depth and painstaking study highlighted a number of complex issues relating to the development of public universities. As administrations and companies, the education they provide is no longer in the service of an élitist culture. Their role is wide-ranging: with close links to economic and social life, they disseminate scientific and technical expertise, make culture available to the general public, and contribute to national and/or regional development (in particular through applied research). In the interests of democracy, more universities are being created, existing ones decentralised and increasingly diverse diplomas and study possibilities (flexible study hours, etc.) being made available. These are all changes which bring new missions and more partners.

'Experimental' audits

It was against this background of change and managerial culture that the national public authorities turned increasingly to external evaluations. Two approaches were possible: to compare the teaching of a given discipline in all any one country's universities (thereby assessing competencies at national level), or to compare the various faculties of the same institution (with a possible stimulating effect). 'At first, private consultants were brought in,' explains Pierre Dubois. 'They made the mistake of approaching universities as if they were companies and applied traditional evaluation methods which were ill-suited to the specific nature of university management. Most were way off the mark. After this somewhat experimental phase, it became recognised that the main contribution of an external audit was to encourage the development of an internal evaluation. Although initially imposed from outside, these checks progressively generated a process of self-assessment that was very positive once the interested parties entered into the spirit of it.'

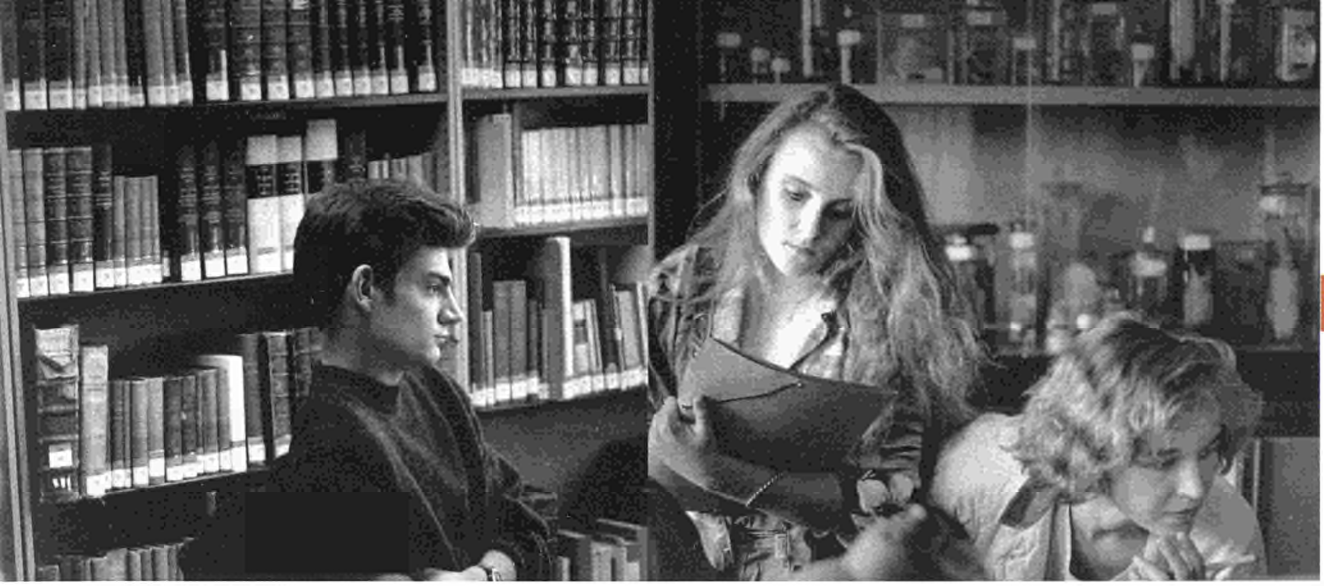
External-internal complementarity

Italy, without a doubt, applied this double approach most successfully. Statutory and compulsory since 1993, external audits are managed by the National Committee for University Evaluation under the auspices of the Ministry of Education, universities and research centres. Each institution also has its own Nucleo de valutazione which makes an internal evaluation. 'Only a co-operative evaluation with shared objectives can introduce change and culminate in success. No method can effectively evaluate the performance of universities without involving those who work there,' points out Stefano Boffo of Rome University.

He believes that the Nucleo plays a fundamental role. 'Universities used to allocate their research funds on a per capita basis in proportion to the rank of the individual, whether a full professor, assistant professor, or researcher. In recent years, some universities, and in particular certain faculties – mainly in scientific disciplines – have switched to a system based on an evaluation of research results.'

In Norway, systematic evaluations have been a legal requirement for all institutes of higher education since 1995. As the system was already in operation the legislation was largely confirmation of a long tradition. 'We have a positive approach to evaluation,' explains Anne-Lise Hostmark Tarrou, professor of education sciences at the Akerhus Centre for Advanced Studies. 'The National Research Centre audits the disciplines at the various institutions and also compares their results with those of other countries, with the aim of helping them to improve.'

Anne-Lise Hostmark Tarrou worked on the Evalue project, seeking to promote field work. Case studies and in-depth interviews made it possible to analyse teaching practices with reference to an evaluation chart based on the degree of openness to interdisciplinarity, student performance, admission and selection criteria, etc. 'This approach is a means of improving an institution's overall quality, as well as being an instrument of self-assessment for any teacher or researcher wanting to improve his or her own work. Evaluations can also ease tensions: between different teaching methods, fundamental and applied research, teaching and administrative staff, lecturers and students, etc. Our own institution learned from the Evalue project in terms of regional development. We used to be scattered over several sites in the Oslo area, but have now opted for a single site where we will be able to develop closer links with local companies.'



Mixed strategies and sentiments

Such systematic evaluation is far from being accepted practice, however, especially in France. 'It is rare for there to be any evaluation of university teaching and, even if there is, it is not a sustained evaluation. Despite being obligatory in principle since 1997, assessment by students remains infrequent. Evaluation is also seen as an inspection and a way of checking up on university lecturers who are more likely to make career progress by concentrating on research and publication than making a commitment to teaching,' points out Jacques Dejean, consultant and professor of management at the Ecole supérieure d'ingénieurs en électrotechnique et électronique (EISEE), who has just submitted a report to the Haut Conseil de l'évaluation de l'école.(1)

'The evaluation strategy varies from one country to another,' continues Pierre Dubois. 'In Finland or northern Germany, for example, the financial question is important and evaluations look far more closely at budget management and possible economies of scale. This approach is growing and is justified when you consider that a university is not just a public administration and group of professionals, but also an enterprise producing services with limited resources.'

Is this model readily acceptable? 'Although evaluation is systematic in Italy, the universities approach it very differently,' points out Stefano Boffo. 'Some use it as an opportunity for innovation and change. Others see it as a bureaucratic constraint. The vice-chancellors have a crucial role. Some use evaluation as a kind of tool with which to introduce the changes they themselves want. Others fail to use the potential of evaluation because they are most interested in maintaining balanced relationships with the various players.' ◗

(1) Cited in "L'université souffre d'un défaut d'évaluation", Le Monde, *6 May 2002*

Marks out of ten for the teachers...

Italy

Student evaluators? Andrea Cammelli, who teaches at Bologna University, considers the results to be very satisfactory, at least at her university: 'Asking students to assess the quality of teaching has brought about certain changes in the attitudes of teaching staff. They respect timetables, teach themselves rather than delegating courses to an assistant, and make more effort in preparing courses and teaching material.' Stefano Boffo of Rome University describes having students evaluate their teachers as unimaginable just a few years ago. Stipulated by the National Committee, it is now a general and accepted practice in virtually all of Italy's universities.

Switzerland

Geneva University has had a training-evaluation section since 1998. Evaluations take student opinions into account, inviting them to appraise the teaching (methodology, learning context, etc.) and not the teacher. Nevertheless, Nicole Colet, author of the last audit report, points out that 'the evaluation is influenced by human and affective factors which make it a very delicate matter, which is why we remain very cautious about how we interpret data supplied by student questionnaires and the conclusions we draw.' Evaluation also has certain pitfalls in itself, such as the temptation for some teachers to deliberately curry favour with the students if they are concerned about their score...

France

A survey by what are known as student 'training delegates' at the University of Marne-la-Vallée revealed that a vast majority of young people feel dissatisfied and ill-informed, and find it hard to conceive of what their role could be within the structures already in place. A 'university administrator' diploma has been created to stimulate their involvement. Courses cover topics such as university management and how to break down a university budget, developing and analysing evaluations, and submitting reports on organisational matters. This innovation seems to be both very motivating and much appreciated by employers who read it on a curriculum vitae.

To find out more

National evaluation institutes

- Denmark – The Danish Evaluation Institute (EVA) www.eva.dk
- Spain – Instituto Nacional de Calidad y Evaluacion (INCE) www.ince.mec.es
- France – Comité National d'Evaluation (CNE) www.cne-evaluation.fr
- Italy – Istituto Nazionale per la Valutazione del Sistema dell'Instruzione (CEDE) www.ced.it
- Norvège – Site du Ministère norvégien de l'éducation www.odin.dep.no/udf/English
- The Netherlands – Center for Applied Research on Education (University of Twente) www.to.utwente.nl/octo/octohome.htm
- Portugal – Instituto de Innovacao Educacional (IIE) www.iie.imin-edu.pt
- United Kingdom – Higher Education Funding Council for England (HEFCE) www.hefce.ac.uk

International programmes

- Eurydice (education information system supported by the European Commission's Socrates programme) www.eurydice.org
- International Association for the Evaluation of Educational Achievement www.iea.nl
- Pisa project (OCDE) www.pisa.oecd.org/

Other links

- Can be found at the Italian Research Ministry's website www.miur.it/osservatorio/linke.htm

Towards a 'know

The days when knowledge acquired in academic scientific circles was handed down and available for all are well and truly over. In today's knowledge circles, acquisition goes hand in hand with protection and exploitation. Patents and, more generally, intellectual property rights (IPR) are very much the 'hot topic' in the world of public research.

'The ultimate aim of public research is no longer simply to produce scientific knowledge but also to promote the concrete use of the emerging opportunities for progress it generates. In a market economy, this exploitation of research results has an intrinsically economic dimension,' stresses an expert at the Research Directorate-General responsible for the sensitive issue of IPR. 'Scientific and technological innovation is increasingly the result of networking between industry, academic laboratories, high-tech SMEs and the public authorities. Intellectual property rights have become a key issue for these network members.'

Public research in the hot seat

Intellectual property rights (IPR) are a complex strategic issue for academic researchers. In a world where the tendency to patent is growing, they too see this as a way of protecting their own results. In particular, they are interested in the revenue a patent can generate, to counter the inadequacies of public financing.

Yet this is a situation which raises two fundamental questions and is the subject of heated debate. First of all, at the scientific level, is there not the danger that this rush to patent will, by virtue of the 'exclusivity' it introduces, put a brake on the dissemination of and access to knowledge, which is one of the missions of public research? This has prompted many European academic researchers – who face the 'publish or patent' dilemma (see following article) – to demand a 'grace period', which industry largely opposes.

The second question concerns the technical nature – and the cost – of procedures to obtain IPR, for which public research institutes are sometimes ill-equipped and inexperienced.

This is why the European Commission, which clearly encourages the protection of research results in its R&D framework programmes, is currently considering ways of making things easier for scientists. Most notably, the Commission embarked recently on an ambitious project to create a 'Community patent' which would permit the unitary protection of inventions at Union level, at a reduced cost and with greater legal safeguards than presently offered by the European patent, applied since 1978.

The experimental exception and documentary resources

Another member of the team working on these issues at the Research DG believes that 'the fear of conflict between the protection of intellectual property and scientific activity is unfounded. In Europe (note: in the United States the situation is less favourable), patent law includes what is known as the *experimental exception*, where a patented invention can be used freely by researchers for experimental purposes… provided of course they do not go on to use it in a commercial application which would constitute an infringement of the patent.'

Moreover, patent offices' databases, which are openly accessible, are a valuable resource of which too few people are aware. The European Patent Office (EPO) databases, located in Munich (Germany), contain almost 36 million documents. This information source is all the more useful as a patent is, above all, a publication providing a detailed description of an invention. The EPO also systematically communicates any genetic sequences contained in patents to public databases. It is, for example, linked directly to the European Bio-Informatics Institute near Cambridge (United Kingdom).

A cultural revolution

It is essential for the world of public research to adapt to a new cultural landscape in which IPR are more than just a means of financing research activities through the subsequent exploitation of results. 'Intellectual property rights should be used at every stage of a research and development project. They are not just tools to provide legal protection when a project is completed, but multi-purpose instruments facilitating project preparation, making it possible to obtain information on the state of the art in fields where progress and the best partners are being sought, and increasing the prospects for the material exploitation of results to benefit the whole community.'

IPR are in a way the 'currency' of the knowledge society, which is now developing, in which multi-facetted knowledge must often be the subject of complex transactions leading to the design of products which are equally complex.

ledge' market

Reference studies

Most of the points raised in this article were discussed by groups of recognised experts drawn from various fields. Their conclusions and recommendations are summarised in a series of reports which are freely available on the Internet europa.eu.int/comm/research/area/ipr_en.htm. One of these deals with the global approach to the strategic use of IPR as considered above. Others examine the central role of IPR in new forms of research – in particular international R&D projects where it is necessary to allow for differences in patent law between Europe and the United States – or in joint research based on the intensive use of telecommunications networks which pose specific problems in the areas of copyright and database protection. Another example is in the field of bio-informatics, which uses huge databases on the human genome. The overall conclusion of these studies is that, if used appropriately, far from being an obstacle to scientific progress, IPR can be an essential tool in increasing the socio-economic impact of research.

IPR in the new framework programme

The Sixth Framework Programme's new rules of participation clearly reflect current IPR issues.(1) "The approach the Commission proposes is inspired by a desire to encourage the material use of research results as well as being prompted by calls from participants (especially in industry) for simplified procedures and better legal safeguards. Many of those participants consider previous rules to have been too 'open' in certain respects. The rules proposed offer a high degree of flexibility making it possible to adapt to different configurations depending on the type of project,' explains an expert from the Research DG. Within a simplified framework, access to either pre-existing knowledge or that generated by a project by participants or third parties can be negotiated on a case-by-case basis. In particular, a participant will only have to provide access to his knowledge if a second participant needs it to use knowledge he has developed himself. Also, results need only be protected when appropriate, implying recognition of the legitimacy of alternative approaches – such as the free dissemination of results without any protection, i.e. placing them in the public domain.

These rules are also adapted to the new 'instruments' (new types of projects) proposed by the Commission, some of which will involve more partners and, inevitably, partners joining or leaving a project while it is under way. This is no more than a basic framework, however. 'The important thing is for the projects to genuinely manage IPR and the exploitation of results (dissemination, licences, spin-offs, marketing) which are all closely linked and require professional management. These aspects will also be considered when evaluating proposals,' explains the Research DG.

(1) The document proposed by the Commission can be consulted on the Europa site at europa.eu.int/eur-lex/fr/com/pdf/2001/fr_501PC0822.pdf

The harmonisation issue

European legislation on the ownership of the R&D results from universities and public research centres is far from harmonised and can seriously complicate the management and exploitation of IPR. While the United States has opted for a blanket solution attributing ownership of IPR to public research institutes, the situation in Europe is more mixed: sometimes the state owns the intellectual property rights, sometimes the research institute and sometimes the researchers themselves.

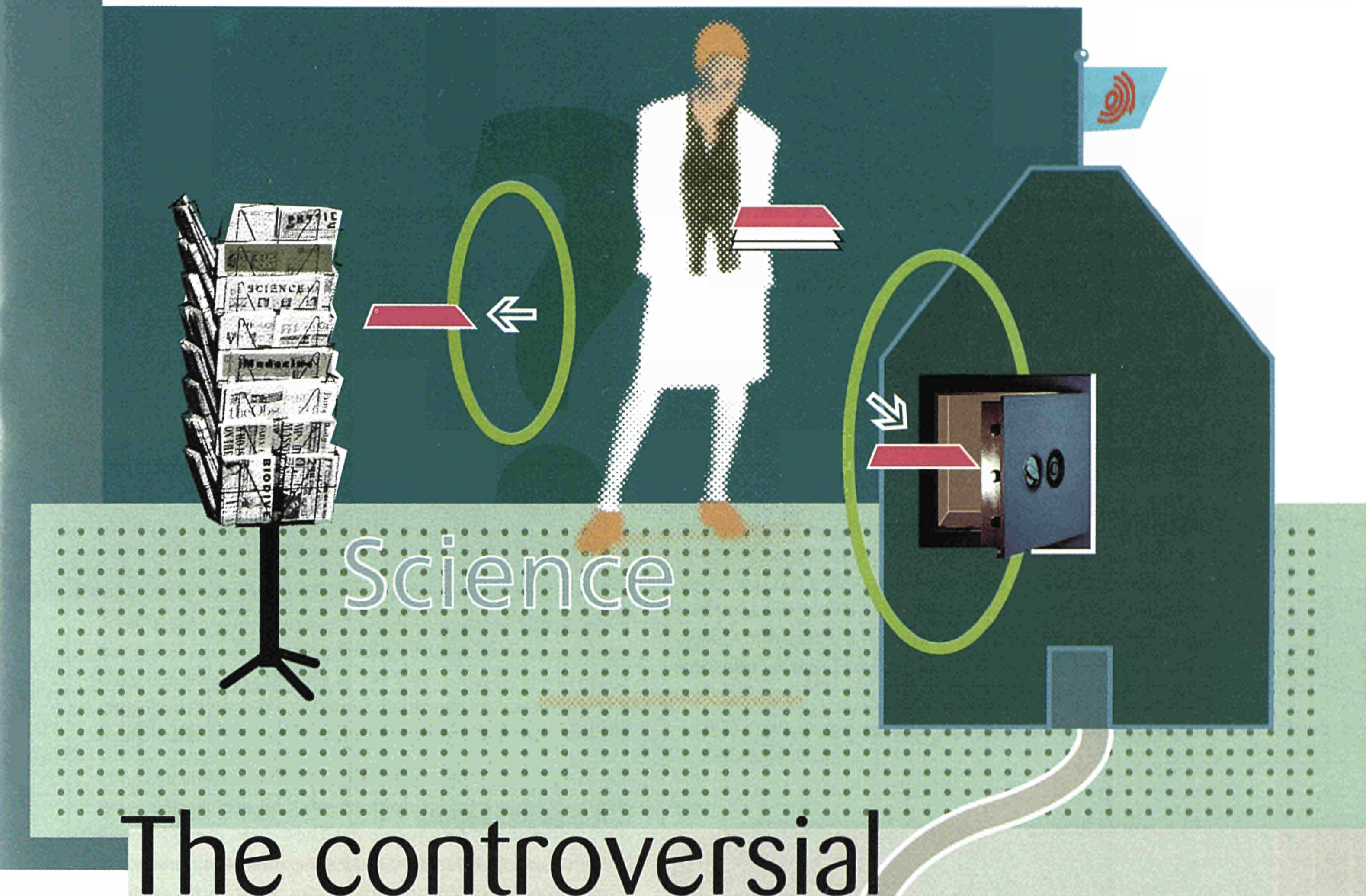
Experience has shown that the US system works in terms of the exploitation of results and socio-economic impact, especially job and enterprise creation. Most European countries now seem to be moving towards this system – even Germany, which for a long time has opted for the 'professor's privilege' system

But how is it possible to negotiate the awarding of IPR on the results of a research project undertaken in co-operation with industry? What legal framework should be applied to the spin-offs, namely the high-tech SMEs set up by researchers to exploit scientific results? Given the growing trend for public researchers to co-operate from the outset with the world of economics, it is essential to determine in advance who will hold intellectual property rights on the results and how they will be managed. Scientists have, however, often been vulnerable during negotiations – this no doubt having something to do with their present suspicions. Obtaining and above all defending intellectual property rights is specialist work – and very expensive. Public research bodies and universities in Europe, as well as SMEs, often lack both the expertise and material means for this and find themselves in a position of weakness when negotiating with manufacturers.

This is why the Commission, through the Enterprise DG, has introduced assistance tools. The IPR Helpdesk, originally set up in 1998 for a period of three years, has just been granted a new lease of life with new partners. The Helpdesk is designed for participants in framework programme projects and includes an Internet site, a regular electronic publication and an individual legal assistance service. Originally managed by a German patents consultancy bureau, it is now coordinated by a team from the University of Alicante in Spain.(1)

Following the trend in the United States, many European research bodies and universities are acquiring offices to manage and promote these issues. To encourage this, the Enterprise DG is on the point of launching the Public Research Organisations Transfer Offices Network (Proton) project, charged with promoting links and exchanges of good practice between these various structures for developing and managing IPR.(2)

(1) www.ipr-helpdesk.org
(2) In particular, Proton will draw on the expertise of Gate 2 Growth, a portal offering assistance in setting up companies and investing in innovation, set up with the support of the European Commission. www.gate2growth.com



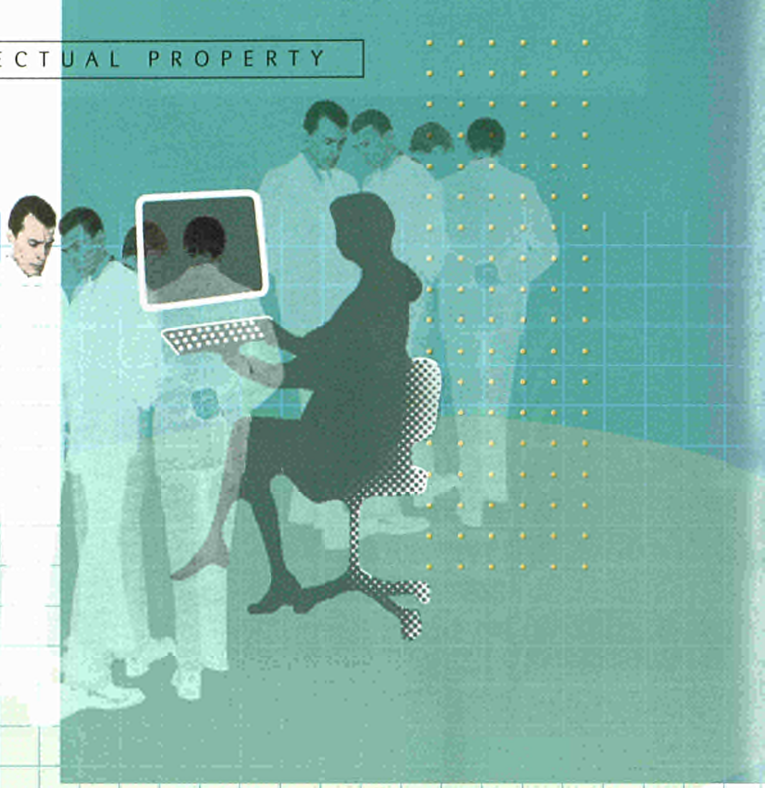
The controversial *'period of grace'*

Torn between their traditional concern to publish results and the growing tendency to patent anything which could find a commercial application, many researchers are calling for a 'grace period'.

Publish or perish – that has been the traditional scientific maxim, at least in the field of public or academic research. The publication of results in recognised specialist journals has always been seen as the key not just to the validation of research results and the dissemination of knowledge, but also to the career progress of researchers. The number of articles published forms the basis of a researcher's standing in the scientific community.

Researchers are nevertheless facing a dilemma. Before rushing to publish – which until now had validated new scientific knowledge – is it not preferable to begin by instigating the lengthy, complex and costly procedures leading to the legal protection of intellectual property rights (IPR) such as patents or utility models, with a view to the exploitation of future applications?

Paradoxically, given the characteristics of European patent law, the two approaches are mutually exclusive and researchers now find themselves in a no-win situation. Publishing scientific results, presenting them at a conference, or simply revealing them to a colleague not bound by a secrecy agreement is enough, in Europe, to prevent any subsequent protection by patent. To do so is to violate one of the cardinal rules on which any subsequent procedure to obtain IPR must be based – absolute originality. The innovation cannot have been divulged, in any form whatsoever, before making the patent application.



Six to 12 months' grace

Academic researchers have consequently launched a wide-ranging debate in which they are calling for a *grace period*, which would overcome this difficulty. This is a simple mechanism, already in force in countries such as the USA,(1) Japan and Canada, under which it is possible to reveal the results of scientific research while retaining for six months or one year the option of applying for a patent to protect them. Researchers are obviously in favour of this. In Japan, however, nearly half of those who use this period of grace are large companies, whereas in Europe industry representatives oppose the system. Should it be adopted systematically in Europe? This is the question that has recently been hotly debated.

In October 1998, the Commission invited about 150 experts to Brussels to hear their views. The following year, the Intergovernmental Conference of Members of the European Patent Organisation asked the European Patent Office (EPO) to 'consider under what conditions the effects of divulging information [prior to the patent application, through a publication, presentation or simple scientific communication] could be taken into account under European patent law.'

The not so secret life of patents

Even without a period of grace in Europe, making a patent application is certainly no obstacle to the dissemination of knowledge. Paradoxically – considering the notion of secrecy often wrongly associated with the concept of a patent – a patent is itself a kind of publication. Patent applications are published 18 months after filing and are accessible through public databases. What is more, any patent application must describe the invention in sufficient detail to enable *any member of the profession* to reproduce it. In this respect, patents are a response to industrial secrecy and historically this was the main reason for creating them.

That leaves the question of deadlines. Should the publication of an article be delayed or an invitation to a conference refused so that a patent application can be submitted? Supporters of the use of intellectual property rights in the research field believe that such cases are much less frequent than is widely believed. A survey among more than 200 researchers and institutions in the field of biotechnologies – a sector in which scientists are increasingly experienced in filing for patents – showed that just 20% of public researchers and 10% of private sector researchers believe that the need to patent significantly delays publication.

A classic dispute

Such occasions invariably produce the same old arguments. The main supporters of a grace period are public sector researchers and, to a lesser extent, certain SMEs. The former want to be able to publish or diseminate their results without delay; the latter stress that before applying for a patent they want to be able to carry out a better evaluation of the invention's technical or commercial potential, such as through prototype testing or by allowing third parties to test – actions which amount to divulging information.

Industry on the other hand opposes the grace period on the grounds that it creates legal uncertainty. It argues that if potentially patentable results are published it blocks any decision on their industrial use for several months, that is until it is known the extent of any claims linked to subsequent intellectual property rights which may be registered. In a report drawn up at the request of the EPO, Jan Galama, head of intellectual property with Philips International, stresses that the right to a grace period is a double-edged sword for the scientists themselves. In his view, in certain hot technological fields such as biotechnology, pharmacy and information technologies, the protection given theoretically by the right to a grace period is far from guaranteed. He believes the risk remains high of the author of a publication being robbed of the means to use the results subsequently by deft competitors using methods difficult to attack in a court of law. "The present economic and competitive environment does not allow us to grant ourselves the doubtful luxury of a generalised grace period," stresses Jan Galama.

Another expert consulted by the EPO, Professor Joseph Straus of the Max Planck Institute for Intellectual Property in Munich, nevertheless calls for just such an option. He believes that in the field of scientific research not even the immediate submission of a patent application "guarantees researchers absolute legal certainty", if only because of the lengthy period (18 months for the EPO) between filing for a patent and its publication. He points out that where a grace period used to exist, such as in Germany, Italy, the United Kingdom and Ireland, it was used as a simple 'safety net' against inadvertent divulgations and to permit testing. "No cases of abuse were revealed," he stresses. He also points out that such a system currently exists in 39 countries which all (except the United States) apply a 'first-to-file' system and calls for worldwide harmonisation of the grace period.

Necessary globalisation

Professor Straus's thinking is in line with general opinion, which considers that any grace period must be implemented at a global level if it is to work. This is a very topical issue with negotiations currently in progress at the World Intellectual Property Organisation (WIPO)(2) in Geneva, with a view to adopting a new treaty in this field, known as the Substantive Patent Law Treaty.

The text under discussion includes an article mentioning the grace period, despite it having been rejected during previous negotiations in 1991. The Commission only has observer status in these negotiations by the Member States and has no official position on the subject. Nevertheless, the Research DG will be soon bringing together the parties to arrive at a minimal position. 'It would be preferable for all the Member States to speak with a single voice in defining the characteristics of this grace period if it were to be adopted', explains Professor Strauss.

The 'provisional solution'

There is another solution, which could resolve this dilemma for researchers: a provisional patent application. Under this system, an inventor who does not yet have all the necessary elements for a patent application – or who cannot yet afford the expenditure – can file a summary description of his invention with the patent office, thereby obtaining a period of one year to complete the application and pay the fees.

It is not difficult for researchers to produce such a project description on the completion of their research. They could thus publish their results without foregoing the possibility of their 'parent' organisation or university being able to take out a patent at a later date. This system was introduced in the United States in 1995 and most experts agree that some of the provisions of the European Convention on Patents and of the Patent Law Treaty of June 2000 have much in common with it.

It must, however, be stressed that this solution is mainly advocated by opponents of the grace period, primarily industry, while researchers view it as insufficient. Professor Straus stresses that "this system does not provide sufficient protection", in particular because researchers do not automatically envisage patenting at the time of publishing an article, and that the risks of such an application being divulged are "enormous". He adds that changes to the law needed to introduce it would be far greater than to introduce a grace period.

(1) Patent law is very different in the United States which operates a 'first-to-invent' system and makes comparisons difficult with Europe, where patents are granted on a 'first-to-file' basis.

(2) A specialised institution of United Nations system, established in Geneva and composed of 179 Member States, the World Intellectual Property Organisation (WIPO) aims to 'promote the use and protection of works of the human spirit'. It administers 23 international treaties on subjects as varied as royalties, trademarks, patents and industrial designs. Its interests thus cover ideas and creativity in the broad sense, from works of art to scientific inventions.

To patent or not to patent

There is also a type of uncoded knowledge, which it is impossible to patent or publish but which is crucially important nevertheless: technical know-how. The only way to circulate it is through the people who possess it. The simplest way is for the researcher to join an industrial team, whether temporarily(1) or permanently.

In fields such as the biotechnologies, information technologies and advanced materials, the transfer of knowledge to the private sector over the past few years has also resulted from scientists setting up their own innovative small businesses. These spin-offs are frequently located on campus (where, at least initially, they benefit from access to the technical facilities of their university or organisation) and provide very advanced services or products to major industrial firms which are unable to develop them themselves. Biotechnology SMEs, for example, sell access to genetic databases equipped with computer-based tools or biological systems for the screening of therapeutic molecules.

Their formal and informal knowledge – patents, exclusive licences and individual know-how – constitutes their sole capital. It is that which they offer as a guarantee to investors with venture capital. A knowledge economy has thus developed in which intellectual property and technical knowledge are a veritable currency.

(1) In some countries, such as France, the inflexibility of the status of public researcher is nevertheless a brake on 'two-way' mobility, even if reforms are envisaged.

News in brief...News in brief...Ne

Sixth Framework Programme 2002 - 2006

In the starting blocks!

Thanks to the energetic efforts of the Spanish presidency, on 3 June the Council of Ministers, European Parliament and Commission officially concluded negotiations on the final content of the Sixth Framework Programme 2002-2006. Completion of this crucial stage should ensure that the timetable is respected: calls for proposals will be launched before the end of the year and the first Community financing contracts will be able to start from the beginning of 2003.

The final points discussed were the 34 amendments proposed by the Parliament in its conclusions following the second reading of the common position adopted by the ministers in January. European Members of Parliament had stressed in particular that greater priority should be awarded to research on certain diseases – such as cancer, cardiovascular and neurodegenerative diseases and children's diseases.

The Council decided to include these amendments. The final agreement brings adjustments to the content and financial breakdown of certain research priorities (see the final version in the table on the following page). However, the total budget for the Framework Programme – €17.5 billion – remains unchanged.

Philippe Busquin, Commissioner responsible for research

'For the first time in the history of Community research, we have not left adoption of the Framework Programme to the very last moment – we have time to guarantee that it will be launched and implemented under the very best conditions.'

Extract from Philippe Busquin's speech to the European Parliament at the second reading of the Framework Programme.

The home straight: rules of participation

The task now is to define the rules of participation for the new Framework Programme. This is particularly important as new instruments have been introduced bringing significant changes to the scope for co-operation between European research teams. The Commission's services have drawn up many detailed working documents as a basis for discussions on programme implementation during the latter half of 2002. These relate mainly to the rules for the selection, implementation and financing of integrated projects and networks of excellence (see opposite page) and other Framework Programme instruments. Of particular significance is the new 'application of Article 169' by virtue of which it is possible for the Commission to contribute financially to research programmes undertaken by a limited number of Member States. Transitional measures are also planned for the provisional continuation of the traditional aid provided under previous Framework Programmes (so-called targeted research projects – especially for SMEs – as well as *concerted actions and accompanying measures*).

Working documents on the instruments:
europa.eu.int/comm/research/fp6/pdf/instruments_070502.pdf

Sixth Framework Programme 2002 - 2006

Overview of the new programme (Decision adopted by the Council of 3 June 2002)

	Types of activity	Millions of €				%
1	FOCUSING AND INTEGRATING COMMUNITY RESEARCH	**13 345**(1)				76.3
	Priority thematic themes of research(3)		11 285(2)			64.5
	› LIFE SCIENCES, GENOMICS AND BIOTECHNOLOGY FOR HEALTH			2 255		12.9
	◗ *Advanced genomics and applications for health*				1 100	6.3
	◗ *Combating major diseases*				1 155	6.6
	› INFORMATION SOCIETY TECHNOLOGIES			3 625(3)		20.7
	› NANOTECHNOLOGIES AND NANOSCIENCES, MULTI-FUNCTIONAL MATERIALS AND NEW PRODUCTION PROCESSES AND DEVICES			1 300		7·4
	› AERONAUTICS AND SPACE			1 075		6.1
	› FOOD QUALITY AND SAFETY			685		3.9
	› SUSTAINABLE DEVELOPMENT, GLOBAL CHANGE AND ECOSYSTEMS			2 120		12.1
	◗ *Sustainable energy systemss*				810	4.6
	◗ *Sustainable surface transport*				610	3.5
	◗ *Global change and ecosystems*				700	4.0
	› CITIZENS AND GOVERNANCE IN A KNOWLEDGE-BASED SOCIETY			225		1.3
	Specific activities covering a wider field of research		1 300			7.4
	• *Supporting policies and anticipating scientific and technological needs*			555		3.2
	• *Horizontal research activities for SMEs*			430		2.5
	• *Specific measures in support of international co-operation*			315(4)		1.8
	Activities of the Joint Research Centre		760			4.3
2	STRUCTURING THE EUROPEAN RESEARCH AREA	2 605				14.9
	▪ *Research and innovation*		290			1.7
	▪ *Human resources and mobility*		1 580			9.0
	▪ *Research infrastructures*		655(5)			3.7
	▪ *Science and society*		80			0.5
3	STRENGTHENING THE FOUNDATIONS OF THE EUROPEAN RESEARCH AREA	320				1.8
	▪ *Support for the coordination of activities*		270			1.5
	▪ *Support for the coherent development of R&D policies*		50			0.3
4	RESEARCH AND TRAINING IN THE NUCLEAR FIELD (EURATOM TREATY)	1 230				7.0
	▪ *Priority thematic fields of research*		890			5.0
	• *Controlled thermonuclear fusion*			750		4.3
	• *Management of radioactive waste*			90		0.5
	• *Radioprotection*			50		0.3
	▪ *Other activities in the field of technologies and nuclear safety*		50			0.3
	▪ *Activities of the Joint Research Centre*		290			1.7
	TOTAL	**17 500**				100

(1) The aim is to grant SMEs at least 15% of the total financial resources under this heading.
(2) Including €400 million for cancer research.
(3) This amount includes €100 million for the continued development of Géant and GRID.
(4) An additional €285 million will be allocated to financing the participation of third country organisations under the 'Priority thematic themes of research', bringing total financing for international co-operation to €600 million (not including the opening up of the 'Human resources and mobility' programme to third country researchers).
(5) This amount includes €200 million for the continuation of the Géant and GRID projects.

Sixth Framework Programme 2002 - 2006

Definition 1: integrated projects (IPs)

Integrated projects are research initiatives aimed at mobilising a *critical mass* of resources and multidisciplinary activities in pursuit of clearly stated scientific and technological objectives on a scale which is judged significant and ambitious in terms of knowledge production and applications.

› The *expression critical* mass refers to the number of participating teams and countries, the amount of financing required and the multi-annual time-scale made necessary by the scale of the objectives. The desired integrating dimension in terms of research and development could include demonstration activities and the training of researchers.

› The *support* for IPs will be in the form of a Commission grant to the budget based on *three fixed rate categories of contribution*: 50% for research activities proper, 35% for demonstration activities and 100% for management costs and the training of researchers. Advance payments will be made on the basis of the costs stated and approved in the project working plans, with subsequent annual adjustment following audit reports on the real costs incurred.

To be consulted (working documents):
europa.eu.int/comm/research/fp6/pdf/ip_short.pdf
europa.eu.int/comm/research/fp6/pdf/ip_provisions_070502.pdf

Definition 2: networks of excellence (NEs)

Commission support for networks of excellence will aim to harness and strengthen *high-level expertise and research capacities* in the interests of research projects which relate directly to the Sixth Framework Programme thematic priorities as a means of addressing the present fragmentation of European research. Within their individual fields, these networks must aim to achieve a *lasting integration of these capacities* and permit the diffusion of excellence within the teams in question and a strengthening of their scientific and technological progress and standing at world level.

› The networks of excellence must also achieve a *critical mass*, in terms of the number of teams and researchers involved for example. In the specific fields where they are trying to increase their excellence, they must be based on joint programmes of activities of a lasting nature and incorporating various aspects: coordination of their respective research and/or equipment plans, joint projects, reciprocal access to their physical or virtual infrastructures, transfer of knowledge and know-how, training and exchange of researchers, etc. Each network will have to set up a joint management structure to achieve these objectives. Although they will have to report to the Commission on the content and implementation of their joint programme of activity, the NEs will have a large measure of autonomy and flexibility in terms of their operation and organisation.

› As it is not easy to express the cost of creating NEs in terms of tangible expenses, the Commission's financial contribution will be based on the principle of a *fixed grant for integration*. The present idea is to apply a sliding scale contribution linked to the number of researchers in the network. For example, a network of between 50 and 150 researchers will receive a grant equivalent to €20 000 per person per year. In the case of 250 researchers, the global allocation will be €4 million a year, increasing to €6 million for 1 000 researchers, etc. The grant will also decrease over time as the Commission wants the networks to enjoy increased autonomy and not to become systematically dependent on European subsidies.

To be consulted (working documents):
europa.eu.int/comm/research/fp6/pdf/noe_short.pdf
europa.eu.int/comm/research/fp6/pdf/noe_0705021.pdf

New management

As European research programmes have grown in scale so the problems of their operational management - launching calls for proposals, project evaluation, selection and follow-up, and financial and contractual management - have become more complex. The requirements are many: decisions taken must be fair and transparent, flexible and efficient; deadlines for implementation must be as short as possible; financial rigour must be respected.

To ensure this is the case, the Commission draws extensively on expertise outside the scientific and industrial community. When evaluating and selecting projects for financial support, for example, a system of peer review applies, exercised by panels of experts recruited following public calls for applications.

In the run-up to the launch of the Sixth Framework Programme, a process of reflection and consultation is under way with a view to implementing the adapted and improved procedures required by the new approaches and instruments. The Commission's main partner in this process is the European Research Advisory Board (EURAB), set up in 2001 on the initiative of Commissioner Philippe Busquin, and which includes representatives of European scientific and industrial communities. EURAB has just submitted a series of recommendations – in particular on the key question of project selection criteria – which should play a determining role in this final stage of defining the rules of participation in the Sixth Framework Programme.

To be consulted:
europa.eu.int/comm/research/press/2002/eurab_recommen.pdf

Sixth Framework Programme 2002 - 2006

ERA-NET, a new inter-state tool

The third activity of the Sixth Framework Programme – *Strengthening the foundations of the European Research Area* – is designed to provide Community support for co-operation between and coordination of research activities under the science and technology policies of the Member States. The Commission is developing an on-line tool for this which will make it possible to visualise the potential for networking these programmes and the opportunities they offer for European researchers from other countries.

europa.eu.int/comm/research/fp6/era-net.html

CORDIS: towards on-line integration

The CORDIS WEB technical service – for on-line aid to European research players seeking to participate in the Sixth Framework Programme – is developing an informatics system, known as FP6 IT SYSTEM, to provide on-line interconnection of databases in the field of project proposals, evaluation information, expert on-line registration and project information.

europa.eu.int/comm/research/fp6/it-system/index_en.html

Research infrastructures

The Sixth Framework Programme includes an innovative system of support for research infrastructures (with a budget of €655 million, 30% of which will be reserved for the major Géant and GRID electronic interconnection projects which are already well advanced). To find out more about the new aspects of this policy, see the site:

europa.eu.int/comm/research/fp6/infrastructures_en.html

Highlighting ethics

Bioethics is a sensitive issue which was central to the compromise reached by the Parliament and Council on the adoption of the Sixth Framework Programme. The field is all the more complex as different Member States have different approaches to certain ethical issues. The Commission is nevertheless committed to applying very strict rules so as to avoid any danger of funding research which could lead to genetic engineering or human cloning, as well as any artificial production of embryos for scientific purposes.

Innovation 1: expression of interest

One innovation concerns *calls for expressions* of interest. These will be introduced this year for the major thematic priorities of the new Framework Programme and will be used increasingly in developing future programmes and drawing up calls for proposals for the submission of projects. They are likely to prove a valuable instrument of dialogue between the world of science and technology and the developers of European research actions.

Innovation 2: two-stage submission

Another useful technique is the *two-stage submission* which will reduce the often excessively high 'failure' rate of the past. Under this procedure, applicants can first submit a brief outline of their idea for a response to a call for proposals. If this passes the initial peer review by members of the evaluation committee, the full submission process - involving much more thought, co-operation (partnership creation) and technical and financial programming - can begin on the basis of more encouraging prospects of success.

EUROPEAN
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2002

The 'European research in 2002' conference

The launch of the Sixth Framework Programme will be marked by a major conference organised by the Research DG in Brussels on 11-13/11/2002. In addition to the sessions dedicated to participation procedures and the content of the major thematic fields of research, there will be major debates on subjects such as

- Citizens and governance in a knowledge-based society;
- Research and innovation;
- European regions: key actors in research and innovation;
- Candidate countries: a challenge for integration;

and

- European research in a global context.

It is possible to register on line at the following address:
www.teamwork.en/inscription/europeanresearch2002/
Researchers from candidate countries can receive financial assistance to attend this event:
europa.eu.int/comm/research/iscp/invitationresearchconf2002_en.html

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New on the Web

- **The European Group on Life Sciences**
europa.eu.int/comm/research/life-sciences/egls/index_en.html
This site is dedicated to the EGLS set up in 2001 by Commissioner Philippe Busquin to advise him on all questions relating to the life sciences (originally called the Life Sciences High-Level Group). It is currently concentrating on three major themes: communication of the life sciences in the media; relations between the new biology and culture (see our diary for the EGLS conference on the subject in November); the life sciences and sustainable agriculture for developing countries.

- **Cell factory: Community-funded projects**
europa.eu.int/comm/research/quality-of-life/cell-factory/volume1/index_en.html
This site presents a summary of the 126 projects financed for a total amount of €266 million under the 'Quality of Life'

programme's Cell Factory key action during the first two calls for proposals in 1999 and 2000. A printed version of this catalogue is also available.

- **EFB Task Group on Public Perception of Biotechnology**
www.efbpublic.org/
A reference site developed by the European Federation of Biotechnology.

- **SCI-TECH**
The cool site for hot science
info.web.cern.ch/info/scitech/

Under the slogan Couldn't be without it, this site is for teachers and young people, explaining that NOTHING we use today would exist without the knowledge that fundamental science has acquired about the world of the infinitely small. The initiative is the fruit of co-operation between major European research infrastructures (CERN, ESA, ESO, EFDA, EMBL, ESRF, ILL) and is as educational as it is fascinating.

- **Molecular Universe**
www.moleculaturuniverse.com/
An introduction to the world of molecules for the layman, developed by Richard Catlow, director of the Davy Faraday Research Laboratory at the Royal Institution (UK). An educational presentation, in pictures, of atomic arrangements in the world of proteins, minerals and plastics.

Recent news on the Europa Research site

- **A new site on the mapping of scientific and technological excellence in the European Research Area with information on Life Sciences, Nanotechnologies and Economics** – 31.05.2002
europa.eu.int/comm/research/era/mapping-excellence.html

- **Meeting the challenges in aircraft emissions: Commission looks into clean alternatives to fossil fuel (the CRYOPLANE research project)** – 29.05.2002
europa.eu.int/rapid/start/cgi/guesten.ksh?p_action.gettxt=gt&doc=IP/02/769|0|RAPID&lg=EN&display=

- **Farm animal welfare: report on the seminar of 23 April 2002 and related projects** – 27.05.2002
europa.eu.int/comm/research/quality-of-life/animal-welfare/seminars/index_en.html

- **Commissioner Philippe Busquin's call to increase research spending in Europe supported by UNICE** – 23.05.2002
europa.eu.int/comm/research/press/2002/pr2305en.html

- **Health and the Environment: European research on endocrine disrupters receives major boost** – 15.05.2002
europa.eu.int/comm/research/press/2002/pr1505en.html

- **Welcome to the new website on International Scientific Cooperation Policies** – 03.05.2002
europa.eu.int/comm/research/iscp/index_en.html

- **Research and Water: Global visions, local actions** – 30.04.2002
europa.eu.int/comm/research/press/2002/pr3004en.html

- **Animal Welfare: European Commission supports research to improve animal breeding and food quality** – 24.04.2002
europa.eu.int/comm/research/press/2002/pr2404en.html

- **The Commission launches the initiative on Global Monitoring of the Environment and Security (GMES)** 19.03.2002
europa.eu.int/comm/research/press/2002/pr1903en.html

- **European post-genomic research – The European Commission grants €39.4 million to three major projects** – 18.03.2002
europa.eu.int/comm/research/press/2002/pr1803en.html

- **ENVISAT: EU Supports New Space Applications for Global Monitoring of Environment & Security** – 1.03.2002
europa.eu.int/comm/research/press/2002/pr0103en.html

- **A European project leads to a new diagnosis of the Ebola fever** – 25.02.2002
europa.eu.int/comm/research/press/2002/pr2502en.html

- **European project opens way for better understanding of human diseases** – 21.02.2002
europa.eu.int/comm/research/press/2002/pr2002en.html

Note: if you want direct access to RTD *info* on the Europa/Research site, the addresses for the four language versions have been changed recently:
French: europa.eu.int/comm/research/rtdinfo_fr.html
English: europa.eu.int/comm/research/rtdinfo_en.html
German: europa.eu.int/comm/research/rtdinfo_de.html
Spanish: europa.eu.int/comm/research/rtdinfo_es.html

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Publications

Magazines, leaflets, brochures, reports

- **European Research Area**
  A common strategy for science and technology in the service of society – Brochure –
  Available in DE, EN, FR
  research@cec.eu.int

- **Imagine, Show, Discuss – European Science and Technology Week** – Brochure –
  Available in DE, EN, FR
  research@cec.eu.int

- **Europeans, science and technology Survey report – Special edition of RTD *info* on the results of the Eurobarometer survey** –
  Available in DE, EN, FR
  research@cec.eu.int

- **No through road?** – Leaflet –
  Available in 11 languages
  research@cec.eu.int

- **The regional dimension of the European Research Area** –
  General information
  dimitri.corpakis@cec.eu.int

- **SME Update** – February 2002 –
  Newsletter
  research-sme@cec.eu.int

- **The Science and Society Action Plan** – General information –
  Available in 11 languages
  rtd-sasap@cec.eu.int

- **Raising public awareness of science and technology** – Leaflet
  improving@cec.eu.int

- **Wise moves – Opportunities for young European researchers** –
  Leaflet
  improving@cec.eu.int

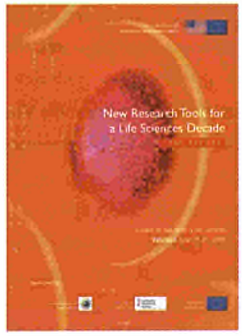
- **Growth in action** – February 2002 –
  Magazine growth@cec.eu.int

- **BIOMED2: impact assessment** –
  Rapport OPOCE

- **Gas turbines of the future** –
  Brochure
  petros.pilavachi@cec.eu.int

Conference reports

- **New research tools for a life sciences decade** OPOCE



Project reports

- **Functional food science in Europe**
  Vol. 1, 2, 3 OPOCE

- **Review of higher education on urban forestry in Europe** OPOCE

- **Urban air quality monitoring strategies and objectives in European cities** OPOCE

- **European initiative on harmful algal blooms**
  elisabeth.lipiatou@cec.eu.int

Printed publications accompanied by the mention of an e-mail address are free and can be obtained by sending a message to the address given.

OPOCE (Office for Official Publications of the European Communities) means that the printed version must be purchased. To order copies please visit the website at:

online.eur-op.eu.int

The publications mentioned are a selection. A complete list of scientific publications from the RTD programmes is placed on the research website every two months:
europa.eu.int/comm/research/pub_rtd.html

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Diary

European meetings

- **14th European Union Contest for Young Scientists**
 22-28/9/2002 Vienna (AU)
 www.2002youngscientists.org/

- **Eastern Enlargement of the EU – Implications for development strategies and development co-operation in the 21st Century**
 19-21/9/2002 – Ljubljana (SL)
 http://www.eadi.org/genconf2002/index.html

- **European Science and Technology Week**
 4-10/11/2002 – In many European towns www.cordis.lu/scienceweek/home.htm

- **European research in 2002 European Research Area and The Framework Programme**
 11-13/11/2002 Brussels (BE)
 europa.eu.int/comm/research/conferences/2002/index_en.html

EUROPEAN RESEARCH 2002

- **The new biology and cultures of the modern time: challenge and perspectives**
 Organised by the European Group on Life Sciences –
 18-19/11/2002 – Brussels (BE)
 europa.eu.int/comm/research/life-sciences/egls/index_en.html

- **Sustainable Agriculture: the Value of Life Sciences for Development**
 Organised by the European Group on Life Sciences –
 30-31/1/2003 – Brussels (BE)
 europa.eu.int/comm/research/life-sciences/egls/index_en.html

Other events

- **International Conference on Project Management**
 31/07-02/08/2002 - Singapore
 www.ntu.edu.sg/MPE/ProMAC2002/

- **Kansai 02 – Integrating Regional and Global Initiatives in the Learning Society**
 12-15/8/2002 – Kyoto (JP)
 www.in3.dem.ist.utl.pt

- **International Conference on Soils under Global Change – A Challenge for the 21st century**
 3-8/9/2002 – Constanta (RO)
 www.soils.wisc.edu/istro/Romania/Romania02-4.pdf

- **Conférence internationale sur l'échantillonnage de l'ADN – International DNA Sampling Conference** –
 5-8/9/2002 – Montréal (CA)
 www.humgen.umontreal.ca/conference/fr
 www.eadi.org/generalconference.htm

- **Photovoltaic for Europe – Conference and Exhibition on PV Science – Technology and Application**

 Jointly organised by ETA-Florence and WIP-Munich
 7-11/10/2002 – Rome (IT)
 www.wip-munich.de/conferences/pv/rome_2002/index.html

- **25th World Energy Engineering Congress** –
 9-11/10/2002 – Atlanta (USA)
 www.aeecenter.org/weec/

- **EPIDOS Annual Conference 2002 – The European Patent Office**
 15-17/10/2002 – Copenhagen (DK)
 www.european-patent-office.org/epidos/conf/eac2002/

- **European Conference on Aquatic Microbial Ecology (SAME 8)**
 25-30/10/2002 – Messina, Taormina (IT)
 www.same-8.it/

- **Tenth ECMWF Workshop on the Use of High Performance Computing in Meteorology**
 4-8/11/2002 – Reading (UK)
 www.ecmwf.int/newsevents/workshops/parallel2002/

- **Ecsite Annual Conference 2002** –
 14-16/11/2002 – London (UK)
 ecsite.ballou.be/net/beta.asp

- **Colour of Ocean Data** – Organised by the Flanders Marine Institute –
 25-27/11/2002 – Bruxelles (BE)
 www.vliz.be/en/acruv/cod/

- **Genomics and Forest Tree Stress Tolerance Short Course**
 11/2002 – Chania (GR)
 adoulis@maich.gr

- **7th international conference on public communication of science and technology (PCST) network**
 5-7/12/2002 – Cape Town (SA)
 www.pcstnetwork.org/

In brief

Women and science: the facts at last

Many voices have been raised in recent years condemning the inequality of the situation of women pursuing a scientific career. Few in number and facing a difficult career path, they tend to occupy lower grade research posts, finding it hard to climb the hierarchical ladder and to gain access to positions of responsibility. Yet traditionally there has also been a lack of any hard facts on the true nature and scale of the problem as a basis for offering a remedy. This is why, in 1999, the Research Council adopted a resolution inviting Member States to take a 'serious' look at this aspect of equal opportunities, and the Commission decided to set up what has come to be known as the Helsinki Group. This group of civil servants and experts drawn from the 15 Member States and the associated countries was given the task of trying to draw clear conclusions from the often incomplete and heterogeneous data collected by individual countries.

The Helsinki Group presented its report on 5 June in Madrid, which confirmed that women are indeed under-represented in the field of science and technology. It also highlights sometimes significant differences between countries and points to the fact that many Member States are now starting to introduce positive measures to make up for the time – and grey matter – lost. For it is not just a matter of correcting an injustice but also of giving Europe the best possible opportunity by using all its available talent.

The group plans to continue its work by increasing exchanges of experience and good practices, encouraging gender studies (the only way of identifying male/female issues) and developing a series of evaluation tools for positive actions and equality policy.

www.cordis.lu/improving/women/helsinki.htm

European Strategy Forum

The European Research Area certainly has some prestigious scientific infrastructures, both national and intergovernmental. They include the ESO observatory in Chile and its Very Large Telescope, the Cern in Geneva, the Grenoble synchrotron, the European Space Agency, and the European Molecular Biology Laboratory. These infrastructures are open to researchers from all over the world and are vital to the development of scientific knowledge. But are they sufficient? Are there management issues which need to be discussed? And what new infrastructures do researchers need now? Indeed, the very term 'infrastructure' is no longer limited to access to equipment alone but also includes the creation of databases (in which social science researchers are cruelly lacking), the existence of ecological reserves to safeguard biodiversity, virtual library networks, and increased computational power by interconnecting super computers for bio-computing.

A Strategy Forum was launched in April to take stock of the infrastructure needs of European scientists. Comprising representatives from the 15 Member States, its task is to evaluate existing infrastructures, stimulate decision-making and provide responses adapted to the scientists' needs. This mission is made all the more necessary by the growing requirements resulting from the increased number of scientific fields and Union enlargement.

www.cordis.lu/rtd2002/era-developments/infrastructures.htm
www.cordis.lu/improving/infrastructure/events.htm

Opinion: plea for ITER

As researchers in the European fusion programme, we thank you for the attention given to the critical situation in nuclear fusion and the importance of constructing the major new experimental device (ITER), but are surprised to see a negative reaction being reproduced without comment in your magazine RTD *info* (September issue: *Read in the press* – reproduction of an article from *Research Europe*, no. 105, 26/07/01).

Fusion research is ready for the next step forward. This is discussed, not only in RTD *info* (June 2001), but also e.g. by T. Federin in *Physics Today* (March, 2000), and documented in the ITER Final Design Report. It is also clear from the recent ITER site offers by Canada and France, and proposals in preparation by Spain and Japan.

It would take many decades to recover, if at all, from a ten-year break in the fusion programme, as unjustifiably suggested in *Research Europe*, due to the loss of know-how and expertise. This cannot be avoided 'if we set aside a couple of fellowships for fusion'. It should be obvious that such a loss cannot be simply restored either by studying previously published papers.

In the on-going energy debate, no option yet offers baseline large-scale electricity generation without fossil fuels or long-lived nuclear waste. Fusion energy could be the solution to this difficulty. The fusion programme has achieved megawatt scale fusion power production and effective solutions to physics and engineering problems. A thoroughly discussed design of the experimental tokamak IET, with several 100 MW fusion power output, has been completed. This international device will enable the EU to study inherent reactor-scale physics and to develop essential technology for future fusion powerplants. The capital cost of building ITER (some €4 billion in total) corresponds to a yearly expenditure less than one percent of the annual electricity bill in Europe. This is a moderate investment to prepare the way for a safe and CO_2 - free energy future.

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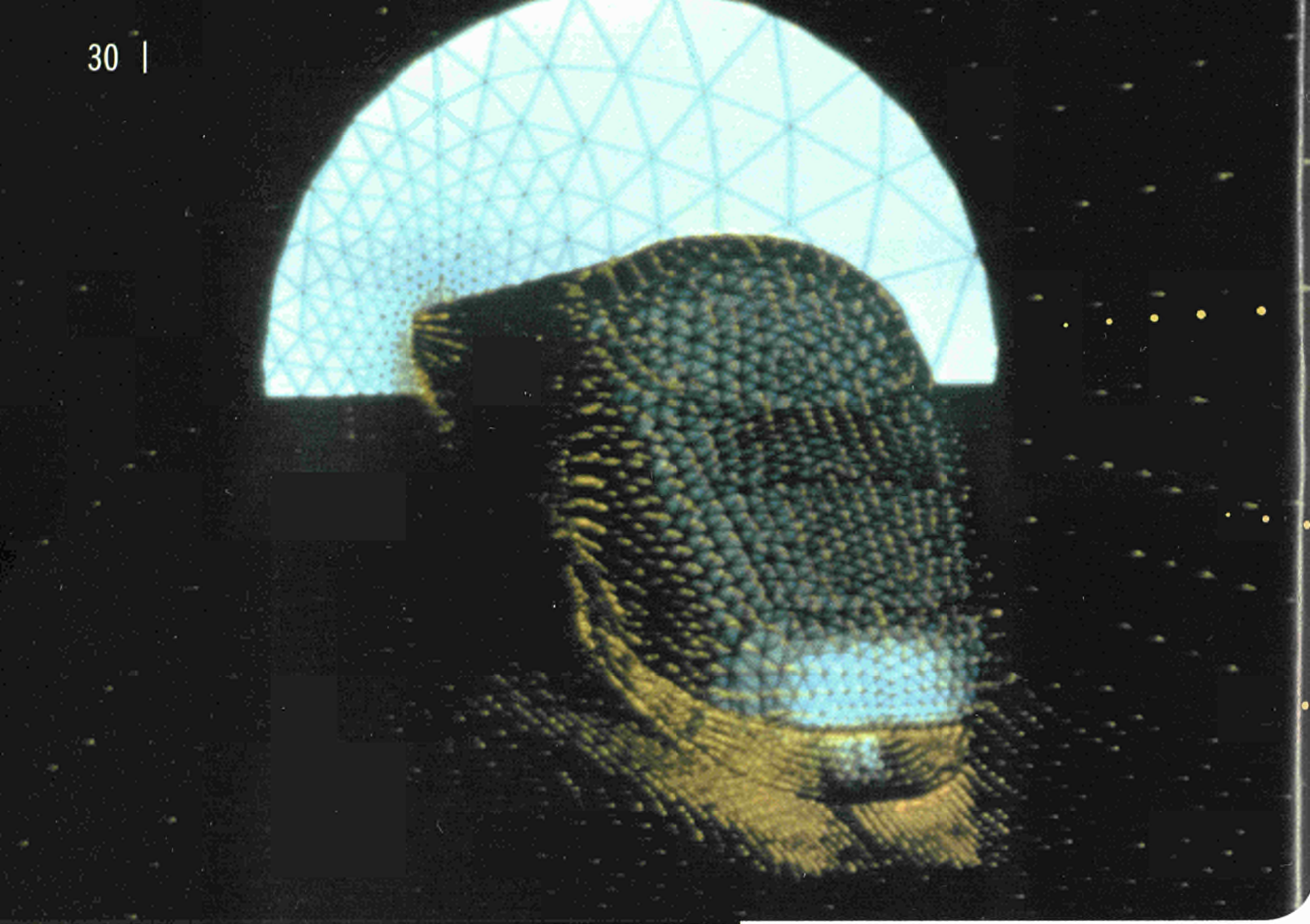


Study by the CAO on the effect of very high speeds in a tunnel. © SNCF – CAV – ALSTOM

The new battle for the

Dating back to the industrial revolution, could it be that the railways have no future in a post-industrial age? The dramatic erosion of market share over the past 30 years certainly supports such a suggestion. Yet the railways are the only real means of taking traffic off the roads, thereby making a major contribution to environmental protection. In seeking a rail revival, the European Union is placing the emphasis on harmonisation, the opening up of markets and technological modernisation. The aim is to create a new European rail area.

Too slow, too heavy, too inflexible: the railways seem locked into the rigidities of a bygone age. The European network – such as it is – remains a juxtaposition of 15 separate systems operating within essentially national networks, involving a huge loss of time in recoupling carriages, switching locomotives and replacing crews every time a train crosses a border. The net result of these repeated stops en route is an average speed of 18 km/hr for international freight transport, which is slower than an ice-breaker clearing a passage through the Baltic Sea in winter! Just 8.4% of the EU's freight is carried by rail, compared with 21.1% in the 1970s, while road transport has increased its share from 51% to 72%.

Obsolescence and deficient infrastructures have caused countless bottlenecks in many countries at the expense of the competitiveness of a rail network that is often unable to meet the growing demand for passenger and freight transport. Despite the development of high-speed trains, passenger transport is stagnating. Today the railways meet just 6% of passenger mobility needs globally.

The cost of improving infrastructures is considerable: €4 and €9 billion respectively a year over ten years in Italy and the United Kingdom. In Germany, the Deutsche Bahn invests €8 billion a year in its network, making it the world's biggest rail investor, compared with €3 billion a year for the SNCF/State partnership in France.

Major projects for the future

To help draw up Europe's new rail transport map, the Commission has decided to grant some €2.78 billion to 14 priority infrastructure projects for transport by the year 2006, almost two-thirds of them for rail. Major works include building rail links through the Alps and Pyrenees and more high-speed links for Passengers. Six projects will tackle bottlenecks and network congestion. The total investment is in the region of €66 billion, funded by the public and private sector at national, regional and Community level.

Environment and harmonisation

Nevertheless, public authorities have high hopes for the railways that could play a key role in achieving a new balance between modes of transport which is vital to unclogging the roads and reducing pollution. As the Commission explains in its White Paper on transport policy,(1) environmental concerns are central to the debate. In Europe, 28% of carbon dioxide emissions come from transport and the roads alone account for 22% of total greenhouse gas emissions.

To revitalise rail and guarantee its competitiveness, Europe is working on an ambitious plan to 'revolutionise' this mode of transport. The aim is to create an integrated European rail area. To do so will mean overcoming the fundamental obstacle of the lack of interoperability between national rail networks and systems. Everything changes from one country to the next: the electrification and signalling, working conditions, driving and safety regulations ... and even, in some cases, the width of the track.

But harmonisation is coming. After four years of intense activity, the technical specifications for the interoperability of the high-speed rail network will soon enter into force. Technical studies have also been launched for conventional rail transport and a directive is presently under discussion to complete the fundamental principles of interoperability and to develop a common approach to safety. The latter is part of the second package proposed by the Commission in January to accelerate the opening up of rail markets.

A single and competitive network

An initial agreement of crucial importance has already been reached to open up freight transport to competition, first of all – from March 2003 – on a *trans-European rail freight network*, and then on all lines in 2008. The Union wants to speed up the process and also open up the national rail freight market by 2006. European legislation will thus enable accredited operators to use the rail networks of all Member States for freight transport, under the supervision of an independent body, the European agency for rail safety and interoperability. Propositions will also be formulated to open up the passenger transport market progressively, starting with certain niche markets – night trains, auto trains, etc. – before being extended to all services.

(1) September 2001 – http://europa.eu.int/comm/off/white/index_en.htm

railways

The grand total

What is the real cost of transport? This must of course take into account the specific external costs of each mode of transport. It is estimated that every time 85 tonne-kilometres (tkm) of freight switches from road to rail, the external costs are reduced by 50%. On average, the external costs of rail transport are €12.35 per 1 000 tkm compared with €24.12 for road.

Average marginal external costs of transport per mode, in €/1000 tkm

Cost element	Road transport	Rail transport	Inland waterways	Short distance by sea
Accidents	5.44	1.46	0	0
Noise	2.138	3.45	0	0
Pollutants	7.85	3.8	3.0	2.0
Climatic costs	0.79	0.5	Negligible	Negligible
Infrastructure	2.45	2.9	1.0	Less than 1
Saturation	5.45	0.235	Negligible	Negligible
Total	**24.12**	**12.35**	**Maximum 5.0**	**Maximum 4.0**

Source: European Commission

TGV – Passenger's side
© SNCF – CAV – Michel URTADO

TGV – Driver's side
© SNCF – CAV – P/Philippe FRAYSSEIX

High-speed **Europe**

The high-speed train has certainly changed the image of rail transport and brought Europe's major centres closer together. Judging by its success, the TGV[1] is the most suitable mode of transport for linking densely populated areas over distances of up to 900 km.

The Japanese were the pioneers. In 1964, the Tokyo Olympic Games were the starting of the high-speed train with the launch of the *Tokkaido*, a conventional train linking Tokyo and Osaka at a speed of 210 km/hr. Three years later, the *Capitole*, linking Paris and Toulouse, reached a comparable speed following technical changes to the line. In 1970, Italy started building the Rome-Florence *Direttissima* designed for trains travelling at 250 km/hr. But it was not until 1981, after a new world record of 380 km/hr had been set, that the TGV first made the Paris to Lyons run in 2h40 (down to two hours now), knocking an hour and ten minutes off the previous time.

Competing for records

Since then, France has continued to concentrate on expanding its TGV network, achieving ever better performances. On 18 May 1990, TGV Atlantique's 325 clocked up a speed of 515.3 km/hr, setting a new world speed record for rail. Today, Paris is just 55 minutes from Le Mans (TGV Atlantique), 1h25 from Brussels (TGV Nord) and 2h55 from Marseilles (TGV Mediterranean).

Other countries have joined the race. In Italy, the new generation of ETR 500s, able to carry 590 passengers at speeds of 300 km/hr, replaced the famous Pendolino, a tilting train running at 250 km/hr on specially adapted lines between Rome and Naples, and Bologna and Florence, Milan, Turin and Lyons. In Germany, the ICE 3 trains reach speeds of 330 km/hr on the Hanover-Waurzburg, Hanover-Berlin, and Mannheim-Stuttgart lines. The high-speed rail link between Madrid (AVE) and Seville, inaugurated on the occasion of the 1992 international exhibition, uses rolling stock which resembles the French TGV and which is made at the Alstom workshops in Belfort, but is designed for a different track width (1688 mm).

The major European project for the future is to further expand this high-speed rail grid by connecting up more and more networks. More than 2 000 km of line are currently under construction or at the planning stage, most notably between Brussels and Liège, Cologne and Frankfurt, Madrid and Barcelona, Rome and Naples, Nyland and Umeå (Sweden), and between the exit to the Channel Tunnel and London. A growing number of new cross-border links are beginning to weave the fabric of a genuine continental rail area.

The tilting train

The *tilting train* – able to run on conventional lines – is also attracting interest in many countries. The technology is based on hydraulic suspension systems which enable the train to take bends at speeds of up to 30% higher, without any discomfort to passengers.[2] This results in time-savings of between 10% and 20% on inter-regional and inter-city networks, at one-fifth of the cost of building the new infrastructure necessary for high-speed trains.

The *Pendolino* in Italy and the ICE T in Germany both use this system, while in the United Kingdom Virgin is using this technology to modernise its fleet, on the London-Glasgow line for example. A similar solution has been adopted on the Helsinki to Turku line in Finland and between Lisbon and Porto in Portugal.

France is trying to adapt tilting technology to its TGV, but this is not easy as TGV carriages form a fixed set, with no more than one degree difference in the tilt between them. 'To allow the carriages to tilt one after the other as the train takes the bend, this angle must be increased, which involves adapting the intercirculation ring that couples them,' says the SNCF. 'The bogies also have to be fitted with a crosspiece and pistons able to tilt the train body.' Despite these obstacles, the first tilting TGV is expected to be running on the Paris-Orléans-Limoges-Toulouse line by 2005.

Eurostar
The Beussingue section
© SNCF – CAV – Jean-Jacques D'ANGELO

Testing the tilting TGV between Melun and Montereau (France)
© SNCF – CAV – Jean-Marc FABRO

The ETR 460, an Italian tilting train, coming out of a bend.
© SNCF – CAV – Fiat Ferroviaria

Service, environment, safety

Although there are, no doubt, some who dream of trains achieving even higher speeds, this is not a realistic prospect. Noise, vibration, the cost of maintaining the track and rolling stock, and energy consumption (up by 50% for an increase in train speed from 300 km/hr to 360 km/hr) would all increase excessively for just a marginal time-saving.

'The high-speed train system has itself arrived at a certain technical balance,' explains Phlippe Renard, head of the SNCF's Research and Technology Department. 'But we are continuing to work on optimising energy consumption, power collection, passenger comfort, on-board services and noise reduction.'

Research on noise pollution is concentrating on the penetration of the train's nose through the air to reduce the aerodynamic noise which becomes particularly problematic at speeds of over 300 km/hr. It is possible to streamline the zones of turbulence – the bogies supporting the wheels – but care is needed not to interfere with the ventilation to avoid overheating. Considerable progress has been made as the latest TGVs are no noisier than a conventional train travelling at 160km/hr. At a distance of 25 metres, the noise from a TGV line does not exceed 65 decibels (dB), or the equivalent of the raise level from a road with light traffic.

'I am convinced that with the high-speed train Europe has invented a suitable transport system,' concludes Philippe Renard. 'The system is appropriate for the size of the continent, its population density and transport needs between urban areas lying a few hundred or at most a thousand kilometres apart.'

(1) Train à Grande Vitesse. Although TGV refers specifically to the system developed by France, the trend is to use it for the various systems developed in other countries too.

(2) When a train enters a bend, centrifugal force pulls the passengers to the outside of the bend. In this type of train the carriages tilt in the opposite direction to centrifugal force, thereby offsetting the pull.

High speed in figures

Network

2 500 km of dedicated lines, in France (1 147km), Germany (510 km), Spain (377), Italy (259), and Belgium (74). (Figures for 2000)

Passengers

147.4 million (1999) – compared with 277.4 million in Japan.
58.7 billion passengers per km (2000).

Market

€1.5 billion, of which the SNCF accounts for two-thirds.

More than just a train

The technological feats of the TGV involve more than just speed. Extending the French network to Brussels and London, for example, meant designing a new kind of ***pantograph*** (the arm in contact with the electric lines) able to capture currents at voltage levels which change every time the train crosses a border. The *Eurostar* pantographs capture a 25 000-volt monophase current between Paris and the Channel Tunnel exit, a 3 000-volt continuous current in Belgium, and a 750-volt current by means of side friction blocks in contact with a third rail in the United Kingdom. The 16 sensors fitted beneath the train also enable it to use four (or six on some lines) different signalling and speed control systems. Finally, the rolling stock had to be 'slimmed down' to lock into the British track, designed for narrower trains than in France

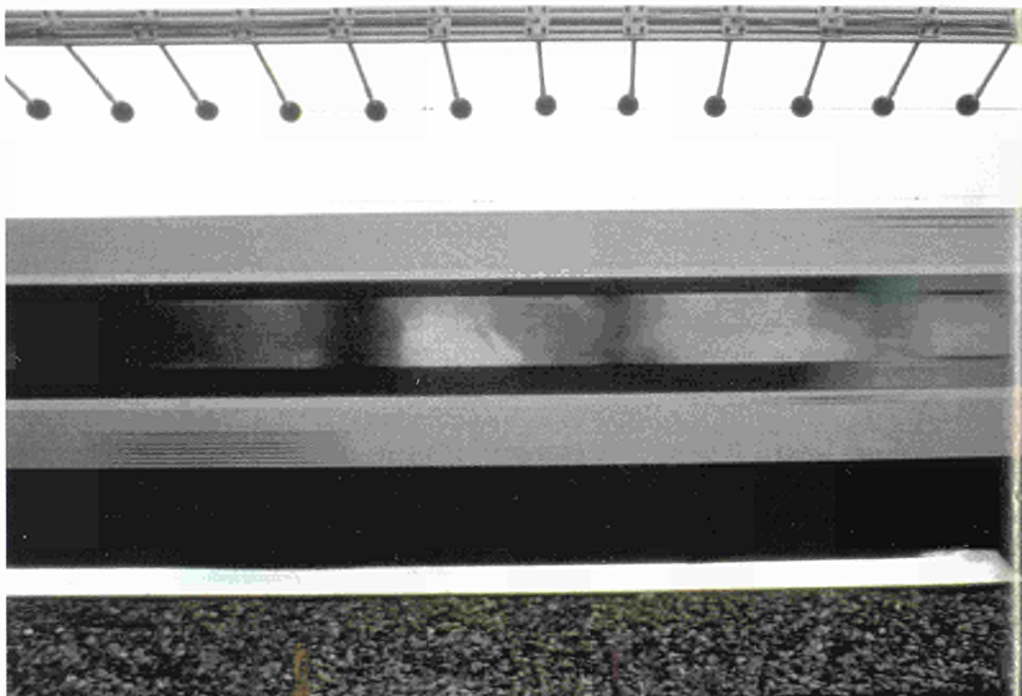
Unlike other trains, the TGV also operates according to the *carriage set* principle: each train consists of fixed carriage sets of the same number of coaches (eight or ten), always coupled in the same order, and with a railcar at each end allowing it to travel in either direction. This system saves considerable time when manoeuvring or 'building' a train. With 18 carriages, the Eurostar is able to divide into two in the event of an incident in the Channel Tunnel, to evacuate passengers along the undamaged section of line.

Another special feature is that the TGV is the sole user of the high-speed lines. The **track** is for its exclusive use and no freight or express train can cause it to slow from its 300 km/hr. Every day, 770 TGVs travel on this dedicated network. The timing is calculated down to the nearest second, and there is always at least four minutes between the passage of two TGVs at any given point to guarantee passenger safety and train punctuality.

Philippe Renard
'Before the European Research Area for rail can become a reality there must first be a shared, long-term vision.'

Apart from changes to the regulations and infrastructures, revitalising the railways requires a major research effort. The rail stakeholders – operators, industrialists and specialised research centres – represented by ERRAC (European Rail Research Advisory Council), set up on the initiative of Commissioner Philippe Busquin, share a common vision of the kind of rail sector they want to see in the year 2020. Philippe Renard, Director of Research and Technology with the SNCF, and President of ERRAC, explains.

The research



Sonometry test. Noise emissions by trains must be reduced drastically to comply with anti-noise standards.
© SNCF – CAV – SYLVAIN CAMBON

Why was an initiative such as ERRAC necessary? Was rail research previously underdeveloped in Europe?

European rail research was perhaps insufficiently developed, but above all Europe was lacking in ambition for its railways. The founding of ERRAC was linked to the growing realisation that the rail option not only had a future but was indeed vital for Europe's transport policy. This thinking has now become a key element in the European Commission's strategy. But if the railways are to fulfil the desired role over coming decades then all the players – operators, industrialists, universities and research institutes – must engage in joint and effective research. Before a European Research Area for rail can become a reality there must first be a shared, long-term vision. ERRAC's mission is to launch this new approach.

ERRAC has published a *Strategic Research Agenda*. What are the priorities in meeting the challenges of rail transport?

The Agenda presents a vision of Europe's railways in 2020 and how research and technological innovation can help to realise it. We first identified five main lines of strategy: network interoperability, the promotion of *intelligent* mobility – meaning all systems using information technology to improve service to passengers and carriers – improved safety, progress on the environmental front, and research on innovative materials. From that point a number of major subjects requiring an across-the-board approach could be distinguished.

Take freight for example. We are not going to reverse the trend in market share without significant improvements in economic efficiency and quality of service, and that means innovating in fields such as line operation and management, train design, efficiency of maintenance systems, development of telemonitoring and all the applications based on information and communication technologies.

Innovation in comparable fields is also necessary for passenger transport. In another area, such as the environment, we must drastically reduce noise emissions, otherwise our trains are going to meet resistance due to the nuisance caused by increasing rail traffic. We must also promote modernisation and a more efficient infrastructure use.

compartment

ERRAC in the long and not so long term

ERRAC was set up in November 2001 as a forum for strategic reflection and high-level consultation. In addition to industrialists, rail operators and infrastructure managers, its members include representatives of national and European research programmes, user groups and environmental organisations. Its first mission was to draw up a Strategic Research Agenda to set the direction of European, national and private programmes.

The main goals to be achieved by **2020** are:

- average speed of 150 km/hr for passenger traffic and 80km/hr for freight;
- at least 95% punctuality;
- 50% cost reduction;
- doubling of capacity for lines and stations and for light rail systems;
- 15 000 km of high-speed lines and 15 000 km of mainly freight lines;
- new integrated networks (multimodal stations, freight on urban networks);
- noise reduction to 69dB for freight and 83dB for high-speed trains;
- 75% reduction in accident victims.

Contact :
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lara.isasa@unife.org
www.unife.org/workgroups/errac_1.asp

Apart from these main lines of strategy, what concrete actions is ERRAC going to advocate? In particular, what do you expect from the new Framework Programme?

The next stage consists of translating these general directions into precise research priorities and thus fuelling the programmes of subsequent cycles. The call for expressions of interest in the Sixth Framework Programme for Research and Technological Development recently launched by the Commission is a means of taking stock of the players' wishes, in the long and short term. During this summer we are going to be able to translate ERRAC's relatively long-term objectives into short- and medium-term goals in the light of the interests expressed. That will enable us to set the priorities for action over the next two, five and ten years in a more considered and effective way.

The projected investment is impressive, especially in infrastructures. But is it realistic?

The stated ambitions for Europe's railways over the coming years do indeed suppose huge investment, in terms of capacity and interoperabilty. When you are moving trains through the Alps you are counting in billions of euro. Similarly, it is not possible to replace overnight all the existing equipment with that which meets the specifications of interoperability. We must move as fast as we can, but progressively, and all that depends on the funds that are required and/or allocated. Technical innovation will enable the European rail network to be competitive and to provide the general public and the economic players with the services they expect at the lowest cost, provided, that is, that Europe as a whole shares this vision and comes up with the money. ▶

A matter of money

Every year rail industrialists invest €1 billion in research and development - compared with €250 million by the operators. The European Union has stimulated co-operation in this field by granting €150 million for the period 1998-2002. About 40 projects are currently in progress with the aim of increasing the competitiveness and efficiency of the rail network and developing an intelligent system of rail transport involving around 200 partners.

Network size

The Union's rail network shrunk from 160 000 km to 153 600 km between 1990 and 1999 (- 4%). In the applicant Central and Eastern European Countries (CEECs) it shrunk by 6% over the same period, to 65 000 km in 1999. But the high-speed network is expanding, from just 285 km in 1981 to 2 347 km in 2000.

Rolling stock

In 1999 there were 34 454 locomotives and railcars (- 30%) and 523 400 freight wagons (- 65%) compared to 1990.

Freight

With 241 billion tonnes per km transported in 1998 (compared with 283 in 1970), the market share of rail freight has fallen from 21.1% to 8.4%. In 1999, 1.3 million tonne-km of freight was transported per km rail in the EU countries and 2.5 million in the CEECs.

Passengers

Passenger traffic increased from 217 billion per km in 1970 to 290 in 1998, representing a fall in the actual rail market share from 10% to 6%. In 1999, there were 1.9 million passenger-km per km of rail in the EU compared with 0.7 million in the applicant CEECs.
In 2001, the annual increase in passenger traffic was 0.6% overall, but 7.8% for high-speed traffic (64 billion passenger-km). However, passenger traffic fell by 3.4% in the CEECs.

If there is one field where rail has an obvious advantage it is the environment. So much so that it is hard to conceive of a sustainable transport policy which does not shift the balance in favour of rail. Nevertheless, new research must be envisaged to maintain this competitive edge. This is especially true for noise pollution, one of the railways weak points.

Taking the

Differences which count

Transporting 1 000 tonnes of goods over one kilometre costs, in terms of pollution, €3.8 by rail compared with €7.85 by road. A train consumes an average if 8.9 grams of fuel per tonne-kilometre, compared with 31.3 grams by road. A high-speed train consumes 2.5 litres of fuel for 100 passenger-kilometres, compared with 5.9 litres by a car. To transport 100 passengers 1 km, a TGV emits 4.2 kg of CO_2, compared with 14.1 for a motor vehicle and 17.1 for an aircraft. A freight train with 30 wagons relieves congestion by taking 60 lorries off the road (and the pollution they cause). In 1999, the railways emitted 7.7 million tonnes of CO_2 into the atmosphere (not counting emissions due to electricity production) compared with 743.3 million tonnes from road transport.

Valence: three days for sustainable transport

A major conference entitled *Surface Transport Technologies for Sustainable Development*, organised by the Commission, was held in Valence from 4 to 6 June. It was attended by the major stakeholders in road, rail and sea transport to study prospects for sustainable development in the field of mobility. Respect for the environment, safety and European competitiveness were at the centre of the debates.

The environmental cost of transport (including congestion costs) is generally estimated to be 10% of GDP, of which road transport makes up 90%. Road transport is moreover responsible for almost 80% of CO_2 emissions generated by transport.[1] All of which shows the train to be one of the least polluting modes of transport.

But there is one small reservation. As the European Environment Agency notes: 'the energy efficiency of rail transport has changed little over the past two decades, suggesting that, even in the rail sector, additional energy-saving measures must be envisaged.' The Commission, therefore, is going to consult with the rail industries to determine the best way of reducing air pollution[2] linked to rail transport – in the same spirit of co-operation as with the automobile industry under the Auto-Oil programme.

Energy savings

The German railways (Deutsche Bahn) have announced a 1% reduction in primary energy consumption for 2000, for electric and diesel traction, as part of an energy-saving programme which runs to 2005. Over the past ten years, there has already been a 19% saving in the freight sector and 15% in regional transport.

In France, progress in traffic and line management and the easing of bottlenecks should help reduce energy consumption by between 6% and 8% by 2020.

Research is also under way to adapt new fuels for the rail sector, including electric traction, gas and even fuel cells. The hydrogen-powered train is not for the immediate future, however. The fuel cells developed to date are in a power range suitable for motor vehicles, buses and perhaps light rail (urban or peri-urban transport). Alstom is working on a project for a fuel cell bus for the RATP, the results of which could be applied to rail by 2007. But, as for all means of transport, the fuel cell poses problems of hydrogen storage, on-board energy management, safety and cost (currently estimated at €2 300 per kW).

Silence on the line

Although environmentally-friendly, trains are nevertheless noisy and quieter models must be developed if, for example, freight traffic is to be increased by operating more night trains.

This noise nuisance is mainly caused by the contact of the wheel against the rails. Consequently, some research projects are trying to modify the wheel profile, making it S-shaped rather than flat, to absorb the vibrations. Other avenues are also being explored. The SNCF has achieved a noise reduction of 7dB(A) on a locomotive prototype equipped with composition brake blocks, and a new exhaust system and fairings. The Italian railways have experimented with wheel fairings and absorbent materials on their ETR 500 high-speed tilting train, achieving a 4dB(A) noise reduction. These materials must now be shown to comply with safety standards.

Green Line

Many European projects, coordinated by the European Rail Research Institute (ERRI),(3) based in the Netherlands, are also looking at the question of noise measurement and sound control by working on the rail as well as the rolling stock. The Silent Freight project, for example, has developed a number of technical solutions (smaller or perforated wheels, sound dampers, fairings) to reduce the noise of freight cars while keeping production costs to an acceptable level. It has enabled new products to be developed which limit noise to 10 dB (a 50% reduction) when combined with the solutions proposed by the Silent Track project, its counterpart in terms of infrastructure.

By studying the noise made by brakes, the Eurosabot project has provided a better understanding of how their action creates irregularities on the rail surface, in particular by heating. But the researchers have not been able to find materials to replace the cast-iron brake blocks while providing the same braking quality.

The Stairrs project(4) is currently trying to provide a synthesis of these various research results to arrive at the most appropriate solutions from an environmental point of view, as well as technical feasibility and costs. The results are expected by the end of the year.

(1) According to the TERM 2001 study by the European Environment Agency.
(2) Electric traction produces no emissions on the actual line where the train runs but it does contribute at source to the polluting emissions of the electricity production system.
(3) European Rail Research Institute (http://www.erri.nl/).
(4) www.stairrs.org/

Links and contacts

International organisations

Union internationale des chemins de fer (UIC) - Paris
www.uic.asso.fr/home/home_en.html

Communauté des chemins de fer européens (CCFE-CER) - Brussels
www.cer.be/

Union internationale des transporteurs publics (UITP) - Brussels
www.uitp.com/

Union des industries ferroviaires européennes (UNIFE) - Brussels
www.unife.org/

Research bodies and centres

European Rail Research Advisory Council (ERRAC) - Brussels
www.unife.org/workgroups/errac_1.asp

European Rail Research Institute (ERRI) - Utrecht
www.erri.nl

Association européenne pour l'interopérabilité ferroviaire (AEIF) - Brussels
www.aeif.org/

European Rail Traffic Management System (ERTMS)
www.ertms.com/

European Railway Wheels Association (ERWA) - Zurich
www.erwa.org/index2.html

GSM-R Industry Group
www.gsm-rail.com/index_i_e.html

Deufrako (coopération ferroviaire franco-allemande)
www.inrets.fr/infos/Deufrako/deufrako.html

Rail industry

ALSTOM
www.transport.alstom.com

SIEMENS
www.siemens.com

BOMBARDIER
www.bombardier.com

Rail operators

SNCF
www.sncf.com/

TGV
www.tgv.com

Deutsche Bahn
www.bahn.de/

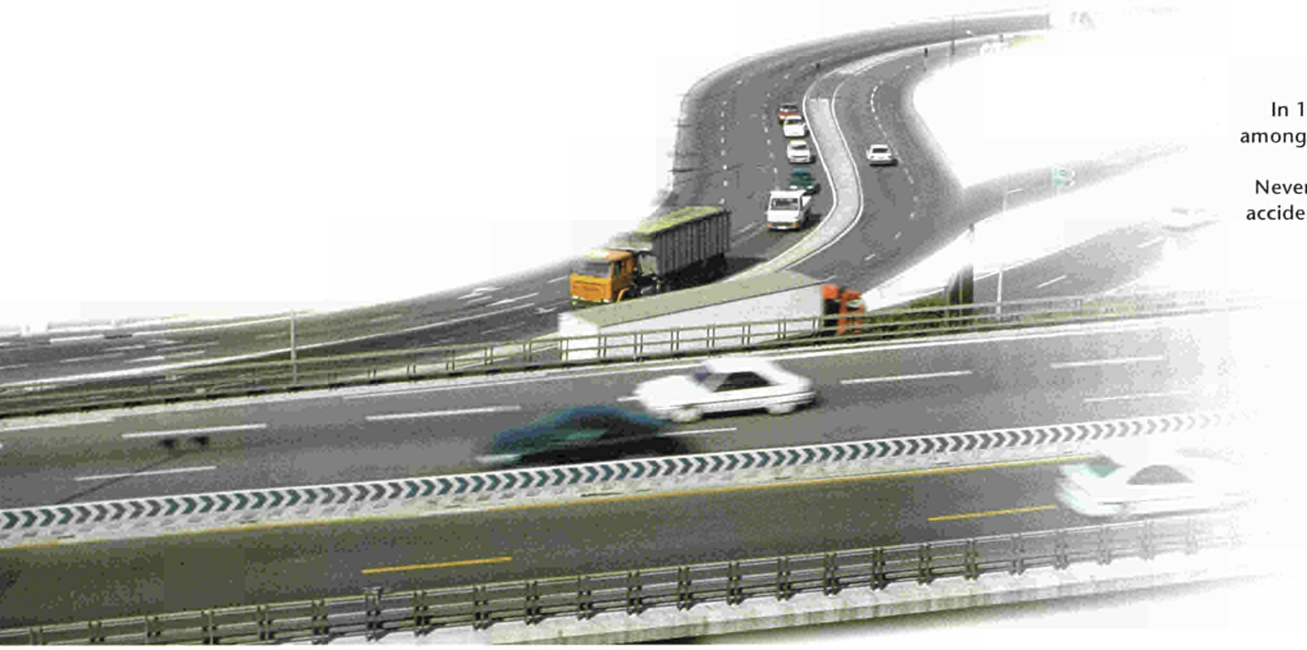
Trenitalia
www.trenitalia.com/

Renfe
www.renfe.es/

AVE (Spanish high-speed train)
www.renfe.es/empresa/ave/index.html

Railtrack
www.railtrack.co.uk/

Virgin Trains
www.virgintrains.co.uk/



In 1998 there were 186 deaths among rail passengers, compared with 42 687 road victims. Nevertheless 957 victims died in accidents involving trains (a 50% reduction in 30 years).

Despite the dramatic nature of rail disasters, it has always been safer to travel by train. Any significant increase in rail traffic in the future must not be allowed to compromise a safety record that is one of the strengths of rail travel.

The safety

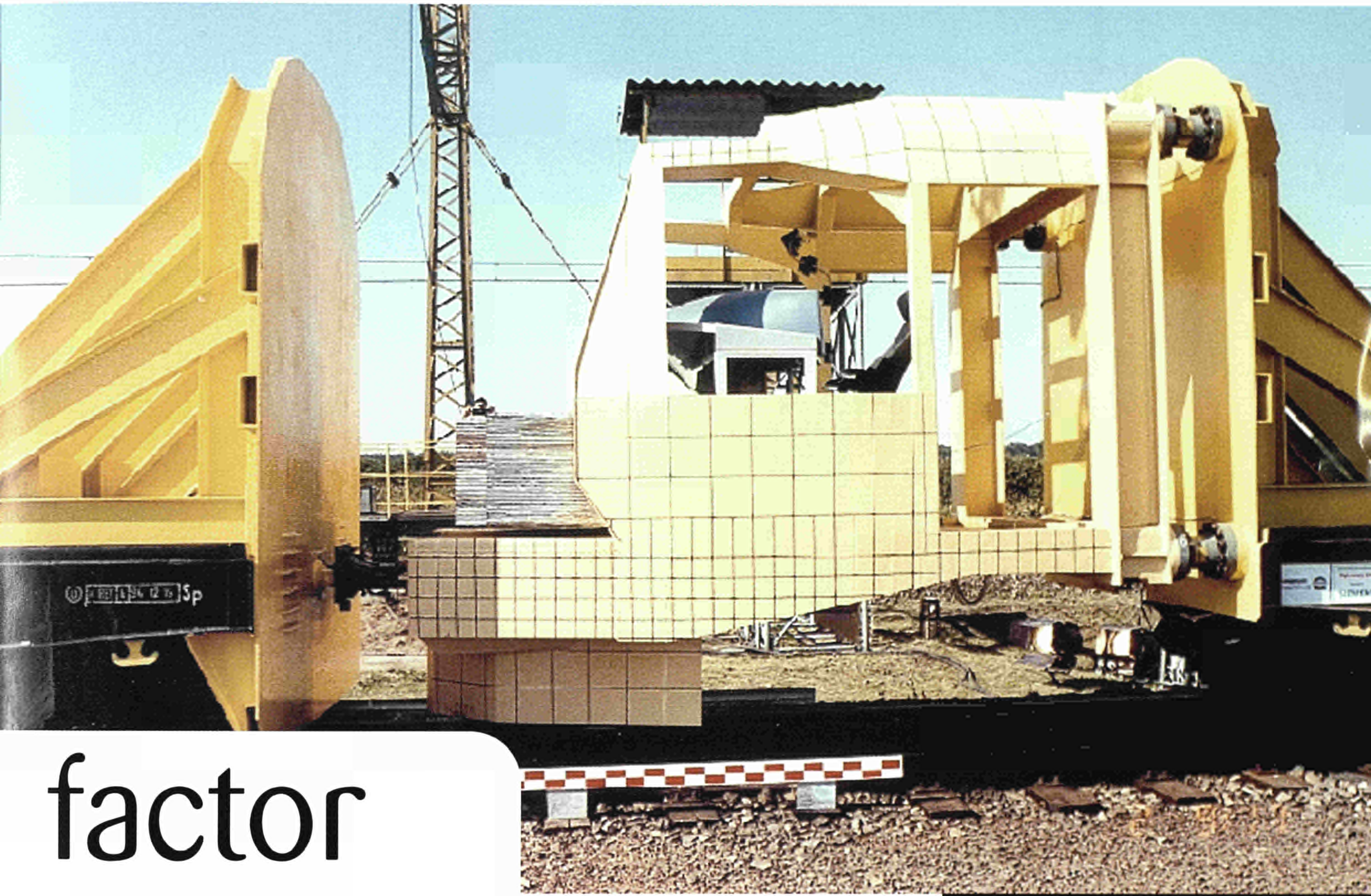
What are the hundred or so deaths on the railways every year when compared with the 40 000 deaths on Europe's roads? Unacceptable figures, nevertheless, say railway officials who fear the considerable impact on public opinion of often dramatic rail disasters.

Two years ago, a study by the National Economic Research Associates(1) showed to what extent national approaches, objectives and methods differ when it comes to rail safety in Europe - in terms of technical standards, staffing requirements, management organisation, approval of rolling stock, and certification of railway operators. The Commission has proposed a directive in this field, in the belief that interoperability must guarantee a level of safety that equals if not surpasses that achieved to date at national level. On the technical front, this means setting standards for every component of the rail system: track, rolling stock, signalling, operating procedures, etc.

Crash test at 100 km/hr

These standards could draw on the results of a number of successful research projects of recent years. One such example is the Safetrain project on new designs for rolling stock which made it possible to set resistance parameters for passenger compartments and driver cabins in the event of collision, with no increase in weight or energy consumption.

After preliminary studies of force propagation and deformation on impact, the first field crash tests were carried out at the Zmirgod site in Poland at the end of 2001. Trains weighing 129 tonnes, laden with a cargo of sensors, hurtled into one another at speeds of between 36 km/hr and 100 km/hr. These in vivo experiments are particularly instructive for analysing the spread of destructive forces, for a given kinetic energy, between the front of the train and the successive carriages.



factor

The loss of vital space through crumpling and carriage overriding: two essential aspects of rail safety studied by the Safetrain European project, in particular by conducting crash tests with trains travelling at up to 100 km/hr.

First applications

'Two main risks were identified for passengers,' explains project coordinator Antonio Vacas de Carvalho. 'First, the reduction in vital space when the train structures are deformed or compressed, and secondly the risk of secondary collisions between the passengers and internal train elements. The most dramatic feature of train crashes is also the tendency for the carriages to pile up or 'override', and devices must be developed to prevent this.'

Recommendations have therefore been made for energy absorption at the front of the train (particularly to ensure a vital space for the driver's cabin) and for buffers at the intersection of train components. Internal elements must also be adapted to reduce injury.

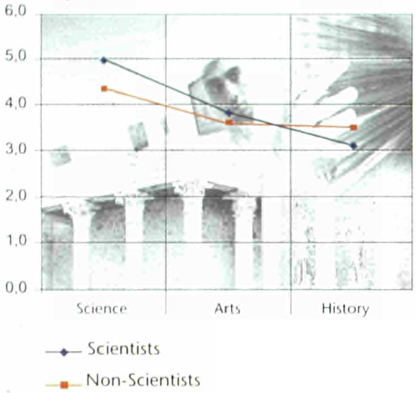
Such solutions have already been applied to the TGV Duplex. Passenger-free zones (luggage compartments, zones in front of and behind the railcars) absorb the shock by crumpling, while the driver's cabin and passenger compartments are designed to reduce impact to a minimum. Also, as the carriages form fixed sets – unlike conventional trains – they can neither override nor spill over the track in the case of an accident.

(1) National Economic Research Associates (NERA): Safety Regulations and Standards for European, Railways; Final Report, Volumes I-V; February 2000. www.nera.com/

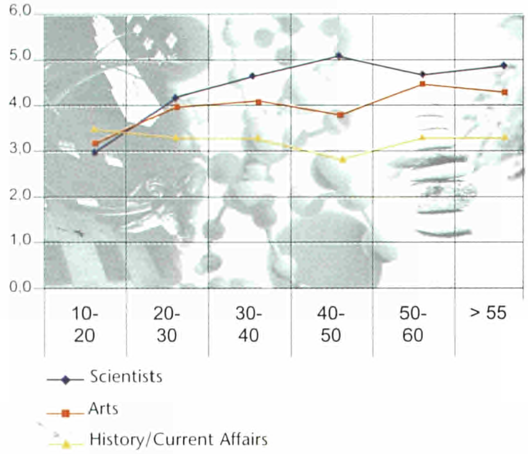
Is scientific culture on the decline? Or has it been lacking for a long time? A survey to test the scientific knowledge of RTD info readers sheds some light on the matter – although the results are not necessarily 'scientifically correct'.

Dispelling the scientific illiteracy myth

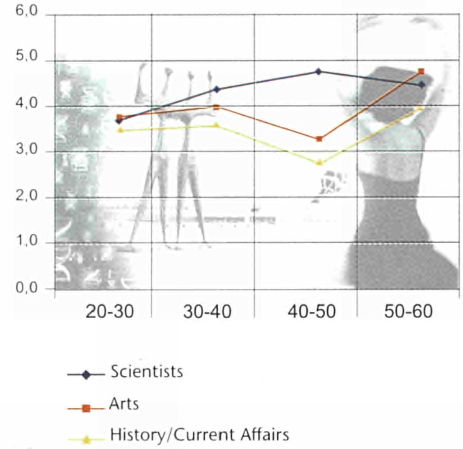
1. Average number of correct answers per question category



2. Average scores by age category (scientists)



3. Average scores by age category (non-scientists)



Scientific literacy is on the decline. Or is it? If we say for argument's sake that it is, the question then is whether this is a recent phenomenon – a by-product of a world where high-tech has come to mean easy solutions – or something that has been eating away at the core of science for much longer? The results of a survey published by *Nature*[1] back in 1989, which reported that only around 10% of the population was scientifically literate, suggest it might not be such a new phenomenon – if you could call it a phenomenon at all.

Critics of multiple choice surveys, such as *Nature*'s and many more since, point out that they only reveal some aspects of scientific culture – providing few points of reference and insufficient comparison with performance in other cultural domains. How can we claim that the public is scientifically ignorant without sufficient data on (say) their knowledge of the arts or history?

To answer some of these questions, RTD *info* decided to issue its own questionnaire, enclosed with the magazine and posted on its website,[2] inviting people to respond quickly and without consulting references, to 21 questions in three categories: science, arts and history/current affairs.

Provided in three languages, the subjects and questions were deliberately limited to factual knowledge and conceptual competence. While it is well known that scientific culture involves additional dimensions, this grouping is sufficient to indicate new directions for educational and training programmes.

Specialist training? You'd never know it!

A total of 220 questionnaires were returned by the end of May. The graph provided (figure 1) shows that the pattern of correct answers is strikingly similar for scientists and people who stated they had no scientific education – even for the science category! This can mean one of two things: that the science items were easier than those in the other two categories, or that scientific literacy is not as poor as first expected.

Supporting the case for the latter, the majority of the non-scientific respondents (50%) answered in the last question of the survey that the 'science category questions were the most difficult to answer'. And yet this is the category in which they performed best. As for people with a scientific education, 77% of them said the history/current affairs questions were the most difficult. However, this is consistent with the fact that these questions have the lowest success rate.

On average, non-scientific respondents performed a little less well in science and a bit better in history/current affairs.

Regardless of the categories of people, the question with the lowest number of good answers is 'Who invented radio in 1901?' (29.8% correct answers: Marconi) and the question best answered is also a scientific question: ' A "brown dwarf" is an expression used in...?' (86.0% correct answers: astrophysics).

Although the small sample size and limited number of questions temper the kind of conclusions we can draw from this experiment, it does show that certain aspects of scientific literacy are better developed than we might think. The irony is: science is everywhere, yet some scientific concepts have widely permeated society while others remain hidden in what has traditionally been the 'realms of magic and myth'. But perhaps not for much longer.

(1) Nature *340 (1989): 11-14*
(2) RDT *info 31* et *http://europa.eu.int/comm/research/news-centre/fr/agenda/quiz_fr.html*