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EDITED BY THE INSTITUTE FOR PROSPECTIVE TECHNOLOGICAL STUDIES (IPTS)
AND ISSUED IN COOPERATION WITH THE EUROPEAN S&T OBSERVATORY NETWORK

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EDITORIAL

Busy Bees Showing the Way

Dimitris Kyriakou, *IPTS*

A piece on the New York Times[1] recently discussed the apparent success of an experiment whose very conception is a testament to the limitless character of human imagination. Scientists were reported to have trained honeybees to seek minute traces of explosives. Even if bees have limitations (e.g. performing under adverse weather), they have certain characteristics that make their 'training' very promising. First, their olfactory sense is spectacularly sensitive. Second, in their hunt they leave no nook uncovered as they weave their way around the search area. Third, they can be easily trained – it has taken scientists, using sugar-water rewards, less than two hours to teach a hive of bees to eschew flowers and pick out a specific residue (2,4 dinitrotoluene) found in explosives such as TNT, in tiny concentrations. Fourth, once a few of them are trained, they transfer the newly acquired knowledge to the entire hive, in as little as a few hours.

In experiments involving twelve trained bee colonies at the Southwest research Institute in San Antonio, Texas only one or two bees per hour picked uncontaminated areas, whereas about 1200 bees per hour correctly picked the contaminated targets. The US Air Force Research Laboratory found that in its tests, trained bees picked the explosive chemical 99% of the time. Moreover, grain-of-salt sized transmitters are to be used in the next few weeks to track individual bees as they follow diffuse trails of bomb ingredients to a source.

Although one could suggest that such innovations could not be used in areas where human presence is high (e.g. airports), one can think of ways in which the trained bees can pick suspects in a crowd, without being even seen by the crowd. There is no space for this here, but think for instance of bees under a thin, porous surface over which passengers have to pass –their reaction when a suspect passes a few centimetres above them can indicate to security agents what and where they should more closely search.

The innovative idea therefore, even if originally funded by the US defense department's defense sciences office of the Defense Advanced Research Projects Agency (DARPA), can have important security implications and applications in non-defence sectors, such as civil aviation. Ideally, it should not therefore be limited to use by the US military.

Beyond the interest of the science and the ingenuity involved in this project, it is perhaps worth bearing in mind that it only started in 1998, received funding of 25 million $US from the US

The views expressed here are the author's and do not necessarily reflect those of the European Commission.

Diversity and Excellence: Considerations on Research Policy

Jordi Molas-Gallart and Ammon Salter, *SPRU*

Issue: The public funding of research operates in an environment of scarce financial resources. Focusing investments on only those centres, individuals or groups that can prove excellent/exceptional capabilities and performance is emerging among some policymakers and scientists as a popular policy option to maximize results. Yet, depending on how this approach is translated into policy measures, it may possibly result in a concentration of research funds and negatively affect the diversity of the scientific and technological base, undermining the potential for the development of new areas.

Relevance: The notion of networks of excellence is central to the current approach to the definition of the forthcoming Sixth Framework Programme, and is also a building block of the European Research Area. The ways in which such concepts will be translated into specific policy measures are still to be defined in detail. It is important to explore prospectively the possible implications of the ways in which the pursuit of excellence as a policy objective is translated into different policy proposals.

The policy problem: distribution of scarce research funds in conditions of uncertainty[1]

Research funding is an uncertain business. The outputs of research and development (R&D) are highly uncertain and skewed.

The skewed nature of R&D outputs has been demonstrated by a variety of studies.[2] For example, using several databases of inventions and innovations, Scherer and Harhoff show that "the top 10% capture between 48 to 93% of the total sample returns" (Scherer and Harhoff, 2000: 559). They argue that when dealing with technology policy, one should expect only 1 in 10 projects to be successful. Skewed distributions also occur when considering other research output indicators. For example, using academic citations we can see that a small minority of papers accrue the vast majority of citations, while most academic papers are never cited (Katz, 2000).

Research funding is an uncertain business. The outputs of research and development (R&D) are highly uncertain and skewed

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Excellent performance becomes the main criterion for the distribution of research funds as a means to concentrate limited R&D resources in a small number of world-leading research actors and, hopefully, to increase research outputs. Past performance excellence is likely to become, increasingly, an *ex-ante* necessary condition to become a receiver of further research funds.

Culling mechanisms and the reduction of diversity

Focusing on the support of excellence is only one side of the coin, the other being that other groups are likely to see their access to research opportunities curtailed. The confusion in the way the term "excellence" is used is partly responsible for this outcome. Often used but rarely defined, "excellence" is taken by many to be simply a synonym of good quality. If so, it could be possible for "excellence to be the norm". Yet, there is another aspect to its definition and use: "excellence" is also a comparative term, meaning better than the norm. In fact, the research techniques used to identify "excellent research" are comparative in nature: scoring mechanisms like the UK Research Assessment Exercise (RAE)[3] are explicitly based on comparative criteria, and the study of institutional performance based on impact indicators like article citations are based on the analysis of the distributions of an indicator or sets of indicators across a population. The groups that these techniques identify as excellent are excellent by virtue of their comparison with the whole population.

In this broadly used comparative meaning, excellent performance can only be achieved, by definition, by a very limited number of researchers or research groups. Under this interpretation, excellence is a relative concept, it only exists by comparison to a much broader population dominated by mediocre (i.e. average) performers. Without mediocrity, there is no excellence. It follows that focusing on excellence will mean "cutting off the tail" of the statistical distribution, corresponding to mediocre researchers (see below for some examples of how this would work in practice). Yet, the resulting distribution will again have a "tail", a better performing one perhaps, but still mediocre if compared with the rest of the survivors. Further, it is very likely that the skewed distribution of results and performance across the population of researchers will remain even after the population has been culled.[4] Under these conditions, the enduring pursuit of excellence by repeatedly eliminating trailing research groups will lead to a reduction in the number, and therefore diversity of research performers. Over time, the continuing reduction in variety would lead to the concentration of research funds to an ever-declining base of researchers.

Policy proposals: some examples

Focusing on excellent performance as the main criterion for funding is likely to increase the concentration of funds in those institutions that have a reputation for past excellence. The use of past performance as a key criterion for the allocation of research funds is becoming an increasingly common policy proposal. This model is now being accepted by many policy-makers attempting to raise research excellence by promoting "concentration" and "co-ordination" in funding, and explicitly seeking to reduce variety, which is seen to be expensive. The model can lead to a situation in which only a limited number of pre-selected institutions and individuals may be allowed to apply for research support.

For instance, in the UK, there are serious policy discussions on the development of new research funding mechanisms that will limit opportunities for those organizations with low Research Assessment Exercise scores. Research organizations that fail to garner a high enough score may be shut out of future research funding rounds. Another example of how this model would work in practice has

If excellence becomes the main criterion for the distribution of research funds, past performance is likely to become the main condition for receiving further research funds

If measures of excellence are based on comparative criteria, cutting funding for projects or organizations at the bottom of the ranking will inevitably result in an ever smaller "population" of organizations on which these comparisons are based

rapid expansion of the software industry that their work was fully appreciated. This pattern has occurred repeatedly in the history of the sciences (Rosenberg, 1992). Sir Robert May, the former Chief Scientific Advisor to the UK Government and Head of the UK Office of Science and Technology, suggests that in order to overcome the essential conservatism of institutions of science, it is necessary for research councils to promote diversity and "ambitious" research. May recognizes that funding "excellence" is not a sufficient policy option (May, 1998).

- *Diversity of sources of funding.* Proposed systems may end up producing concentrations of sources of funding as well as of recipients of funds. One of the main strengths of the US system of research is that there are a number of overlapping and competing funders of research. This competition among funders creates opportunities for new entrants to win resources and enables new areas of research to emerge (Pavitt, 2001). In comparison, European researchers have fewer sources to access when they search for funding.
- *Research plays different roles (including training).* There are numerous studies showing that research and innovation interact in a variety of ways (Salter and Martin, 2001), and that the outputs of academic research go well beyond the generation of new knowledge as embodied in scientific papers. It has been shown that a key benefit of publicly funded research to innovation is the development of trained problem-solvers (Pavitt, 1991; Steinmueller, 1994). Research funding expands the pool of talent for firms to draw upon when developing new products and services. Further, publicly funded research creates the possibility for new fields of inquiry to be developed and expands social choices about the development of new technologies.
- *Size matters.* The demand for scientists and engineers by industry has grown consistently over the past 50 years. In response to this demand, governments have expanded the size and breadth of the research system in which universities play a central role. Cutting off research funding to a large number of these universities would disconnect many students from the research process thus reducing the supply of scientists and technicians trained in research methods and techniques.
- *Excellence is not stationary.* It is possible to have a highly mobile population within a skewed distribution. In other words, those that perform at an average level at a certain point in time may develop excellent research in the future, and vice versa, excellent research groups may become complacent (particularly if their access to funds is made increasingly easy).
- *'Democratic' or inclusive funding mechanisms can help to achieve social cohesion.* In many OECD countries considerable attention has been focused on ensuring a more 'democratic' or inclusive distribution of research funding. Given the characteristics of cumulative advantage in science, it has been found that left to itself research funding tends to be highly concentrated in a small number of regions. Policy measures have been designed to address this problem. In the US, for instance, the National Science Foundation EPSCoR programme (see below) has been set up to support proposals from less favoured US States.
- *Uncertainty.* The problem faced by funding organizations is to determine *a priori* what will be excellent research. Under hypothetical conditions of full information and certainty, an efficient solution to resource allocation could be found. Yet, when luck and serendipity are important factors in the generation of research results, it is very difficult for peer review panels to know when or where excellence will emerge. Under these circumstances, research funding organizations have tended to select proposals from a variety of academic institutions, in

One limitation of "excellence-only" funding models is that they tend not to promote the kind of diversity that may be necessary to foster innovation

Excluding underperforming organizations will reduce possibilities for contact between students and the research process, thus possibly restricting the supply of future researchers

The Basque regional government in Spain is considering a layered approach to research funding as a means to promote diversity. The approach would use different sets of mechanisms to promote and support the research work of different types of units, from established research groups to groups with no previous research experience (Gobierno Vasco, 2001). In the US, the goal of ensuring more 'democratic' funding has recently been translated into the Experimental Program to Stimulate Competitive Research (EPSCoR) supported by the National Science Foundation and several US States. EPSCoR is designed to overcome the tendency towards concentration of research activities by providing special backing to States receiving a small share of total NSF research funds (0.7 percent or less averaged over a three-year period). Currently, 21 States and Puerto Rico are eligible to benefit from several support actions including funding for new research infrastructures and special arrangements when submitting research proposals to the NSF (National Science Foundation, 2002).

Conclusions

Focusing on comparative, past-performance-based measures of excellence is not enough to develop a useful policy framework. Particularly dangerous is to use such assessments of excellence to determine *ex-ante* who is eligible to conduct research. By closing off opportunities for new entrants, such an approach may reduce the variety and breadth of the research base and is likely to have a pernicious impact on new fields of research. Besides, it is important for funding agencies to realize that the distribution of research outputs will remain highly skewed regardless of whether they adopt the "excellence-only" model. By definition, average research can never be eliminated and it is futile to pursue its eradication.

Alternative approaches encourage diversity in the research base by using a variety of funding instruments. The choice now faced by governments is not to fund average or excellent research, but rather to further concentrate research funding in the hands of the few or aim to support diversity and generate depth in the research system. To fund high quality research, agencies should continue to rely on peer review of research proposals rather than narrowing their future choice by concentrating funds in a small number of groups with a track record of excellent performance as identified by the limited set of indicators at our disposal. Review methodologies must attempt to ensure that this process does not cut off the sources of variety in the research system. Space needs to be created for ambitious research, research that does not fit inside the bounds of traditional disciplines and does not appear to fit conventional models of excellence. Research funders can beneficially promote diversity by focusing on the funding of a broad range of research projects, from a wide range of different organizations, judged by the quality and novelty of their proposals. This process could be aided by review panels composed of experts drawn from a variety of different perspectives and backgrounds, including academic and non-academic communities. Funding new entrants is likely to remain expensive and generate research that is unsuccessful. However, this is a price worth paying in order to sustain diversity.

These are important considerations when notions of excellence are translated into policy practice in the context of the forthcoming Sixth Framework Programme. We would argue that a portfolio approach to funding would require the maintenance of a variety of instruments, structured so as to enable new entrants and smaller research groups to benefit from research funding and European collaboration. The new FP6 is moving towards a mixed economy model with networks of excellence, integrated projects and open project competitions. For instance, the networks of excellence are likely to be a key tool within the new set

A portfolio strategy of support recognizes that only a few successes will pay off on a large scale and is based on the projection that generous returns from relatively few successes will also cover the cost of many less successful projects

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butions to science and engineering in the United States. In addition, the number of foreign-born scientists and engineers in the US workforce has increased by nearly 10 percent a year since the 1990s. In 1996/97 the number of foreign scholars lecturing in the US totalled 62,350, up 5 per cent from the preceding year (WTO 1998).

However, the recent acts of terrorism against the US, the backlash against immigrants that followed, and the subsequent heightened security –that is mainly focused on foreigners– are expected to send strong deterrent signals to potential S&E (science and engineering) emigrants. A growing perception abroad of the US as a place with growing xenophobia will inevitably hamper the development of the US research system in an era of global mobility. Likewise, a change in the perception of the US as being a safe and welcoming place could encourage aspiring S&E migrants and students to consider alternative destinations. In 1992, it took just one incident (the tragic killing of a Japanese student due to a linguistic misunderstanding) to drive many Asian students away from the US. It is reported that Asian students are still being warned to be careful in America[1]. Recently proposals have been put to the US Congress to impose a temporary halt on all student visas, to ban students from certain countries from coming to the US, and to closely monitor and screen foreign students in the US. Recent events of espionage too have put a strain on the extent to which foreign S&Es are trusted in certain posts. Some research has already registered a major decline in applications made by foreign students to US universities (IIE, 2002).

However, although the terrible events of September 11th may encourage talent to stay away they cannot be responsible for where it goes. Even before the recent security crisis, the US has been facing increasing competition from other countries, such as Australia and the United Kingdom, mainly for Asian students. More recently, Canada has come to compete successfully in the recruitment of foreign students as well (WTO 1998). Table 1 provides an overview of the major host countries of students from Asia. The US tops the list followed by the UK and Germany, which raises the question as to whether the security crisis in the US will mean more students from Asia will make their way this year to European countries.

As the prime destination for talent from abroad, the US has benefited greatly from the contribution of immigrant scientists and engineers to the advancement of its research agenda

Table 1. Major host countries to international tertiary students from Asia (Latest year for which data available: from various years, from 1993/94 to 1996/97)

	Number of students	
United States	290,876	40.7
United Kingdom	71,314	10.0
Germany	60,000	8.4
Japan	49,000	6.9
Russian Federation	39,000	5.5
Australia	31,000	4.4
France	19,000	2.7
Canada	17,029	2.4
China	16,790	2.3
	14,390	
	714,500	

Source: UNESCO (1998, Table 3.14, pp.396-423).

encouraged to push ahead with their efforts with the likelihood of greater than ever success.

- Non-permanent S&E residents who do not or cannot return to their country of origin might increasingly seek alternative destinations. Various push and pull factors combine to make new destinations more attractive. Europe and Canada are set to benefit from this trend. Given its proximity to the US, Canada could appear to be an increasingly attractive destination, but the breadth and depth of the European S&T scene might appeal to some of these S&Es.
- Increased emigration of scientists and engineers who are established permanent residents who would find the growing international labour market increasingly attractive. Persons who would not have considered the option of emigrating (for a 2nd time) might consider this option more seriously when presented with interesting opportunities.

The outlook for Europe

More recently, there have been several indications that some countries in the EU (and the European Economic Area in general) are keen on joining the club of countries actively seeking highly skilled immigrants. The post-1960/70s notion of halting immigration in Europe is being gradually replaced by the idea of 'smart immigration'. Denmark, France, Germany, Ireland, Norway, Netherlands, Sweden and the UK have all either introduced new legislation facilitating the immigration of skilled labour or provided tax discounts for highly skilled foreign labour (Mahroum, 2001). At the EU level, proposals have been made by the European Commission to establish an EU "green card" (i.e. permanent resident's permit) for the benefit of non-EEA nationals who have been residing in the EU for more than 5 years. This legislative change is a prerequisite for changing the kind of immigration in Europe, as it sends a signal to more skilled would-be immigrants that Europe is open for them too.

Table 2 shows the proportion of foreign workers in various categories for nine countries based on Sexton's work (Sexton, 2000).

Table 2 shows Belgium, Germany, the UK and France to have the highest percentages of highly-skilled foreign workers among EU countries, whereas Italy and a number of other countries (Spain, Finland, Portugal) all have much lower

Denmark, France, Germany, Ireland, Norway, Netherlands, Sweden and the UK have all either introduced new legislation facilitating the immigration of skilled labour or introduced tax discounts for highly skilled foreign labour

Table 2. Proportion of non-nationals in labour force by category

	ISCO 1 Legislators, senior officials, managers	ISCO 2&3 Professional and technicians	ISCO 4-9 Other work categories, non-professional, non-manager	TOTAL
Sweden	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
France	[illegible]	[illegible]	[illegible]	[illegible]
Germany	7.7%	4.0%	10.1%	7.9%
Italy	1.1%	0.7%	1.0%	0.9%
EU Average (includes other countries not listed above)	4.3%	3.1%	5.1%	4.5%

occupations, whereby no taxes are paid on the first 25 per cent of their income.

Conclusions

Europe seems to be moving rapidly towards a new immigration regime that distinguishes between skilled and unskilled immigrants. The new changes might transform Europe into one of the most welcoming destinations for highly skilled immigrants. Even at the cultural level, language restrictions on foreign academics have been relaxed and many positions are now advertised in English. Even if the reduced attractiveness of the US proves to be a temporary trend, the window of opportunity that now exists might provide the chance for reviving Europe's old role as a magnet for talent from all over the world. Perhaps what is most needed is the realization and acknowledgement of this opportunity and to act upon it by raising awareness of Europe as an alternative destination. Some EU countries are better prepared than others, but the diversity of the EU might prove to be a main advantage as it can accommodate inflows from an equally diverse group of countries.

Keywords

highly skilled immigration, foreign students, immigration legislation

Notes

1. See URL link to the Asian American Movement

http://www.libarts.ucok.edu/english/asian/lectures/movement/index.html

2. The name given to the effect whereby the "rich get richer and the poor get poorer".

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The Role of Innovation Strategies in Regional Development from the Accession Countries' Point of View

Tibor Dory, *IPTS*

Issue: Regional policy interventions and instruments can have a major influence on encouraging competitiveness in an era of rapid global economic, technological and cultural change.

Relevance: The European RIS and RITTS projects were encouraged to adopt a broad definition of innovation embracing the whole range of managerial, commercial, technical and financial factors which enable a new or an improved product/process to be introduced into the market place. RIS/RITTS-type exercises could also significantly influence the development of innovation systems in accession countries, but regions within these countries should not merely copy Western European experience, rather they need to launch initiatives of their own, in accordance with their level of development and available resources.

Systemic approach to innovation: How do regional systems of innovation come about?

Economic geographers and regional economists have long recognized the importance of localization, agglomeration and the regional economy in the wider dynamics of innovation, industrial growth and economic development. Since the mid-eighties they have been paying considerable attention to the relationships between technological change and regional innovation networks. Numerous empirical studies have been conducted in the field, and additionally a number of researchers have tried to devise a theoretical framework enabling the identification, systematization and quantification of innovation networks (*Braczyk et al.* 1998).

Innovation is playing an increasingly central role in enhancing the competitiveness of enterprises, branches of industries, regions and countries. Nowadays not only are those innovations essential which are embodied in products or services developed in research centres and laboratories and successfully introduced in the market, but a

Economic geographers and regional economists have long recognized the importance of localization, agglomeration and the regional economy in the wider dynamics of innovation, industrial growth and economic development

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However, no unique way exists to foster regional innovation capacities and to ensure the competitive advantage of regional firms. This probably constitutes one of the main policy challenges for European regions in economic transition. Concluding from the theoretical overview, the establishment and support of a functioning regional innovation system – including a favourable innovation culture, the identification of regional innovation potential and the support of innovation networks – can be considered an important element of a successful regional development strategy.

Lessons learnt from the European RIS/RITTS exercises

There is an increasing recognition that encouraging competitiveness – in an era of rapid global economic, technological and cultural change – requires key policy interventions at various levels. In the European Union there has been an important change in the focus of the Structural Funds –the main instrument for promoting social and spatial cohesion within the EU– over the last two decades. Initially the Structural Funds were largely geared towards the provision of "heavy" infrastructures in the less-favoured regions (LFR), such as roads, buildings, land reclamation, basic training and so forth. In recent years, however, the emphasis has begun to shift towards "soft" infrastructures, like innovation-support services to foster the exploitation of research and technological development (RTD). This new focus can partly be explained by the fact that the Commission is now more intent on addressing not just the symptoms of peripherality, but also the causes, one of which is deemed to be a weak capacity to innovate. After 1994, in the new programming period of the Structural Funds a new generation of regional innovation policy could be observed. The new regional innovation programmes also entertain a much broader understanding of what constitutes innovation, thus highlighting the role which a wide array of organizations can play in fostering innovation capacity (*Morgan–Nauwelaers* 1999).

In parallel with the main interventions of the Structural Funds, the Commission has launched a number of pilot projects to explore ways to overcome structural difficulties (economic and technology gaps between the Member States, inter-regional differences and increased polarization). In 1993 eight pre-pilot projects were launched to test and develop further the initial idea of "Regional Technology Strategies" in the field of innovation promotion at regional level. The concept was renamed as Regional Technology Plan (RTP), which created a great deal of interest from other regions and led the European Commission to publish an open call for proposals in 1995, to initiate pilot schemes for the implementation of *Regional Innovation Strategies* (RIS) funded under Article 10 of the European Regional Development Fund (ERDF). In parallel with this action, the former DG XIII (now DG INFSO) launched a *Regional Innovation and Technology Transfer Strategies and Infrastructures* programme (RITTS – Innovation Programme within the Fourth RTD Framework Programme)[1].

The RIS and RITTS projects were encouraged to adopt a broad definition of innovation embracing managerial, commercial, technical and financial factors which enable a new or an improved product/process to be introduced onto the market place; or enable a public or private organization to introduce or improve service delivery to the general public. Innovation in such a context is not only about increasing economic wealth but it is also an improvement of social well-being (primarily through the creation or safeguarding of employment opportunities in the regions). To date over 100 European regions have conducted exercises of this kind and have started to implement the action plan.

There is an increasing recognition that encouraging competitiveness – in an era of rapid global economic, technological and cultural change – requires key policy interventions at various levels

The RIS and RITTS projects, which were funded by the ERDF and DG INFSO, respectively, were encouraged to adopt a broad definition of innovation embracing managerial, commercial, technical and financial factors

Conclusions: How can regional innovation systems be built in accession countries?

The successful Western European examples unambiguously confirm that current regional policies place emphasis on supporting the establishment and diffusion of innovation. *The new endogenous growth-theories* emphasize that technological development plays a crucial role in economic growth, and through the *concept of regional innovation systems* they offer a theoretical framework for the *regional innovation systems*. In the course of worldwide and Europe-wide regionalization processes, both national and *regional governments are re-evaluating and re-thinking their conventional research and technology policies*. However, in most accession countries the "regions" are too small in terms of geographical area, numbers of inhabitants and economic weight. In administrative terms these newly funded regions are not strong enough to develop an independent innovation policy. The institutional and economic dimension of the regions does not show a clear regional identity, because most of them were funded as a requirement of the EU for managing the structural and cohesion funds.

In recent years a variety of measures and programmes have appeared both worldwide and within the European Union, regarding the de-cen-

...in regions of accession countries (RIS-NAC)

...projects promoting innovation strategies in accession countries were ...completed by 2002/2003. The main objective of these projects is to develop ...strategies in accordance with the RITTS/RIS project scheme and methodology. ...supported by at least one EU region that has already undertaken a RITTS/RIS ...regional innovation strategy and action plan. This approach will ensure ...will take full advantage of the experience gained through the previous ...strategies in partner regions.

...are available at the network of *Innovating Regions in Europe (IRE)*. ...facilitate the exchange of experience between regions developing regional ...strategies and schemes, and to improve their access to good practice. The ...illustrate the main objectives of the new RIS-NAC projects. (For further ...innovating-regions.org).

...project aims to develop an innovation strategy with the support ...Germany) and Lazio/Puglia (Italy). The objectives of these projects are:
...awareness of the importance of innovation and technology transfer ...regarding the main RTD and innovation priorities which should receive ...
...by providing support to SMEs active in growing sectors, and support ...
...skills, mainly through the application of innovation management ...
...organizational framework to support innovation.

...Cyprus and will be supported by partners from Central Macedonia (Greece) ...of the project is twofold: to design a strategy for technological development ...implement this strategy by developing an action plan, the aims of which are:
...innovation support services
...innovation infrastructure
...competitiveness of SMEs.

...of the RISC project is to develop a mechanism to attract funds that will ...technology and innovation capability of Cyprus.

- more attention for relatively neglected regions with development potential
- making available adequate financial resources and setting realistic and achievable targets.

Recent research suggests that regional learning is crucially important in order to increase firms' knowledge base, their competitiveness and their ability to be included in networks. Such processes should be embedded in a regional vision built on broad participation by different actors and the region's public. Facing the particular context of economic transition and the forthcoming enlargement of the EU, raising innovation issues constitutes an important step towards sustainable regional development for regions in accession countries. Finally, we can conclude that these exercises have a contribution to make to the catch-up process underway in these regions and ultimately to the integration of European research and that they can make a contribution to the development of the European Research Area.

Keywords
innovation systems, innovation strategies, networking, regional policy

Note

1. Although the administrative and financial responsibility for the RITTS project lay with the former Directorate-General XIII (Telecommunications, Information Market and Exploitation of Research) and that of the RIS projects was run by the former Directorate-General XVI (Regional Policy and Cohesion), the projects are jointly managed by the two Directorates-General. While the two types of projects are similar in their methodology they differ on a number of points, the main differences being that the RITTS projects were designed to evaluate, develop and optimize regional infrastructure and policies and strategies for supporting innovation and technology transfer, whereas the RIS projects were designed to create partnerships between key actors in a region with a view to defining an innovation strategy for the region in the context of regional development policy.

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Internet Banking: what it is

Browser-based online-banking (Internet banking as opposed to client-server dedicated financial software) makes it fast, easy and affordable to open a secure Internet channel, through which customers can conduct routine banking queries and transactions. Greater consumer convenience, enhanced functionality and efficiency and possibly improved profits are the key drivers on the supply side. Consumers can enjoy very competitive interest rates, low bank charges, around-the-clock availability and the possibility to pay electronically for an increasing number of products and services.

The financial services sector was one of the first to adopt the Internet as a new marketing channel, as soon as Internet technologies were sufficiently diffused. Moreover, due to the intangible nature of the products and services on offer, greater expectations of success in this sector were created. These expectations were raised yet further when Internet banking was proven to lower the transaction costs between bank-branch and Internet-bank services by the order of 100:1 (Physical branch $1; Telephone $0.50; ATM $0.27; PC dial-up $0.08; Internet $0.01)[1]. While achieving such a low banking transaction cost, proved at first possible for newly created virtual banks, the functions of branding, marketing, and in general, customer acquisition proved complex and costly.

In Europe we have witnessed at least three types of Internet banking. One using the Internet simply as an alternative channel (no price differentiation vis-à-vis other access modes). A second type where an Internet-only bank is created (independent of the entity that created it) bringing strong price differentiation in a move to acquire new customers. And a third one through which the banking entity tries to integrate all of its channels (through the use of appropriate Internet technology) offering a variety of tailored products and services. Whatever the business model, most European banks are offering Internet banking services at the very least as a defensive move so as not to lose valued customers to ambitious, innovative new entrants.

B2B e-commerce and Internet banking

Business clients seem to have embraced Internet banking mainly because of the convenience it offers, together with reduced charges for electronic payments. Corporate clients can benefit

Banks developed flexible Internet-based systems to meet customer needs but in many cases, the returns achieved have not lived up to initial expectations

Financial institutions offered browser-based online banking services early-on and a number of different service-delivery models were tried

banking customers

customers to perform almost the whole range of banking
interface. In most cases, however, customers seem to prefer
manage their accounts. Most SMEs, when banking online, obtain
with a few already applying for credit or buying and selling invest-
Bank's B2B.com, provides online-banking and secure purchase-
SMEs with sales of between 5 and 250 million. Sweden's largest
banking SME customers, is developing a wireless access
capabilities of the mobile phone and while waiting for 3G
e-procurement of office supplies and equipment is the
what is currently on offer is:
registration;
time), generation of various types of customized reports and
tools;
transfers, applying, ordering and signing electronically
viewing and modification of account data;
policies, securities, loans, tax certificates, etc.

tunity to meet the financial needs of companies trading on the Internet.

In the near future some additional interactivity will be included, leading eventually to direct (personalized) marketing of products and services. Customization and personalization to boost customer retention and financial supermarkets (where third party products are incorporated on a banking portal) are some of tomorrow's marketing targets for banks. Still there will be a need to improve competition in this market by for example requesting that the pricing of banking services and banks' decision-making process become more transparent.

e-payments constitute an important offering

New e-payment solutions are now available which enable customers to save money and time and improve the quantity and quality of information on cash flow. In a true end-to-end e-payment system, one would create, digitally sign and forward payments in a secure Internet environment. On the other hand electronic payment systems refer to more than just the payment function. Payment systems are never only about payments but also encompass technical security measures, authentication mechanisms, legal regulations and potential law enforcement, contractual regulations of liabilities and insurance against risks. Moreover, powerful handheld devices have the potential to gradually influence the delivery of e-payment services. Changes in the use of payment cards (including credit, debit and pre-paid electronic money) as well as the demand for cash are foreseen as consumers transact (transfer amounts between their bank accounts and those of retailers) by means of portable devices (mobile-banking).

Trust is a less important issue for this segment since trading partners generally have a previous relationship and pay through invoices and other payment procedures that are common in that specific business context. For example in Germany these payment procedures tend to be based on credit-transfers, whereas in France cheques and payment cards play a bigger role.

For SMEs, now that a wide range of e-procurement solutions have been developed, attention is shifting towards making further use of the applications to streamline the payments process. An increasing number of marketplaces, suppliers and solution providers are starting to include facilities to get payment authorization and to transmit payment orders. Whatever the settlement path selected, provided both buyers and sellers are given sufficient assurances, there is a role for financial institutions that are willing to provide increased credit flexibility (making funds available at a price to a non-risk customer). Thus there is opportunity for increased efficiency in the whole transaction chain.

Security as the main element

Increased levels of security, such as 128-bit encryption, digital signatures and specific authentication procedures (token-based or smart-card authentication, or dynamic passwords) can create a role for banks based on their image as trusted third parties. Authentication and validation of identity is the main public concern on the Internet, with external and insider security attacks, hackers, viruses and denial-of-service attacks following close behind. Network security must guarantee access control, data confidentiality and integrity, authentication, and non-repudiation. With digital signatures, trading partners may exchange documents with an appropriate level of certainty. However, businesses still prefer to settle payments by traditional rather than electronic means of exchange (especially for high-value transactions).

Security and trust seem to be used by banks as the main means to motivate customers to

In the near future some additional interactivity could be included in online banking services, leading eventually to direct (personalized) marketing of products and services

A truly end-to-end e-payment system would allow users to create, digitally sign and forward payments in a secure Internet environment – in this context security needs to cover regulatory and other issues as well as technical ones

SMEs may lack awareness of network security issues, or the resources to act on any knowledge they may have, perhaps leading to slower uptake of the possibilities offered by online financial services

Keywords
Internet banking, SMEs, e-commerce, electronic invoicing

Note

1. Valid for the U.S.A. Simple average of three studies by (i) US Department of Commerce; (ii) Booz, Allen & Hamilton, 96; and (iii) Goldman Sachs and Boston Consulting Group.

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design of products and services. Exploiting the potential of information technology puts high quantitative and qualitative demands on human resources, too. And using information technologies as productive tools very often requires a considerable amount of tacit knowledge, which links the codified knowledge of the virtual world of ICTs to the real world. Therefore, globalization has not eliminated the importance of location; rather it has increased the value of non-transferable, geography-specific factors.

Knowledge and Innovation

Innovation cycles are getting shorter. This means on the one hand that all innovation and innovation-related factors, such as human capital, educational skills, research and development, and intellectual property rights and their management, have to be considered highly important. On the other hand, shorter innovation cycles require greater flexibility from economies and individual enterprises as well as from labour markets and government policies.

Companies and entrepreneurs are now trying to find new combinations or relationships between economic performance and R&D, know-how, IPRs, supply chains, brands and skills, and so on. Computers and the Internet are offering the means for a sweeping reorganization of business, from online procurement of inputs to more decentralization and outsourcing. The mobility of services, including business services, is part of the general process of globalization. Firms tend to choose to locate their business activity where the framework conditions (regulatory frameworks, production costs, transport costs, etc.) are most suitable. This could arguably affect particular sectors of the economy as firms relocate to areas better suited for their line of business, whether for economic or legislative reasons (e.g. India attracting mostly run-of-the-mill programming tasks from businesses around the world, while learning the business and building the infrastructure). The speed of change and the range of possible choices lead to a general increase in uncertainty and a demand for methods to deal with these uncertainties, on the level of the individual firm as well as on the level of policy.

Europe's S&T system as a source of knowledge and innovation shows specific strengths and weaknesses, which are presented in the table below.

The situation of Europe within the changing economic landscape will largely be determined by the ability of its S&T system to create, renew, and use a Europe-wide knowledge base. Integration enhances the competitiveness of economic entities. Completion of the internal market will allow firms to enjoy reduced marketability costs for a larger European market, and lower transactions costs, access-to-skills costs, capital costs, etc. The integration process leads to (re)location decisions, which, depending on the degree of integration, and on "marketability" costs (which may include

One consequence of the rise of the knowledge economy is an increased emphasis on human factors and human resources, particularly in roles requiring tacit knowledge

ICTs are enabling sweeping reorganization of business, and players in the global economy are able to choose their location on the basis of the framework it offers as much as on the strength of geographical factors

The situation of Europe within the changing economic landscape will largely be determined by the ability of its S&T system to create, renew, and use a Europe-wide knowledge base

Table 1. Strengths and weaknesses of the European S&T system

Strengths	Number of students
• Quality of human resources and the systems of education • Wide variety of schools and strong research tradition • Excellence in research institutions	• [illegible] • [illegible] and new firm creation • Fragmentation and separation of research activities

Source: Compiled by the authors

Intellectual property rights were formerly considered to be primarily a national concern but are now clearly an international issue. Harmonization and reciprocal recognition of intellectual property rights are viewed by corporations and many policy-makers as a key factor in promoting international trade.

IPR principles should become part of the training of managers (including senior management), scientists and engineers. The education of scientists, technologists, and business managers in most of Europe does not usually include formal exposure to the field of intellectual property. This frequently results in a failure to appreciate the general intellectual property environment, and even a failure to carry out research activities in an acceptable manner (e.g. maintaining laboratory notebooks and procedures in a manner acceptable to the courts). Senior management must be involved with intellectual property. Visiting laboratories, and involvement in intellectual property analysis as a component of competitive strategy should become normal activities for all senior managers.

However, there are also dangers and risks associated with the management of intellectual property rights. Patents are often claimed to be an important incentive for research and development. However, patents are nowadays often used in ways that are very different from their original concept and aim of protecting inventions and fostering their distribution. The various strategic uses of patenting are not limited to large firms[7]. Small and medium-sized biotechnology businesses, naturally restrained by their economic resources, also use strategic patenting in order to achieve competitive advantages without expending too much of their own resources. In a way, small companies depend even more on patenting than larger ones, since their patent portfolio is often the only economic asset they have. There are already serious concerns about over-patenting and its negative effects. Heller and Eisenberg[8] warn against excessive biotechnological patenting, in particular of the deterrent effect of high transaction costs and the resulting "under-use" of patented biotechnological information. Although ethical issues are not under discussion here, it has to be asked whether certain classes of knowledge ought to be in the public domain rather than in private hands where they are used for economic purposes. For example, patents on medical procedures have come in for a great deal of criticism. Society at large also has an interest in ensuring certain technological knowledge remains publicly available for educational reasons.

Another example is that of software patenting. Although big names such as Oracle, Adobe, etc. have claimed that patents on software are more harmful than useful, the US legal system has allowed the filing of patents for elementary software processes for a decade. The 30,000 software patents filed every year are now used to attack and eliminate independent software publishers or free software authors. After intensive US lobbying efforts, Japan has also introduced software patents.

The question as to whether current exclusions from patentability such as in relation to certain biotechnological inventions and computer software still serve a useful purpose needs to be addressed, though it is important to bear in mind that too strong (as much as too weak) an IPR protection regime can discourage innovation.

Conclusions

A rapidly changing context is clearly placing knowledge generation, diffusion and ownership centre stage. Key challenges today involve the following factors :

- the increasing speed of change and emphasis on knowledge and wide access to it, in order to adapt to change

In the knowledge economy knowledge can become a company or individual's key asset, making it necessary for scientists, technologists and managers to have an understanding of the functioning of the IPR system

Although IPRs are recognized as a necessary incentive for research, excessively strong patent rights can potentially hinder the development of new ideas. Biotechnology and software patenting are two areas which have come under attack in this regard

Patents are nowadays often used in ways that are very different from their original concept and aim of protecting inventions and fostering their distribution

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The mission of the Institute is to provide techno-economic analysis support to European decision-makers, by monitoring and analysing Science & Technology related developments, their cross-sectoral impact, their inter-relationship in the socio-economic context and future policy implications and to present this information in a timely and integrated way.

The IPTS is a unique public advisory body, independent from special national or commercial interests, closely associated with the EU policy-making process. In fact, most of the work undertaken by the IPTS is in response to direct requests from (or takes the form of long-term policy support on behalf of) the European Commission Directorate Generals, or European Parliament Committees. The IPTS also does work for Member States' governmental, academic or industrial organizations, though this represents a minor share of its total activities.

Although particular emphasis is placed on key Science and Technology fields, especially those that have a driving role and even the potential to reshape our society, important efforts are devoted to improving the understanding of the complex interactions between technology, economy and society. Indeed, the impact of technology on society and, conversely, the way technological development is driven by societal changes, are highly relevant themes within the European decision-making context.

The inter-disciplinary prospective approach adopted by the Institute is intended to provide European decision-makers with a deeper understanding of the emerging S/T issues, and it complements the activities undertaken by other Joint Research Centres institutes.

The IPTS collects information about technological developments and their application in Europe and the world, analyses this information and transmits it in an accessible form to European decision-makers. This is implemented in three sectors of activity:

- Technologies for Sustainable Development
- Life Sciences / Information and Communication Technologies
- Technology, Employment, Competitiveness and Society

In order to implement its mission, the Institute develops appropriate contacts, awareness and skills for anticipating and following the agenda of the policy decision-makers. In addition to its own resources, the IPTS makes use of external Advisory Groups and operates a Network of European Institutes working in similar areas. These networking activities enable the IPTS to draw on a large pool of available expertise, while allowing a continuous process of external peer-review of the in-house activities.