Annex A: Detailed reports of visits to Member States and US/Canada and examples of good practice

This annex includes details of the interviews that have been carried out with a wide cross section of policy officials, think tanks, university representatives, business people, venture capitalists and entrepreneurs between July and October 2001. Nine countries were visited in total. Good, practice is illustrated in shaded boxes.

Please note that the comments and examples below are only tended to be illustrative, and reflect the opinions presented by people who were interviewed. However, having spoken to a range of key people in each country, certain broad themes and concerns tend to emerge quite strongly. These are reflected in the accounts below.

In addition, it should be noted that the good practices offered are not to be seen as ideal solutions that would be appropriate for all countries. When thinking about policy solutions, one needs to ask the question: good practice for what? Each country needs to consider the appropriateness of policies given, in particular, the size and openness of its economy, firm size distribution, innovative capacity, and the current level of economic development.

CANADA

1. Industrial policy

Industrial support schemes were sometimes criticized for focusing on marginal firms – those that would have failed without help – often in the name of regional support and equalisation schemes. One view was that this had fostered the development of an entire industry of weak firms whose main preoccupation was the receipt of public funds, not growth or profitability. Some therefore saw a need for large scale restructuring of government industrial support. There were some positive signs though: a recent Ministry of Finance paper argued that the federal government ought to focus not on industrial subsidies but on human capital.

It was stressed that both EU countries and Canada had much to learn from the US in terms of focusing on strong industries, not weak ones.

The Canadian system of R&D tax credits was widely supported, and considered to be designed extremely well. One scheme allows companies to write off their R&D capital expenditure against profits immediately, and another offers companies a minimum of 20% credit towards current R&D expenditure (there are in addition schemes offered by the provincial governments). Volume based schemes were thought superior to incremental schemes, which often encountered administrative difficulties.

2. Commercialisation and science-industry links

It was felt strongly that Canada does not commercialise its research as much or as effectively as the US. This meant that more spending on the science base was not enough. In fact, Canada's research was often better commercialised by US firms, so that, for instance, US pharmaceutical firms exploited Canadian-funded research to develop drugs which were then sold back the Canadian healthcare system at substantial profit. A recent initiative, the Canadian Institutes of Health Research, approved by the Canadian Treasury because its initial remit was to focus on commercially viable innovation, had since become dominated by the concerns of the research establishment and was now focusing on basic research.

There appeared to be an ongoing problem of higher education institutions (HEIs) having insufficient legal expertise to deal with intellectual property portfolios, which slowed down the commercialisation process. More work also needed to be done to improve the communication between public and private research departments.

The Vitesse programme, run by the National Research Centre (NRC), offers researchers 8 months in an industry setting and 8 months of academic training in a specific, often cross-departmental discipline such as photonics or bioinformatics. This enables private companies to pick a suite of courses from any Canadian HEI to ensure their researchers are trained in the appropriate specialism. This has required seed funding from the NRC, but will in time become self financing.

An entrepreneurship programme, also run by the NRC, allows researchers six months paid leave to have training in running a business, and still permits them to use the NRC's research facilities. In addition, researchers are given a two year chance of commercial success, and offered a research placement at the end if they have not been successful.

3. Knowledge transfer

The Ottawa Centre for Research and Innovation (OCRI) is a knowledge transfer organisation founded by industry which sees itself as the 'glue' in the middle of collaborative research. It offers a plethora of different services, including networking events and a monthly forum for lawyers. It helped professional services firms make a culture change when dealing with small firms – for instance by suggesting they restructure their fee payments and provide mentoring and pro bono services up front. It has strong links to education, employing over 30 teachers and enabling companies to interface more productively with schools. It is currently thinking about providing HEIs with the legal capacity for IP in order to smooth the process.

4. Supply of skilled scientists and engineers

The supply of researchers was regarded as a serious issue in Canada; there are also concerns about a 'brain drain' of top talent to the US. A recent OCRI initiative, the National Capital Institute of Technology, is industry led (though with public funding) and aims to create an MIT (Massachusetts Institute of Technology) of the north, with a focus on retaining academic talent in Canada.

5. Venture capital

More was felt needed to increase the supply of capital at the early stages. There was recognition that access to venture capital, and not soft loans or loan guarantees was now the principal need of small businesses. The government is trying to increase the amount pension funds invest at the small end (currently about 5-10%) to US levels. And the Canadian Community Investment Programme helped build networks between angels and ensure sound investments. A recent positive development had been the creation of the CDNX – a technology stock exchange – prior to which companies aiming to make an initial public offering (IPO) would often use the NASDAQ.

An OCRI initiative, the entrepreneurship centre, is a very hands on small business service offering venture capital and mentoring which receives public funds.

Technology Partnership Canada (TPC) leverages private investment in high tech companies in the environmental and aerospace sectors by investing public money. This enables government to share in the upside, and replaces a subsidy system.

6. Government strategy and leadership

There was a growing consensus, in industry and government, that Canada had increasingly to market itself as better than the US. Owing to a core-periphery effect experienced with the US, it was thought that the Canadian brand ought to contain a strong emphasis on a healthy enterprise and innovation environment. For instance, despite some concerns about the total tax take at state and federal level, corporation tax and capital gains tax now compare favourably with the US – in fact, corporation tax will be lower than in the US in 5 years time.

In Ottawa itself a number of vehicles have been of use: seven years ago, an Economic Development Committee was set up to identify industry clusters in the region. In addition, a partnership between business, education leaders, provincial and local government and OCRI, provided a helpful vehicle to discuss shared concerns. This actually benefited from not having a mandate or specific remit, since it is able to raise a very wide variety of issues.

A policy research initiative in Industry Canada was now driving forward a rigorous analysis of Canada's areas of comparative advantage and systematically benchmarking achievement in key areas.

7. Standards and regulation

There was much interest in how regulatory regimes interact with the innovation environment, especially in areas where there was a public interest such as food safety, drugs, or water quality. There was recognition that these regimes must be very clear – show a sense of direction in government policy so industry can make important strategic decisions. In some areas it was seen as beneficial to harmonise standards with the US, but in others to go alone – eg in allowing the patenting of higher life forms, adopting a more liberal encryption regime.

It was also considered important to promote public education: for instance, make sure that genetic engineering is associated with healthcare and environmental advances, not genetically modified tomatoes.

Details

Meetings included: Barb McNally; **Ottawa Centre for Research and Innovation**.

Ross MacLeod; **Industry Canada**

Arvind Chhatbar; **National Research Council**

Roderick Bryden; **World Heart Corporation**

Sam Boutziouvis; **Business Council on National Issues**

DENMARK

Key findings

1. Venture capital

A small venture capital market has developed over the last few years. Prior to that, small companies would often have to contract with larger ones, which often meant slower growth. Entrepreneurs were still felt to need, among other things, greater market experience, an understanding of the customer base, and a strong focus on branding and marketing.

The Danish Growth Fund was a good example of public money being used to leverage private equity (similar schemes are in operation in Sweden, Finland and Germany). This replaced an expensive soft loan scheme. Because the scheme shares fully in the upside of its investments, it is self financing (it has a capital base of about £200m). The fund's managers invest strategically in order to build the capacity of VC specialists, with a view to reducing public support once a critical mass has been established. There is likely to be an ongoing market failure, however, in areas of new technology. In addition, the fund attempts to help strengthen the management in start ups, for instance by placing a representative on the company board.

Effort was being made to increase the supply of capital from pension funds. The government was looking at tax reform of the pension and insurance industries (tax incentives are being temporarily offered to pension funds). In addition, the Growth Fund attempted to act as a bridge between large institutional investors and small firms with specific expertise.

To increase the supply of risk capital a legal framework for so-called innovation funds has been established. These innovation funds will invest primarily in small and medium-sized unlisted companies. Acknowledging the risks associated with this type of investments and the competencies needed to assess them, innovation funds are targeted at professional investors, e.g. pension funds and other institutional investors.

In contrast to the legislation governing "normal" investment funds, capital shares in innovation funds cannot immediately be required redeemed, and innovation funds are allowed to support the companies, which they have invested in, by granting loans and through participation in the management team. In addition more flexible payment schemes for the management of innovation funds are allowed as compared to the rest of the financial sector.

As a means to speed up the establishment of innovation funds, pension funds are temporarily (2001-2005) allowed to deduct 5 per cent of their investments in innovations fund in their taxable income as long as the total annual deduction does not exceed 0,05 per cent of the total assets.

2. Knowledge transfer

A dedicated technology transfer organisation was thought needed, partly because universities themselves did not have the capacity to communicate the knowledge they generate to the wider world. More communication and collaboration with foreign research institutions and businesses was also needed.

Research and Technology Organisations (RTOs) received government support, and there was a desire to channel some of the money into supply side projects, where there is often the greatest market failure. This would facilitate work on more strategic industry concerns such as, for example, nanotechnology or food production technology.

3. Science-industry links

Universities were thought to be poorly managed, with poor connections to industry. They also appeared to be reluctant to let VCs support university research activities.

There were no post-doctorate positions, which were often the key to encouraging researcher mobility – and especially drawing in talent from abroad. University posts were usually filled until retirement with no real possibility of removing underperforming staff.

An IPR act in 1999 had helped greatly simplify universities' intellectual property policies, regulating the distribution of IPRs between institutions, researchers and businesses. It offers an incentive for all parties to generate and exploit scientific inventions by dividing the revenue from IPR contracts between the inventing researchers and the institutions. By offering a clear legislative framework on IPRs, the act facilitates co-operation contracts between academia and industry. Furthermore, it promotes the creation of new innovative enterprises by allowing universities and other public research institutions - within certain limits - to become shareholder in spin-off companies.

According to the IPR act public, research institutions are required to provide the necessary organisation and competencies to evaluate scientific inventions, to handle patent applications and to negotiate IPR-contracts with industrial partners.

A government appropriation of 58 million DKK (approx. 8 million euros) over a four-year period has been granted for the implementation of the new legislation. Five cross-institutional networks have been established in order to educate local patent officers and R&D-leaders, to improve the use of patent databases and to promote the marketing of IPR's.

There was concern, however, that the three months universities have to make a decision regarding the intellectual property created by scientists is far too long – with scientists needing to publish their results sooner than this.

4. Government policy

Some people in industry felt that the government needed to do more to promote innovation, and in particular, entrepreneurialism. More needed to be done to champion careers in science and engineering.

However, the Government's Industrial Development Strategy brought in nine different ministers who met twice a year to discuss challenges and objectives. This had a comprehensive focus, looking at the needs both of high-tech firms (with support for eg science parks and specialist research groups who manage to leverage private investment) and of traditional firms (with encouragement of the organisational innovations required in industries such as construction). This also looks at the potential for exploiting sources of knowledge other than the science base, such as knowledge-intensive business services.

5. Framework conditions

Although corporate taxes were now reasonably competitive, personal taxation was regarded as punitive, with top rates above 60% (though rates had been reduced in recent years). This was a significant disincentive for foreign workers to work in Denmark. Recent legislation permitted foreign scientists to be taxed at only 25% for a limited number of years – but it was thought that this should be extended.

There is also a recommendation now to change the bankruptcy laws.

Perception that the administrative burden is high is thought to discourage new firms. In addition, a lack of competition in certain sectors is considered a significant impediment to innovative behaviour.

Details

Meetings included:

Søren Mouritsen; **Pharmexa** (biotech firm)

Jens Pagter Kristensen, Frederik Pedersen; **Economy Ministry**

Charlotte Rønhof; **Confederation of Danish Industries**

Knut Conradsen; **Technical University of Denmark**

Holger Rasmussen; **Ministry of Information, Technology and Research**

Lars Aagaard; **Ministry for Business and Industry**

Christian Motzfeldt; **Danish Growth Fund**

FRANCE

1. Administrative/institutional barriers

An important barrier acting against French innovators. There was a body of opinion which felt that the state stifled innovation, by being too fully involved in the innovator's decision making process. One view was that the limits of administrative solutions to the innovation challenge were fast being reached - a 'systemic limit'. Some welcome efforts were being made to streamline administrative levels, such as a target of being able to set up a company in 24 hours.

It was not clear if a **systematic evaluation** of policy effectiveness was in use, which meant less effective policies could go unchallenged. Policies towards the **services sector** seemed to reflect a possible lack of evaluation. In addition, the service sector seemed to be overlooked in policy formulation, in part because many of the sector's innovation processes were in the opinion of one contact "difficult to define", in part because it was harder to judge whether the sector had made a technological innovation compared to manufacturing. The lack of understanding resulted in a lack of focused policy support, and by default, an apparent bias towards manufacturing. However, policy had started to recognise services' needs, with the Agency for Innovation recently required to allocate 10% of its funds to IT services.

2. Universities

Partly in view of the evident success of US university-business links, universities (as opposed to other public research institutions) were seen as an increasingly important part of innovation policy. They became the nexus of several issues summarised elsewhere in this report: knowledge transfer; IPRs; university-business links.

The grandes écoles were centres of research excellence, able to serve the demands of the industrial base (often from the old state-owned industrial complex) through well-developed lines of communication. This was a major strength of the French innovation system. Despite being slightly unclear how well the grandes écoles were meeting the demands of emerging technologies, **recently about two thirds of the increase of the public research budget have been dedicated to biotechnology. The state has also pledged to increase by 25% the number of ICT public research staff before 2005.**

The wider picture, however, was considered one of variable performance, the university system in certain aspects weak (there is no post-doctoral research system), hampered by bureaucracy and unable to respond to new challenges.

3. Intellectual property rights (IPRs)

IPRs were consistently recognised as an important incentive for innovation. But current arrangements for university-business links represented a barrier to innovation, leaving it unclear who owned IPRs for research work undertaken and hence who received the royalties. Universities (as distinct from the grandes écoles) were seen as poorly organised to address the complex issues of patent rights and were in any case relatively weak in hard sciences, limiting opportunities for lucrative spin offs. And few seemed to be in a position to negotiate systematically an appropriate sharing of possible patent royalties between researchers, their universities, and the collaborating firms. Without the incentives that clearly defined IPRs could provide, **university-business spin offs had found it difficult to get started.**

4. Knowledge transfer

The situation with regard to IPRs had meant that the **transfer of knowledge out of the research base into the commercial environment** had been slowed. Compartmentalisation of roles within the administrative system had also acted as a barrier for knowledge transfer. With a strongly centralised system, the network between the centre and the research base could be weak, limiting the flow of information and knowledge through the French innovation system - though in the context of the established links between the French industrial base and the grandes écoles, this was also a strength of the French innovation system.

Partly state-funded incubators are increasing in number, and are seen as a success. And "technology research and innovation networks" promote collaboration between state-funded research and industrial research in specific areas. This is market-driven, aiming to satisfy economic or social needs in the medium term.

To encourage the diffusion of knowledge, **regional policy** that drew on local and national funding was seen as a key tool for building up the absorption capacity of the region for new technologies created in other regions. To get support for change, action at the regional level was important, to create a sense of local pride and ownership. This had worked well. Central government also had representatives placed in each of the 22 French regions to help overcome potential barriers created by a strong centre.

5. Fiscal incentives and other direct state support

As elsewhere, the **French policy approach had shifted** from sector specific measures (usually on a large scale), to horizontal measures such as reinforcing knowledge networks, government direct grants through reimbursable expenses and subsidies. But there was a lack of policy evaluation with which to judge best practice.

The current incremental R&D tax credit cost around Fr 3bn annually, and included relief for innovators on the costs of patent applications. Plans to widen it to being an 'innovation tax credit' had been abandoned due to problems of defining innovation and cost (estimated at 4 times the current tax credit). The tax credit was viewed by business as a welcome signal of government support, **but not particularly critical for deciding the level of R&D undertaken**: experience showed the relief would be spent elsewhere in the business, not necessarily on R&D.

6. Encouraging R&D and innovation: the wider environment

Some progress in increasing the availability of risk capital for innovators had been made: business angels had been encouraged through the fiscal framework; more was being done on 'pre-seed' capital; and the legal framework for venture capital funds had been eased. But it was felt that more remained to be done, with fears expressed as to whether venture capital funds would prove vulnerable to economic downturn.

Access to capital was also being improved through competitions for innovation funds. Roughly 1/3 of winners were from the research community. The competitions' particular value was the kudos it gave the winners when applying for further loans from financial institutions.

In general, progress had been made in moving away from sectoral measures and towards horizontal support, such as the R&D tax credit. In addition, there are loan guarantees for small companies. Policy has recently become far more focused on SMEs, where there is stronger evidence of market failure.

Details

Meetings included:	Sophie Galey-Leruste and colleagues; **Ministry of Industry**
	Prof. Rémi Barré, Director, **Observatoire des Sciences et Techniques**
	Erich Spitz; **Thales and former Deputy Director of R&D, Thompson S.A.**
	Didier Coulomb; **Ministry of Research**

GERMANY

Key findings

1. Service sector

There had been increasing concern since the late 1990s that the needs of the service sector were being overlooked. This was particularly important in the light of recent statistics which suggest that 4000 jobs are cut in the manufacturing sector each month, while 10,000 new jobs are created in the services sector. The problem was manifold: for instance 80% of vocational training relates to manufacturing; and employer groups and trade unions are more diverse and less well established in the service sector, where there are often a proliferation of interest groups.

The government was looking at ways to reorganise the scientific community to meet the needs of the service sector. It was felt that the present system of peer review was a constraint on innovation.

The Federal Ministry of Education and Research (BMBF) has recently opened up its collaborative R&D funding programmes to companies in the services sector. Furthermore, in early 2001 it launched a services sector research programme, which has looked at how benchmarking, service engineering (i.e. the systematic development of new services) and standardisation can facilitate services innovation.

2. Networking

EXIST was the latest in a number of successful schemes which have aimed to promote networks between universities, capital providers, and services companies to facilitate university spinouts. Furthermore, in less applied sectors the BMBF has funded the establishment of virtual clusters, in nanotechnology for instance.

Pro Inno (PROgramme INNOvation competence SME) offers grants for national and international research partnerships between SMEs and research institutions and is aimed at innovation that is close to the market. Importantly, the scheme of the Federal Ministiry of Economics and Technology (BMWi):

- does not interfere with the decision of the firm to select technology fields
- allows the firm to choose between different forms of cooperation (e.g. staff exchange, cooperation with a research institution or another company)
- has an international focus
- helps to import know-how and open access to new markets

Most of the projects are interdisciplinary and cover several fields of Technology. Enterprises are encouraged to cooperate with suppliers, firms in different industrial sectors and research institutions with a good record in technology transfer (e.g. Fraunhofer institutes).

INSTI Innovation e.V., launched in February 2001, is a non-profit making network which facilitates workshops, company innovation checks, technology audits, IPR consultancy, the exploration of new business areas, the development of patent and commercialisation strategies, and market monitoring. This network forms part of the INSTI initiative to stimulate innovation (see below).

3. Intellectual Property Rights

SMEs were often very cautious about patenting their IP, concerned that they would disclose their innovations to competitors. It was felt that small companies needed to adopt a thorough portfolio approach to IP; often they were unaware of the value of their intangible assets, or unsure how they could go about valuing them. And when companies did look to protect their IP, they often underestimated the costs, and ended up seeking help when close to bankruptcy.

Double inventions were also a problem. The use of a comprehensive patent database (e.g. Fachinformationszentrum (FIZ) Karlsruhe) could prevent this.

An additional problem was that capital providers are sometimes reluctant to invest in SMEs whose IPR holders are CEOs or members of the board.

INSTI (running since the mid-1990s) is an extremely comprehensive scheme which looks across the board at ways to promote the use of scientific and technological information to stimulate innovation. For instance, SMEs that have not sought any IP protection in the past five years have been offered a 50% subsidy (now only 25%) towards the cost of patent searches, applications, patent lawyers, feasibility studies and related activities. Other activities include the establishment of inventor clubs, an expert network (patent lawyers, patent agencies and commercialisation organisations), and activities to raise awareness for innovation and IPR issues at schools.

4. Publicly funded research and commercialisation

In universities, a ‘professor’s privilege’ to their own IP appears to have led to the undercommercialisation of research results. This privilege should be abandoned by early 2002, as Germany adopts a rough equivalent of the US’ Bayh-Dole Act. However, there was still concern that many publicly funded research centers are simply not geared up to commercial exploitation.

The BMBF had changed its guidelines in order to ensure that income from commercialisation is fed back into projects. The cost of IP protection of research results generated in BMBF funded projects may now also be covered from public grants. In addition, since 1999 funding guidelines have required project bids to include a commercialisation strategy for potential R&D results. In early 2001, the government launched an action scheme to promote technology transfer. As part of this, the government encourages the establishment of regional patent and commercialisation agencies which help groups of universities and non-university research institutes in any one region to exploit R&D results.

Fraunhofer institutes provide both applied research for specialist industrial sectors, and strategic basic research in developing areas. Public funds are dependent on receipt of support from industry, meaning that research activity never strays too far from industrial needs. Each individual institute has a great deal of strategic autonomy (as well as audit autonomy), and is therefore incentivised to identify systematically the industrial problems that will emerge in the medium to long term. Most institutes therefore tend to manage their research priorities as a business. This is increasingly the case as institutes face competition from other research centers who can often undercut them. Complex legal issues, and for instance, intellectual property rights, are dealt with uniformly by the central Fraunhofer society. While the Fraunhofer institutes remain striking examples of best practice, ongoing (and recognized) concerns include: an inflexible pay structure and a need to reorient the disciplinary structure to new areas such as biotechnology and ICT.

5. Incentives for innovation

Despite the removal of tax incentive schemes to R&D in operation in the 1980s, there were some calls to reintroduce a well designed tax credit, which it was felt would raise overall levels of R&D spending, as well as provide a far more favourable fiscal environment for innovative companies. There were, however, some doubts expressed by small companies about the effectiveness of fiscal incentives for increasing SME investment in R&D.

6. SMEs

There was a proliferation of SME support schemes, which caused difficulties for SMEs. However, a central database on the Federal Economics Ministry's website, did provide a useful, comprehensive list of support available.

It was suggested that some local savings banks actually offer better conditions for SMEs than government financing schemes; the latter still require local banks to act as intermediaries.

Training and lifelong learning were considered very important, but it was thought little could be done to provide adequate support for small businesses, for whom staff time, and not necessarily finance, was of paramount importance.

7. European schemes

The administrative burden for small projects under the Framework Programme was considered too great. The Framework Programme needed to become far more flexible to account for rapid technological developments. It was even suggested that the current anticipation of the sixth Framework Programme was holding companies back from investment – that is, actually holding back the innovation process.

Meetings included: Peter Wenzel-Constabel, Ursula Zahn-Elliot, Frau Diegelmann, Johannes Velling, Günter Reiner; **Federal Ministry of Education and Research**

Rüdiger Eisele; **German Confederation of Small and Medium-Sized Enterprises (BVMW)**

Thomas Einsporn, Bernd Risch, Angelika Lee; **Cologne Institute for Business Research**

Thomas Bergs; **Fraunhofer Institute of Production Technology (IPT)**

Position Papers* **The German Industry Association (BDI) and the German Association of Chambers of Industry and Commerce (DIHK)**

* DIHK: "Innovationspolitik für kleine und mittlere Unternehmen – Handlungsempfehlungen and die Bundesregierung" (Innovation policies for small and medium-sized companies – recommendations for the Federal Government), December 1999;
BDI: "Innovationspolitik aus einem Guss? Auf die Erträge kommt es an!" (Consistent innovation policies? All that counts is results!) , May 1999

GREECE

Overview

The Greek innovation environment was improving: a new venture capital fund and business links has been copied from the UK; a legal framework to allow university spin-offs has been put in place; and R&D spending has increased. There were a number of quite serious issues, however: the education system needed improvement, many firms were not technologically advanced (only 12% of firms are on-line) and there were significant concerns about the effect regulation has on enterprise efforts.

1. Framework conditions

With **liberalisation** only recently introduced into key sectors of the economy – banking, telecoms – the incentives competition provides for firms to innovate have been weak. EU funding has had a large weight in the economy, which appeared to have affected incentives: applications for SME support from the EU (a key source of finance for these firms) was unlikely to have been on a commercial basis, easing the pressure to seek innovations to win funds and gain a competitive advantage. More was felt needed to bear down on state aids which benefited certain areas of the economy. And in the past, regulation and hidden barriers had discouraged the open trade and inward investment that would have forced less efficient companies out of business. This had limited links with economies at the technological frontier.

Some of these issues were being addressed: privatisation is well advanced, regulation is being tackled, and EU funding is due to fall. R&D support had also shifted away from sectoral support towards horizontal measures. It was felt that the government now needed to press ahead with these reforms and attract FDI.

2. Administrative barriers

Administrative barriers were regarded as the key barrier to innovation. Some of these issues were now being tackled through imitating **best practices**: one-stop shops; a business links network [KETA] across Greece to improve the co-ordination of business support programmes; and efforts to streamline procedures to start up a company.

Another important reform, though not due until 2005, was to align Greek **accounting standards** with the rest of the EU. This should help potential investors to judge better the financial health of a Greek company.

3. Lack of finance

This was considered an area of weakness. Until the recent liberalisation of the banking sector, SMEs appeared to have little access to formal finance through the banks, relying instead on informal networks of friends and family to raise capital (this worked well for start-ups but not for the crucial expansion stages). Funding support for SMEs relied on EU funds, which may dry up in 2006. Encouraged by recent government initiatives, **venture capital** companies had started to become more active but the sums involved were generally small.

Reforms to improve performance were in progress. A 'New Economy Fund' matched government financing with private venture capital, the providers of which took the risks of managing the investment. With Government backing, incubators had now started, though formal links were yet to be established with universities.

Perhaps the most major reform has been the introduction of competition into the banking system, which has led to a greater variety of, and access to, financial products. Banks (such as Alphabank) were well aware of the value of their SME base, seeing it as an untapped market to sell additional products (insurance; small business support) that would raise margins as well as promote growth in SMEs.

4. The education system and science-business links

Universities were perceived as insufficiently oriented to the market. Many thought they did not offer courses relevant to the needs of the changing economy and often protected the interests of departments against attempts to commercialise research. In addition, rigid quota systems for some courses led to severe mismatches in the supply and demand for graduates in some areas. And while recent reforms to provide a legal framework for university spin-offs were in place, there remained a lack of clarity concerning intellectual property rights, one person commented that there was a "lack of know-how" in the field.

The overall effect had been poor science-industry linkages. Venture capitalists had yet to tap the universities' knowledge pool, often looking abroad for such knowledge: links with other innovation systems were therefore important as conduits for new ideas and needed development to facilitate knowledge transfer. With around 50% of overall R&D expenditure being passed through the higher education system, this was a key weakness. Also, this has often led to a preference for foreign higher education: more Greeks study at higher education systems abroad than any other EU state (roughly 30,000). They are helped by mobility funding within EC Framework Programmes which has also aided co-operation with other universities, in particular in the ex Soviet bloc.

The new incubators had yet to show signs of formal links with the universities. But since last year, a formal legal framework was in place that allowed university spin-offs. Over a year on, 14 proposals had been received by the Ministry of Development though these had not yet been agreed.

Details

Meetings included:	Mr D Deniozos, Dr Samouilides, Mr Patiris; **General Secretariat for Research and Technology**

P.Mamos, C.Charalambous; **EOMMEX [Greek SME federation]**

D Maroulis; **ALPHABANK**

N. Plakopitas and T. Couloubis; **Global Finance venture capital fund**

Mr Ioannis Patsiavos; **International Relations, Federation of Greek Industries**

Mr K Kaldis; **British Council**

Mr Kyriakos Mitsotakis; **National Bank of Greece Venture Capital – NBG Technology Fund**

Mr E Bouboukas; **National Documentation Centre**

THE NETHERLANDS

Key findings

1. The shortage of high-skilled labour

There are imminent personnel shortages in various segments of the labour market. The labour market is tight, in particular the labour market for ICT specialists and scientists, and in medium-high and high-tech manufacturing.

Another serious problem that has recently arisen is personnel shortages in science. There is both a large number of staff about to reach retirement, and a relatively low share of new S&E graduates in the 20 - 29 years age class.

Furthermore, there is a large outflow of young talent. The Netherlands Bureau for Economic Policy Analysis (CPB) has estimated that shortages will arise in 2003 and 2008 if the current economic climate remains the same and the outflow of scientific personnel continues in the next 5-10 years.[1]

The relatively low share of new S&E graduates in the 20 - 29 years age class may to some extent explain the low share of employment in medium-high and high-tech manufacturing. [2] The share of the total workforce employed in these sectors is 4.7%, which is well below the EU average, and decreasing.

2. The lack of innovations by firms [3]

Firms perform relatively little R&D. Business expenditures on R&D in ranged from approximately 1% of GDP to 1.16% in the period 1981-97. This is low compared to the OECD-average (NOWT, 1999). In 1999 the lag in comparison to the EU-average has grown from 8% to 12%.

An additional cause of concern is in high-tech manufacturing. In relation to GDP, the added value in the high-tech sector is below EU-average. A decrease of 26% in added value over the period 1993-1997 is worrying.

3. Financing innovation

The university base is funded well by international comparison. The allocation of funds is to a large extent historically determined and bears no relation to the delivered results. There is a lack of incentives to stimulate universities to allocate resources efficiently and strengthen linkages with the demand for knowledge in society.

[1] CPB, De Arbeidsmarkt voor wetenschappelijk onderzoekers.
[2] Figures from the Netherlands Bureau for Economic Policy Analysis (2001) suggest that the main sector of employment in the Netherlands is the service sector.
[3] From the foresight study *Verkenning Economische Structuur*, VES

Only a small proportion of government funds is allocated on a more competitive basis; consequently there is a relatively low level of co-operation between firms and universities. Only 6% of innovative firms co-operate with universities and 7% co-operate with knowledge-based institutions. The EU-average for both is 8% (1996).

Firms are able to raise relatively large amounts of funding. Both venture capital invested in high-tech firms as a percentage of GDP and (new) capital raised on parallel markets (and by new firms on main markets) as a percentage of GDP are above the average for the EU. However, the access to seed-capital needed for the first phase in the innovation process (from idea to product) is limited. Due to the lack of this capital many innovations fail to materialise.

4. The use of patents in science[4]

An increased stimulus of innovation requires the right conditions. Concerning intellectual property, the costs of patents are 3 to 5 times as high as in Japan and the United States. Moreover there are indications that besides costs also the time[5] patent procedures require in Europe compare unfavourably to those in the United States and Japan. Additionally the use of patents by the scientific community remains a concern.

5. WBSO (Fiscal Research Facility)

The WBSO reduces the amount levied for income tax and social security premiums and/or increases the self-employed persons' allowance for personnel involved directly with R&D. It has been successful in attracting a diversity of companies. The budget for 2001 was euros 742m.

6. Syntens (Coaches for SME's)

Syntens runs a number of company-specific, region-specific and national activities for SMEs and entrepreneurs. It is internationally oriented and partner in several European projects. All Syntens' regional offices:

- Provide information to SMEs and policy makers
- Help link demand for knowledge to its supply (the Syntens knowledge network)
- Support collaborative innovation ventures between companies
- Help to identify new knowledge areas relevant to entrepreneurs and to make them accessible.

---

[4] From the *Concurrentietoets 2001*

[5] A. Arundel, et.al., *Industrial Property, Innovation and the Knowledge-based Economy*, Uitgave Beleidsstudies, Technologie Economie (37), Ministry of Economic Affairs, April 2000.

7. Cluster policy and networks

Cluster policy focuses on stimulating co-operation between small and bigger enterprises, is policy intensive and contains no financial instruments. Four main strategies are used:

- **a) Strategic improvement of information flows.** A 'clustermonitor' aims to systematically analyse the characteristics and strengths of potential and existing clusters. To date, monitors have been carried out for three sectors: electro-magnetic power, building and multimedia. In addition, 'Technology Roadmaps', and 'Cluster Conferences' (in which different clients, producers, suppliers and knowledge-institutes jointly discuss new developments) have been set up.
- b) **A strong focus on regional initiatives**, with closer cooperation between national policy and Regional Development Agencies (ROM).
- c) **Increasing use of foresights**. Foresight scenarios are developed in close cooperation with firms and knowledge institutes in order to be able to respond better to new (technological) developments.
- d) **Innovative procurement**. Government infrastructure projects are looking more closely at the innovative aspects of the project design, as well as giving more opportunities to private parties to form innovative consortia.

8. Leading Technological Institutes (LTIs)

LTIs are virtual research institutes with a central management capacity, which concentrate on a specific area of fundamental strategic research. This area is selected in close co-operation with knowledge-intensive companies, and is often interdisciplinary. Companies are usually required to make a substantial organisational and financial commitment to the institute, although some institutes receive public funds.

SPAIN

1. The service sector

Getting the innovation environment right for companies in Spain's large services sector, especially SMEs, was regarded as a key priority. An issue was the availability of good scientific and technological information as well as good scientists for service industries.

2. Intellectual property rights

IPRs protection mechanisms could be improved in Spain. Firms were often unfamiliar with IP regimes, or sceptical about their worth. Much intellectual property seemed to be grounded in tacit knowledge or know-how, resulting in significant barriers to codification. Even where patenting might have been appropriate, it was seen as an expensive, heavy-handed form of protection, which still offered insufficient legal certainty. Firms felt they would be placed at a competitive disadvantage if they expended their time and resources on patent applications and management. There was a desire to develop a broader range of IP protection, which would involve a bigger role for copyright and trademarks, for instance.

3. Availability of finance

There was common concern that there was insufficient start up capital available for small firms; banks were seen as conservative and risk averse. The Government was taking action here: it now offers subsidised loans to carefully selected technology-based SMEs in order to trigger the availability of equity. However, one issue raised was the apparent undervaluation of IP by sources of capital; though the national patent office was being consulted on solutions to this.

4. European programmes

Companies' Framework Programme and Eureka bids were aided by the Ministry of Science and Technology and the Centre for the Development of Industrial Technology (CDTI), with a good deal of success. Eureka received praise for its encouragement of highly networked projects, and there was approval of the recent trend towards more funds going to SMEs. But there was criticism for the lack of coordination between the use of regional, national and European resources. It was felt the European Research Area could be improved by greater specialisation within Member States. In addition, the Framework Programme would could be focused more on applied research and not only on subsidising the wages of university researchers.

5. Knowledge transfer

National Research and Development Programmes sought to pool information from universities. But the science base was perceived as very detached from industrial needs. Managers tended to rely on clients, not universities, as their sources of technology transfer. Consequently, it was felt that the promotion of research commercialisation in universities could be improved.

There was also a recognised difficulty in the diffusion of technology between clusters and regions. For this reason, a new Ministry of Science and Technology was created after the last general elections to co-ordinate research and technological policies and to improve knowledge transfer. Nowadays, specific programs to reach this target have been set up concerning technological centres and parks, encouraging technological co-operation among the different innovation system actors.

At the same time, some regional governments have elaborated their own technological programs aiming at those objectives. For instance, the Basque regional government had been successful in fostering high levels of transfer, and technology transfer companies, such as the technological centre network, tended to have a strong regional base. There were concerns about the lack of closer networks with less developed regions and with other member states.

6. Incentives to R&D

Public policy had moved from R&D subsidies to tax credits, which were seen as having less of a distortionary effect on incentives. Fiscal measures now include deductions of up to 45% of company tax and free depreciation of fixed assets related to R&D expenditures, with relief covering activities which favour technology diffusion and exploitation. They also apply to foreign owned companies.

However, small firms tended to feel less benefit from fiscal incentives because they might not have much tax to write off. Consequently it was thought that there remained a need for targeted subsidies for SMEs. In addition, there was concern that the State Aids rules were hampering R&D investment, especially in smaller firms, because panel evaluations, when assessing subsidies ex-post, are too slow.

Details

Meetings included:

Martin Gallego Málaga, **Ministry of Science and Technology**

Juan María Burdiel Nales; **Ministry of Economy**

Francisco Giménez-Reyna; **Centre for the Development of Industrial Technology**

Mauro Villanueva Monzón; **Robotiker** (non-profit RTO)

Juan Pedro Marín Arrese; **Sociedad Estatal de Participaciones Industriales**

Francisco Marin Perez; **Eliop** (small industrial company)

UNITED KINGDOM

Key findings

1. Venture capital

The UK is a relatively strong performer in delivering venture capital investment and has the highest share of venture capital investment as a proportion of GDP in the EU. This success has been driven in part by favourable tax conditions for venture capital investment. However, it was felt by some respondents that as in other countries there is still a market failure in delivering formal venture capital of amounts below £500K. A number of government initiatives should help, including Regional Venture Capital Funds and early growth funding which aim to lever in private investment to provide small scale high risk finance. Venture Capital Trusts, by giving tax incentives to individual investors, have also generated over a billion pounds of investment in amounts below £1m. The market failure in this part of the market is driven largely by informational failures and this is particularly true in high technology, where private sector investors sometimes lack the specialist/technical skills required to assess properly the commercial potential of technology based small firms. Furthermore, there was clear recognition that while there was an abundance of ideas which had the potential for commercial success, many were never worked up because of a widespread lack of wider business and management expertise.

Some felt that banks were too conservative and unwilling to provide higher-risk debt finance. The Small Firms Loan Guarantee scheme run by the Small Business Service but operated through the banks has eased access for some firms, but access to finance still remains an obstacle to many firms and in particular very small-scale equity finance. A few high street banks have however been attempting to develop their support to small innovative companies. HSBC have set up a chair of innovation at Brunel University, and run courses for the bank's managers on SME appraisal and the particular needs of technology-based firms. The banks have also started to invest in public/private venture capital funds investing in the regions. Barclays Bank have set aside £200m for this purpose. But despite support from banks for a number of schemes there remains a general weakness in the market for higher-risk debt products.

Some thought that investment by pension fund money was being impeded by risk aversity among investors (in spite of the recent enthusiasm for ICT investments). And some concern was voiced both about the reliance on traditional valuation methods, such as dividend yields and P/E ratios, as well as the short termism of financial markets. Recent reforms to capital gains tax (including taper relief to encourage investment for the longer term) have helped, improving the post-tax returns of longer-term investments in a small business with growth potential.

2. Public sector-private sector interface

There were a proliferation of schemes and initiatives designed to promote innovative behaviour, but many were too small to build up the critical mass required to become readily recognized by client groups, notably SMEs, who often find the support system overly complicated. It was felt that the desire to make public funds accountable should not lead to undue levels of bureaucracy.

3. Knowledge transfer

It was felt that there were weaknesses in the UK's systems of knowledge transfer, with a lack of bodies systematically promoting the translation of research results to commercially viable innovations. Improvements had been made in recent years, however, with a variety of Government initiatives. In addition, there was scope to increase the activity of research and technology organizations (RTOs) which were able to trade profitably in knowledge transfer. However, some Government attempts to improve the situation seemed to have foundered because they became too focused on basic research (for reasons of accountability).

Faraday Partnerships offered a viable solution. These involve seed funding for technology transfer infrastructure (including technology 'translators' and some 'enabling' research) along sectoral lines. 17 partnerships have been approved so far, though there is still scope for these to increase their turnover, and for many additional partnerships to develop (especially in often neglected areas such as financial services).

4. Science-industry links

Much progress had been made in reconciling universities' academic activities with their management of intellectual property, although some universities had work to do here. A general complaint was the lack of a common approach by universities to IPRs. Recent Government support for building links between universities and industry was welcomed.

Although it is extremely difficult to measure the value added of the output at postgraduate and post-doctoral level, it was felt that more work ought to be done here.

5. IPRs

The establishment of a cheap and efficient Community patent was of great concern to business. For small firms, some banks offer limited insurance to cover the defence of intellectual property. However, this tended to be inappropriate at the inventor stage, largely because of the high premiums involved (about £10,000 pa).

It was felt that a sufficient range of IP protection was available (including patents, trademarks and copyright) – though government needed to appreciate better the importance of nonregisterable rights, such as design rights, which companies could adopt more quickly. There was a significant failure, however, to communicate properly to firms, especially SMEs, the importance of managing IP as a portfolio, where the form and cost of protection was appropriate to the piece of IP concerned. It was felt that government needed to provide better information, advice and guidance, whether this was done through the patent office or through a commercial route, such as patent agents.

6. Networking

It was thought that businesses did not collaborate enough. Government could do more, for instance provide secretariats, help organize or promote fora or conferences for business. As much as possible, it was felt that closer networks ought to be built on ones that exist already, such as trade and research associations and manufacturing clubs.

The government's Foresight programme consists of 13 panels which oversee networks open to businesses, including those from overseas. The panels attempt to anticipate future business developments and needs. They can provide, for instance, an inward investor with facilitated access into the high quality UK science base, and can help them to establish effective links with other businesses in their sector, Government Departments, regulatory and trade bodies.

7. European programmes

The Framework Programmes were criticized for subsidizing basic research, when their intended focus had been applied research. In addition, it was thought that evaluation was done cheaply and lacked credibility. Accessing and managing funds was extremely laborious, and much effort going into bids and applications turned out to be wasted.

8. Business environment and incentives to innovation

Fiscal incentives to business R&D were thought by many to be needed to raise overall levels of investment. There was broad support for the proposed R&D tax credit for large companies, as well as continuing the tax credit for SMEs already in place.

Meetings included:

Brian Blunden; Chairman, Association of Independent Research and Technology Organizations **(AIRTO)**

David Gill; Head of Innovation and Technology Unit, **HSBC**

Stuart Ager; Head of Innovation and Growth Unit, **Natwest**

John Beacham, Peter Mucci; **Department of Trade and Industry (industrial secondees)**

Tim Bradshaw, Senior Policy Advisor, **CBI**

Andrew Stevenson, Chairman, **E-Synergy Ltd** (venture capitalists)

Anthony Wheaton, Investment Director, **E-Synergy Ltd** (venture capitalists)

Nick Bloom, **Institute for Fiscal Studies**

Martin Ridge, **DTI**

UNITED STATES

The components of US success

1. Industrial policy

A creative, dynamic and productive industrial base was seen at least partly as the result of government acceptance and facilitation of a high level of creative destruction, and willingness not to intervene to support either struggling or marginal firms. This would allow innovative firms to exploit their ideas to the full, for small firms to grow quickly and challenge incumbents, and enhance the contestability of markets. But it also meant accepting a significant level of job churn, which many European job protection strategies did not make possible. **It was felt that the EU needed more disruption if it was to realize gains in the long term.**

Innovation at the industry level had been aided by deregulation, high levels of R&D collaboration (which through the 1980s had been made possible in part by a relatively relaxed application of antitrust laws), the successful application of ICT, and government championing small business growth. On this last point, the Small Business Innovation Research program (SBIR) is set aside 2.5 percent of federal agencies' R&D budgets.

Fiscal incentives for R&D were generally well received by business, although there was criticism of the US scheme, which was renewed on an annual basis, providing a lack of certainty for companies. A fixed scheme that provided more certainty would have been preferred.

2. Clusters

There was substantial interest in clusters as a key driver of innovation. The Council on Competitiveness, in a recent piece of research (with Michael Porter) that managed to identify just 41 true 'clusters' across the US, had attempted to disaggregate the ingredients necessary for a successful cluster. But very few general conclusions could be drawn, leaving little scope for interventionist policy. It was thought that there was a strong need for local and possibly regional policy makers to champion and encourage key industries in a strategic way. However, state and federal governments needed to operate far more indirectly:

- ensuring a steady supply of highly skilled people;
- ensuring research funding is distributed in a way which promotes and does not hinder the development of technologies with growth potential;
- developing and providing the appropriate frameworks of analysis both to enable potential clusters to take on best practice, and to identify those industries which are sufficiently concentrated and growing quickly.

There was some concern, however, that analytical approaches to cluster development encourage political and business leaders to focus on overcoming weaknesses, when in fact **the best advice was often to focus relentlessly on one's strengths and comparative advantage**.

3. Management

The US seemed to have a far more technically literate management than many EU countries, reflecting the fact that there are far more researchers based in industry in the US (see Annex E). Indeed, there was genuine surprise that someone with solely managerial skills (such as an MBA graduate) could successfully lead an innovative company. It was thought that while it was usually possible to give someone with a technical background the relevant business skills, it was virtually impossible to impart to managers the adequate scientific knowledge to grow and develop a technology-based business.

4. Support for start ups

There was optimism that the wave of first tier innovators had now effectively created a venture capital industry of a critical mass, with successful entrepreneurs putting their own gains back into new ventures. This also meant that venture capital in the US has tended to be 'smart' – that is based on a good understanding of the technologies involved (generic business skills were seen as insufficient). A developed market for high technology stocks (the NASDAQ) was also seen as crucial. All of this was regarded as essential.

At their most advanced, VCs in the US take a very hands on role in start-up development. **STARTech** in Dallas is a good illustration here; likewise, the Houston Technology Centre offers free access to legal and banking services, mentoring by ex-CEOs and CFOs, wider links to the local angel network and seminars for scientists and researchers with promising ideas. The concept of 'incubation' is therefore taken much further than a mere 'bricks and mortar' approach.

Public involvement can also be used to good effect. For instance, under a Small Business Administration (SBA) programme, Small Business Investment Companies (SBICs) – privately owned VCs – are able to draw down match funding from the federal government for their own early stage investments. This leaves the SBA with an equity stake of its own.

5. University-business links – commercialisation of research

There is a clear understanding between leading universities and their researchers about patent ownership and the division of royalties. In addition, universities actively promote equity stakes for researchers. Despite some concern about the 'over-commercialisation' of research, with academics possibly becoming less willing to collaborate with others, this was not seen as a real issue. Indeed, it was felt that more contract work imposed highly desirable pressures on academics, and there was even the suggestion of tying research grants to matching support from industry to ensure a greater focus on 'strategic' research.

Peer review was also criticised for failing to allow other groups – such as the business and finance communities – to make evaluations of research. Many thought that the EU had lessons to learn here.

6. Networking

There were very high levels of networking throughout the economy – and at its best, this led to a high degree of consensus at the local and regional levels among both policy makers and business (although most felt there was more to be done here in making government as much as possible *a part* of the system). Clusters such as Silicon Valley have received much attention for flat management structures and porous boundaries between firms – interaction would take place at many levels: for instance engineers and venture capitalists might discuss technological innovations over a beer. It was noted that in a more knowledge-based economy such social learning was becoming ever more important.

Other notable examples of networking include MIT's industrial partners programme (which is replicated by other leading HE institutions) and SEMATECH (after 1994 when it became an international grouping) – a consortium of 13 semiconductor companies based in Texas, which seeks to influence semiconductor manufacturing technology from seven countries.

7. General US innovation performance: reasons for success

It is clearly difficult to explain precisely the reasons for US success, although contestability did seem to be a crucial factor. However, a number of other factors came up frequently in discussions:

- Low regulation associated with starting and growing a business (Texas, for instance, still has no zoning regulations)
- Low individual and corporate tax rates
- An extremely advanced science base
- A highly competitive environment (faced both by universities and businesses)
- The lack of stigma attached to failure and bankruptcy (individuals very rarely lose the right to credit) – failure almost seen as a prerequisite for success
- A risk-taking, entrepreneurial culture
- Excellent distribution networks, including transportation
- Strong intellectual property regimes – first in patents (from the early 1980s) and then in copyright (although some expressed concern about a possible dilution in the quality of patents).
- The federalist system: state and federal policies could often complement each other to good effect; many state technology policies were seen as very good

Problems and potential problems

1. Publicly funded R&D

Investment in physical sciences and engineering had recently suffered, for which there were two main reasons: a tendency in recent years to focus on biosciences; and the general decline in Department of Defense R&D expenditures since the end of the cold war (which had led to a benign neglect of the physical science base). Consequently it was feared that the stock of research in the physical sciences had been substantially eroded, building up potential problems for the future. In addition, there was the suggestion that the productivity of research was being adversely affected. Interestingly, this concern was now even being voiced by the natural sciences community: the National Institute for Health has pointed out that advances in biomedical research and innovation often depend on innovations in the physical sciences.

The defense sector was considered now to be so undercapitalised that it was more inclined to 'spin in' technologies from the commercial sector than create spin outs itself. Institutional rigidities as well as its monopsony position were also to blame.

Relatedly, there was widespread concern about the reduction in the supply of physical scientists and engineers, a problem which was currently only being mitigated by substantial immigration.

2. Education

There was widespread concern about school pupils' lack of enthusiasm for maths and science – a further indication that the future supply of scientists and engineers is far from certain. Local school boards were seen as a powerful interest group, reluctant to lose their autonomy in, for instance, curriculum provision, to either the state or federal government. But greater standardisation from Kindergarten through to 12th Grade was often seen as essential to ensure that high achievement was made more uniform.

3. Legal issues

There was some concern that the commercialisation of technology might be threatened by a large increase in the volume of intellectual property litigation. There was particular concern that universities were becoming over-aggressive defenders of their intellectual property – claiming ownership of innovations far downstream from the original patent which they hold. But it was stressed that the EU was far from reaching any problems in this area.

4. Technological 'lock in'

There was some concern that, where there was an absence of national standards, companies would develop proprietary systems of their own. For instance, booksellers' barcoding systems contain a multitude of information useful to their owners, but not to competitors, and there are concerns about software inoperability. This sort of behaviour may be conferring undue market power on incumbents.

Details of visit

Visited: Washington and Houston

Meetings included: Barry Bosworth, Jack Triplett; **The Brookings Institute**.

Stephen Merrill; **Science, Technology and Economic Policy board, National Academy of Sciences**

Kent Hughes; **Woodrow Wilson Institute for Scholars**

Debra van Opstal; **Council on Competitiveness**

Robert Atkinson; **Progressive Policy Institute**

Lloyd Bentsen; **Houston Technology Center**

Jim Reinhartsen; **Clear Lake Area Economic Development Foundation**

Richard Wainerdi; **Texas Medical Center**

Michelle Michot Foss; **University of Houston Energy Institute**

Jim Tour; **Rice University Center for Nanoscale Science and Technology**

Jacqueline Taylor; **University of Houston Small Business Development Center**

GOOD PRACTICES in countries not visited

Austria

K.plus Competence Centers foster long term cooperation between industry and the research base, offering R&D expertise and human capital in specialist areas of research. The intention is to generate a critical mass of research capability at a national level and to encourage pre-competitive R&D cooperation.

The Austrian Industrial Research Promotion fund (FFF) provides financial support for industrial R&D and innovation ventures, as well as support for scientists working with companies. In addition, it offers an independent evaluation of companies' research projects and helps to promote collaborative R&D.

Belgium

Networking

State funded research centers in the Flemish region have aim to group together high tech teams (in areas including microelectronics and biotechnology) from across Belgium and further afield. These offer training activities, dedicated research, technology transfer and in addition carry out high level exploratory research which aims to satisfy the future needs of the industry.

Science-industry links

FIRST (Formation and impetus in the field of Scientific and Technological Research). fosters basic industrial research and promotes, among other things:

- Sending university researchers to enterprises for 3 to 6 months (with subsidies offered to SMEs).
- Researchers setting up their own enterprises based on their research results.
- Writing doctorates in collaboration with industry

Sweden

Science-industry links

The Competence Centre Programme (started in 1995) helps develop university-industry interaction, comprises 28 Competence Centres at 8 universities and is engaged with about 250 industrial companies. These centres contribute to:

- collaboration between academic researchers and personnel from industrial companies in concentrated and integrated research aimed at long-term benefits for the companies as well as for the universities and researchers;
- active industrial participation in formulating strategic goals and in implementing academic research;
- faster transfer of new technology to industry;
- strengthening of long-term research collaboration, technical competence and renewal in industry.

Science-industry links

Technology Link Foundations aim to facilitate the commercial exploitation of university research and inventions, with a focus on patenting, licensing, lowering knowledge search costs for firms and stimulating co-operation between SMEs in joint projects. At the same time, University Holding Companies (owned by universities) aim to form project companies in order to exploit research from universities and develop services for such exploitation. They are expected to become minority owners in firms created jointly with researchers and industrial actors.

The Technology Link Foundations in co-operation with the Holding Companies have, furthermore, formed Patent & Exploitation Offices, which actively support researchers' exploitation efforts.

Portugal

Productivity of publicly funded research

Growth in public funds for research institutions and projects is being accompanied by tough evaluation by international panels of experts. This balances a growth of resources with a demand for greater efficiency. Consequently, research institutions are becoming more autonomous and affected by international competitive pressure (in terms of international quality standards and publications in refereed journals). In the late 1990s Portugal experienced a very fast growth rate in the number of its papers cited; furthermore, the growth rate in publications has also been much higher than that of the number of researchers, suggesting productivity improvements.

Supply of scientists

A scholarship program for MAs and (increasingly) for PhDs and post-docs is contributing to a fast growth rate of new researchers and new PhDs in S&T fields. In addition, programs are now being launched to promote researchers' ***mobility into firms.***

Economic incentives to R&D

In addition to a tax credit scheme for firms performing R&D, the government offers financial support for research carried out by consortia of firms and R&D institutions. This helps to foster links and promote networking between firms and research teams, sometimes successfully mediated by sectoral technology centres and other enterprise associations.

Finland

Knowledge transfer

Tekes, the national technology agency, is responsible for funding and co-planning with industry and research institutes a variety of technology programmes. These are extensive multi-annual cooperative projects comprising research projects by the universities, applied research, and corporate product development. They are used to promote development in specific sectors of technology or industry, and the results of the research work are systematically passed on to business. A national technology programme lasts for 3–5 years and has a budget of at least EUR 5 million.

Knowledge transfer

VTT, is a state-owned research institution, which carries out three types of activities: government funded research, jointly funded projects and commercial activities. Government funded research focuses on strategic research projects aimed at developing competitiveness and acquiring knowledge and expertise to meet the future needs of customers. Jointly funded projects are initiated on the basis of need and typically involve the participation of VTT, Tekes, the EU, and companies or other benefiting parties. In commercial activities, research knowledge is translated into new products, production processes or businesses in partnership with the customer. In 2000, the incomes from commercial activities were 40 % and from jointly funded project 44 % of the total incomes. VTT has eight research institutes.

Italy

High technology networks

In Catania (Sicily), the local university works closely with the private sector, notably ST Microelectronics, a semiconductor firm. It participates in a large number of joint research projects, has developed new specialised courses in the semi-conductor field, and co-developed a large number of patents.

This has spawned a highly networked technology cluster, which has attracted a large number of businesses, including international firms. This has been aided by the marketing policies of local municipalities: "InvestiaCatania" has been the first one-stop-shop in Italy (it was recognised by the EU as an example of local "best practice" in the Luxembourg process).