
European
Commission
Innovation papers No 28
Innovation tomorrow
Innovation
A publication from the Innovation/SMEs programme
part of the Fifth Research Framework Programme

European Commission

Innovation tomorrow

Innovation policy and the regulatory framework: Making innovation an integral part of the broader structural agenda

Louis Lengrand & Associés
PREST (University of Manchester)
ANRT - France

Innovation papers No 28

Directorate-General for Enterprise

EUR 17052

Cataloguing data can be found at the end of this publication.

Luxembourg: Office for Official Publications of the European Communities, 2002

ISBN 92-894-4549-1

Printed in

PRINTED ON WHITE CHLORINE-FREE PAPER

Cataloguing data can be found at the end of this publication.

Luxembourg: Office for Official Publications of the European Communities, 2002

ISBN 92-894-4549-1

Printed in

PRINTED ON WHITE CHLORINE-FREE PAPER

CONTENTS

LIST OF FIGURES

Figures numbers refer to the paragraph of the document which they illustrate.

INTRODUCTION

The Lisbon summit in 2000 set a critical strategic goal for the European Union. The European Union should, by 2010, *"become the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion"*.

How is Europe to achieve this goal? This question inspires the present report. It focuses specifically on the topic of **innovation and its relation to policy and policymaking.** Innovation is influenced in significant ways by areas of policy over and above "innovation policy", as it has been heretofore understood. **The argument is that a "third generation innovation policy", which recognises the centrality of innovation to effectively all policy areas, must be developed.**

INNOVATION

Innovation is a central element of the Lisbon objective. **Innovation** is required to become, and **to remain, "competitive and dynamic".** It is now well known that innovation is a central element of economic performance. Its growing importance makes it a core feature of the knowledge-based economy. Innovation has also facilitated the development of the knowledge-based economy. (For instance, enabling the shift to service-based activities and widespread use of new Information and Communications Technologies.) **But the nature of innovation is also changing in the knowledge-based economy.** Knowledge-based activities stimulate new kinds of innovation, and also allow for innovation processes to be reconfigured. Many other influences are also reshaping innovation and the boundaries between various areas of policy. **We cannot assume that established policies for encouraging innovation are adequate** to the new conditions. **Nor can we assume that the ways in which other policy areas have taken innovation into account are still adequate.**

Innovation in a knowledge-based economy is diverse and pervasive. It is not just based on research, or science and technology, or enterprise and ingenuity - although all of these remain very important contributing factors. **Innovation** – especially successful innovation! - **also depends on organisational, social, economic, marketing and other knowledge. It frequently requires intellectual and artistic creativity. There is an increasing emphasis on such "intangible assets" within firms.** Their role in allowing for regions and nations to become dynamic participants in the knowledge-based society is also acknowledged. But problems in properly valuing such assets have become strikingly apparent in the financial turbulence of recent years.

Regulatory and institutional reform is being – and should be - encouraged across a wide range of policy areas. In general this has not been undertaken with ideas of promoting innovation in mind. The rationale for reform has been that outdated, overcomplex, or over-prescriptive regulations are encumbering business. The assumption has been that

reforms will more or less automatically foster innovation by freeing up the resources consumed in this way. However, not all regulations do simply inhibit innovation – some shape it, some actually foster it. Furthermore, innovation can also be actively encouraged by innovation-friendly reforms in various policy areas. This has been recognised in some fields and specific cases, but it is a more general state of affairs. Furthermore, lessons can be drawn from experiences in different countries and different policy areas. There may well be synergies between and across policy areas, too, so that co-ordinated reforms could have more of an impact than one-off instances.

Similar implications to those concerning regulatory reform arise from efforts to reform governance processes. Here, the relations to innovation especially concern the legitimacy of research efforts, and the public attitudes to expertise, innovations and innovation-related policies. There are potential tensions between efficient and flexible innovation policymaking, and the need for openness, transparency and dialogue.

The "third generation innovation policy" will have to confront the significance of a wide range of policies for innovation in the knowledge-based economy, and establish ways of building analysis and action relevant to innovation into all of these policy areas.

Policymakers and other stakeholders concerned with innovation, and other topics that impinge upon innovation, have to deal with numerous objectives and immediate pressures. The challenge for the third generation innovation policy will be to maintain a core emphasis on innovation across the board. This emphasis will need to be sensitive to the continuing transformation of innovation processes in the knowledge-based economy. It cannot be a matter of a one-off set of reforms – attention will need to be paid to ongoing change in the nature of innovation. This sensitivity will have to be maintained while innovation is being built as a criterion into a series of policy areas.

INNOVATION PERFORMANCE, INNOVATION POLICY, AND THE KNOWLEDGE-BASED ECONOMY

The innovation performance needed by Europe requires us to constantly enhance sustainable capacities to sustain productivity growth.

The present report brings together ideas and conclusions emerging from various lines of study (described in the "methodology" section below). In order to put the analyses and case studies into context, the report briefly examines the **main characteristics of a knowledge-based economy.** Three broad groups of features of the knowledge-based economy (along with associated features such as globalisation) have a considerable bearing on the nature of innovation:

- The rise of services and intangibles
- The ongoing rapid development of Information and Communication Technologies and the Information Society
- The new roles of knowledge, organisational learning and human resources.

The current European Innovation Policy, based on the Innovation Action Plan arising from the December 1995 Green Paper on Innovation, included, among its three principal objectives, the goal of establishing "a legal, regulatory and financial framework conducive to innovation". Innovation is a contributing element of the knowledge-based economy. It is also something that is transformed by the new practices and organisations that are emerging here.

Regulatory and institutional reform is also related to the rise of the knowledge-based economy. It reflects an effort to bring knowledge into policy design and implementation, so as to make policies more effective (and, indeed, to find means of achieving policy objectives that are more effective than conventional regulations, where appropriate). There are several reasons for such regulatory reform:

- improving internal efficiency;
- improving service delivery,
- simplifying procedures, so as to reduce confusion (e.g. about grants and incentives), and the administrative burdens (e.g. in SMEs and other users).

Regulatory reform can achieve increased effectiveness and thereby help to solve challenging economic and social problems. One way in which it does so is by combining actions and strategies in related policy areas. Similar effects have been achieved in businesses, by removing the boundaries of functional departments and focussing instead on business processes.

Current innovation policy – "second generation innovation policy" – emphasises the importance of the systems and infrastructures that support innovation. These are influenced by many policy areas, in particular research, education, taxation, IPR and competition policy. But these policy areas are not exclusively focused on innovation matters; they are not the only ones to impinge on innovation; and the need to work together is not always recognised.

THE TARGET: THIRD GENERATION INNOVATION POLICY

The 1st generation of innovation policy was based on the idea of a linear process for the development of innovations. This process begins with laboratory science and moves through successive stages till the new knowledge is built into commercial applications that diffuse in the economic system. The emphasis of policy was on fostering critical directions of scientific and technological advance, and enhancing the flow of knowledge down along the innovation chain. 2nd generation policy recognises the complexity of the innovation system, with many feedback loops between the different 2stages" of the process as outlined in the 1st generation model. It also gives more recognition to the generation and diffusion of innovations within what have become known as "innovation systems" (national, regional, sectoral, etc.). Policy seeks to enhance two-way communication across different points in the innovation "chain", and to improve innovation systems in ways that can better inform decisions about research, commercialisation, tech-

nology adoption and implementation, etc.

Even though 2nd generation policies still have to be embedded in many agencies, the contours of a new generation of innovation policy are now becoming apparent. Such a new generation of policy would emphasise the benefits of co-ordinating actions in policy areas, and making innovation – and innovation-friendly policies – one of the core principles of this.

Thus **"third generation innovation policy" would place innovation at the heart of each policy area.** The report outlines the case for doing this, in each of a set of policy areas considered. There are of course many differences of detail from one policy area to another. The common aim is to maximise the chances that regulatory reform will support innovation objectives, rather than run the risk of impeding or undermining them. But to accomplish this means fusing two sorts of knowledge. First is knowledge about *(the changing nature of)* innovation processes and innovation policy. Second is knowledge about *(the rationale and reform processes underway in)* the specific policy areas. This fusion should be assisted by the sort of broad-brush review presented in this report. Systematic research on the topics discussed here is, however, relatively sparse. Only a few areas, such as competition policy and IPR policy, have attracted much attention in terms of their relations to innovation – and such attention has typically been directed at very few of the links that exist. This limits the depth with which the topics can be reviewed here. Nevertheless, a number of themes do clearly emerge suggesting how the knowledge-based economy jointly challenges innovation and other policy areas.

But accomplishing the objective of fusion requires **considerable depth of understanding about specific policy design and implementation issues.** This can only come from extensive in-depth involvement with the specific areas. Efforts to specify what is needed from the basis of one or other academic discipline – be it economics, political science, or even innovation policy studies - are bound to be too narrow. Furthermore, such efforts are unlikely to be politically persuasive to those actually encharged with policy design and implementation.

Thus, while the broad contours of a "third generation innovation policy" can be outlined, a **serious effort to articulate and fuse the bodies of knowledge that need to be brought together to add depth to this is still required.** Indeed, such a task of articulation and fusion is a feature of the innovation process itself. In the innovation process, new ways of collaborating to produce innovations are pursued by different actors, none of whom possess sufficient range of in-depth experience to put together all the pieces required to make successful innovations. Similar challenges confront policy innovations. The new policy cannot be introduced quickly and simply by announcing that a third generation policy is overdue. **There will be a need for leadership, education, examples, guidance and co-ordination services.** Responsibilities for bringing together relevant evidence and benchmarking progress, for ensuring that all policy areas do take on the message of the centrality of innovation, and learning the lessons of experience and experimentation need to be established.

The creation of a third generation innovation policy should be a political objective. The steps described above should be accompanied by a regular review of progress in this direction, perhaps on a biannual basis. This should be the opportunity for widespread debate on the critical principles and issues arising. Such knowledge-based policy is essential if the knowledge-based economy is to be achieved in line with the Lisbon objectives.

Main Policy Recommendations

A clearer understanding of the knowledge-based economy and of the importance of innovation and innovativeness within it, must continue to be developed, and should be communicated widely and across all policy areas.

A new generation of innovation policy is required. Elements of this **third generation policy** are visible, but further development of the key ideas should be a strategic goal. The third generation innovation policy will result in innovation concepts being embedded in many policy areas. This requires much more than the issuing of pronouncements about a new policy. It will be necessary to identify and involve key stakeholders in the process, and **to develop interfaces that allow for pooling of knowledge, learning from experience and evidence, and further co-ordination of policy initiatives.** Though the third generation policy will need to be developed interactively, rather than imposed form on high, this process will require leadership and vision, with high profile and high level innovation "champions" sustaining it.

The study reaches a number of conclusions in respect of different areas of policy. First, consider two general approaches to policy reform that are currently underway – regulatory and institutional reform, and reform of governance.

Regulatory and institutional reform is an opportunity for efficient policy design processes to be introduced, and this is also an opportunity to take into account the implications of policies for innovation. It will often be appropriate for efficiency and effectiveness reasons to design measures across policy interfaces, to ensure that policies are working in the same direction. Existing approaches to Business Impact Assessment need to be further developed so as to allow all reform processes to be designed and assessed (ex ante, wherever possible) with innovation criteria to the fore. As well as stressing implications for industrial innovation, they should also allow for the impacts of reform on innovation in non-business organisations (public services, Universities, etc.) to be examined. Systems should be installed for regular intelligence gathering, improved understanding, and benchmarking of contributions of reform to innovation. The major regulatory factors impacting innovation across all policy areas, and the relationship between different factors within and across areas, need to be identified and monitored.

Governance is also important for innovation. The reform of European governance presents challenges and opportunities in this respect. Informed public opinion about broad classes of innovation must be nurtured. One element in achieving this will be the improvement of systems of public communication about RTD and innovation programmes -

their design, rationale, evaluation, etc. Ways to achieve greater public involvement in decision-making as to priorities, ethics, etc. should continue to be developed and extended. Furthermore, potential areas of social or ethical concern need to be identified and addressed. Trust in regulatory agencies must be earned (and seen to be earned) – it cannot be assumed. Thus openness and participation are important, and multiple methods to achieve these ends will need to be instituted.

In addition to these two broad themes, the study addressed a series of policy areas. In the main report these are ordered according to a rough assessment of how far they deal with factors driving innovation, generating innovative capabilities, or dealing with questions of environmental and social sustainability raised by innovation. Here we present them simply in alphabetical order. The major conclusions reached include the following:

Competition policy's aim of fostering greater market competition should, in general, benefit innovation. However, research indicates that there are complicated links between competition and innovation, especially in highly innovative and rapidly changing sectors. In particular, technological and other innovation-related collaborations may be impeded by laws intended to restrict oligopolistic behaviour and collusion. This complicated picture requires **flexible design of policies around clearly stated principles that give high priority to innovation. Regulatory agencies and other implementers and interpreters of policy (such as the judiciary) need to be better informed about the innovation considerations associated with decisions concerning collaborations, monopolies and mergers.** These issues are also closely entangled with matters of Intellectual Property, which also needs to be brought into the equation.

Education and Culture. The social institutions here are sources of human capital and creativity, as well as themselves being the source of many innovations and of the knowledge that underpins many more. Higher Education Institutions (HEIs) can be more entrepreneurial with respect to innovation. Policies can assist them here, for instance in terms of facilitating spin-offs and interactions and collaboration with industrial and other innovators. Of course, this has to be kept compatible with the maintenance of scholarly and ethical standards. But many disincentives are inadvertently built into current institutions and regulations. These should be replaced by systems that reward individual academics for activities that link to innovation. Equally, people with entrepreneurial and intrapreneurial experience should be enabled to contribute more to HEI research and teaching. In terms of human resources, it is important to developing individuals who combine solid disciplinary understanding with capacities to engage in multidisciplinary teamwork and to communicate across professional boundaries. Business Schools and Management Colleges, together with many other HEI courses, should be encouraged to provide high-quality training in innovation-related matters. The can be supported by such means as validation of courses and provision of suitable teaching material.

Employment. The changing nature of work, and the impacts of labour law, needs to be examined in relation to influences on innovation. This is especially true insofar as the changes affect the growing class of "knowledge workers" who are major sources of inno-

vation. Increased mobility of such workers can raise questions of contractual restrictions - governing, for example, their use of Intellectual property and their employment in particular firms and sectors. There remains a need to develop pension, income tax, and related systems further. This should make it easier for staff to be mobile in terms of geographical location, employment, and self-employment. More generally, methods of providing support for the development of systems and procedures that reward employees for seeking innovative solutions, rather than "playing it safe", should be developed. While this is largely a matter for private initiative, public policy has a role to play in promoting awareness, good practice, and exchange of experience. The rewards that innovative activities and "thinking outside the box" can yield should be demonstrated. High-quality material concerning innovation and entrepreneurship should also be developed for use in expanded programmes of lifelong learning.

Enterprise. Enterprise is at the heart of successful innovation, and not just in the private sector. Entrepreneurial attitudes - even if not precisely identical motivations - underpin much innovation in public sector organisations. Support for such enterprising attitudes in general should be fostered. Small and medium sized enterprises (SMEs) will continue to remain an important focus of innovative effort, and of policy interest. The two should be brought together: innovation support facilities can be built into systems that aim at supporting SMEs in general. Support for the development of networking and innovation "clubs" is another element here. Links with HEIs and with business services that can assist SMEs' choice and implementation of innovations, and the further development and commercialisation of their own innovative ideas, should be fostered. There is much need to continue to assist SMEs with adoption of innovations. This is especially so for those innovations that will allow them to participate on a more equal footing in the knowledge-based economy, and in some cases achieve entry to new markets and more independence from large-firm-oriented networks. Examples of support that might be specifically relevant here include for instance, web design and maintenance services for small producers and retailers. (These might best be organised on a locality basis - there are liable to be significant economies of scale and reductions in learning times associated with pooling of resources across, and services of this kind to, SMEs.) Award systems can be good ways of promoting and diffusing knowledge of good practices, and an example here would be the introduction of awards for innovative SMEs (in "traditional" as well as "innovative" sectors), and for SME support services themselves. Information on the drivers of innovation performance – e.g. a "benchmarking " of emerging trends in the global environment as experienced in different sectors, supply chains, regional and countries, and the responses adopted to deal with these – can contribute to building new capabilities for innovation. Enterprises and economies can build foundations for ongoing innovation and learning by competing in global value chains. Here too SMEs need support to achieve involvement appropriate to their level of technological competence.

Environment. Environmental issues are bound to continue to grow in importance, and to receive continuing research effort in their own right. Such research should routinely include consideration of the scope for applications of innovation in support of environmental objectives. Other RTD programmes should, conversely, build into - their design,

functioning, and reporting, processes - routine consideration of the contributions of these processes to enhancing sustainability. There are considerable synergies to be achieved by bringing environmental and innovation objectives closely together - and potential opportunities for distinctive EU achievements here. Another example is in the sphere of Business Impact Assessment, where it is possible to include criteria specifically concerning positive and negative effects of regulations on environmental innovation. Environmental regulations themselves should be regularly reviewed with innovation issues in mind. For example, alternatives to mandatory and potentially technology-freezing rules should be examined. These include performance-based regulation (encouraging flexibility in finding solutions to environmental problems), and process regulation (encouraging better understanding of critical points of impact and innovations at which damage may be reduced). . Information and awareness campaigns are important for alerting SMEs and less dynamic sectors to the scope for environmentally-oriented innovations. It is important to increase recognition that environmental threats may be translated into technology strengths and market opportunities (e.g. alternative approaches to energy generation, remediation technologies, "clean" technologies)

Financial Services and Risk Capital. There is continued need for the development of instruments providing finance for early-stage innovation and smaller firms, with apparent gaps in availability of small-scale venture capital requiring attention. Financial support for various activities (e.g. licensing, patent investigations, etc.) also needs to be fostered. Further development of web-based financial services for SMEs is also recommended, together with appropriate awareness campaigns and support services. The financial community should be helped to acquire better intelligence about emerging areas of technological opportunity. It also needs support in better understanding the general dynamics of innovation (e.g. time required to reach profitability, complementary assets that may be required for commercialisation, typical barriers). Better tools and standards are needed for accounting for innovation-related intangible assets and intellectual capacity in firms. Strong business participation in such a process is required, to ensure that reporting regimes and procedures benefit those regulated, as well as imposing the lowest possible new burdens on them.

Information and Communication Technologies. Policies fostering the development and use of ICTs will continue to be required as the technology itself develops, and its uses become more pervasive and manifold. Problems of access and skill persist (even if their forms change). In addition to continuing efforts to bridge skill gaps, it is thus important to continue to be vigilant against "digital divides". For example, measures may be required to ensure that SMEs are not excluded from e-markets by high entry costs, and that cheaper software and support services that are appropriate to SME business processes are available. Public bodies (local and regional agencies and HEIs as well as national governments should be encouraged to participate in the development and demonstration of innovation-oriented "knowledge management" and information systems (so as to establish standards, awareness of good practice, etc.). **The scope for extended use of open source software should be further explored. The potential of ICT to be an enabling tool for many of the developments suggested for other policy areas should be exploited.**

Intellectual Property Rights IPR protection is generally seen as conducive to innovation, though most of the supporting analysis concerns the patent system. The strategies of companies with respect to patent acquisition, and, latterly, the use of copyright rules to limit the behaviour of other agents, requires careful appraisal in terms of impacts on innovation. Certainly, renewed efforts to establish common European patents are required. However, **the revisions to patent law that are under discussion require extended consultation that explicitly consider the innovation impacts of retaining or changing existing frameworks.** (Examples of controversial proposals for change are modifications of the rules for dynamic sectors - e.g. shorter lifetimes of patents - and extension of the scope of patents - e.g. to cover business processes.) **Similar consultations are also required to examine ways in which copyright and other rules may need to be adapted to stimulate – rather than impede – innovation.** (There is rapid development of copyright law to fit it with the activities enabled by new digital media. But this urgently needs to be reviewed in the light of the innovation impacts of these developments in law and practice.) Improved advice and support should be provided to SMEs for their development and implementation of IP strategies (including negotiation with large business partners). IPR regulations and competition policy need to be jointly examined in the light of innovation trends in the knowledge-based economy.

Regional Policy. There has been considerable recognition of the regional embeddedness of much innovative activity, with clusters and systems often (not always) having a strong regional basis. The study suggests (in the case study work as much as the literature review) that **it is equally important to recognise that it is most often cities and metropolitan areas that are the crucibles of innovative activity.** These entities require specific attention in regional innovation policy, even though in some cases there will be bitter competition between cities to be the regional champion (while in other cases cities may be more able to co-operate). Regional innovation strategies should be helped to build more on regional distinctiveness (rather than simply identifying the same set of priorities (ICT, biotechnology, new materials...). It is important to recognise the significance of innovation and new technology for "traditional" sectoral activities (e.g. tourism) in cities and regions - some of these "traditional" activities are being revitalised and reshaped in the knowledge-based economy. Opportunities for linking sectoral strengths (for example, combining strengths in medical care and tourism, or in energy and environment) should be fostered.

Taxation Policy. While tax removes resources that could be applied to innovation, tax rules (selective or otherwise) can be developed so as to promote innovative efforts and particular directions of innovation. On the first point, **tax incentives for innovative effort are recommended.** These should include but going beyond R&D, and thus methods of systematically appraising non-R&D inputs to innovation (and possibly innovation performance) should be developed. Attention should be paid not just to rewarding the level of activity, but also to encouraging continuous improvement of such effort. (In the first instance this will need to be assessed in terms of inputs, but ideally output-oriented approaches will be devised). There has been considerable interest in the development of environmentally-oriented taxes; these should be seen as providing an opportunity to spur innovation. Accordingly, relevant criteria should be brought into design of

such taxes. Continuing attention is required concerning the question of whether a new form of taxation is required to respond to the new economic drivers of the knowledge-based economy.

Trade Policy. Liberalisation of trade should promote the diffusion of knowledge and innovations, though trade between countries need not spread benefits equally. Trade disputes, unfortunately, easily escalate into serious political confrontations. Thus, international efforts are required to establish mutual understanding and shared norms concerning the systematic incorporation of innovation concerns into trade negotiations and procedures. (These should include such governance issues as those connected with public acceptance of specific innovations) The EU must play a leading role in these processes, not least because there are substantial differences between European and US experience of these matters. Trade liberalisation in knowledge-based services needs co-ordination of rules and other practices (for example those governing professional practice and qualifications) across different countries

Across all these diverse policy areas - and presumably across other areas of policy that we have not studied here, such as consumer and transport policy - there are common points. The overall recommendation is that procedures for enhancing dialogue and mutual learning should be introduced to render all policies innovation friendly. This approach will support the successful implementation of the policies, and contribute to the development of third generation innovation policy.

A NOTE ON THE STUDY

As indicated above, this report concerns the need and scope for reform of various policy areas in the light of the changing context of innovation, given the goals set by the Lisbon objectives. It is based upon case studies, discussions and analyses conducted in a study organised for European Commission DG Enterprise Innovation Directorate in 2001 – 2002. The overall purpose of the study was:

- to synthesise the new approaches to innovation policy required by, and being implemented within, a knowledge-based and creative society

- to identify and review the links between innovation policy and other policies, in particular those policies relating to the legal and regulatory framework for innovation, with a view to providing analytical pointers for further co-ordination.

The policy areas considered are those specified below. It is highly likely that other policy areas would also have yielded relevant results. Furthermore, important issues such as enlargement and enlargement policy have explicitly not been taken on board in the present study, since these would have increased its scope considerably.

A NOTE ON THE METHODOLOGY EMPLOYED

The study proceeded by using a number of methods:

- Literature review was used to identify issues, debates and relevant evidence, and brief accounts of each topic prepared;
- Case studies were used to examine concrete cases of the intersection of these policy areas and innovation; and
- A High Level Working Group (HLWG) of senior academics, industrialists and policymakers, was convened to meet and discuss these issues, drawing on the material prepared.

The study proceeded by considering a series of policy areas specified by DG Enterprise:

- competition
- education and culture
- employment
- enterprise
- environment
- financial services and risk capital plans
- governance
- policies fostering Information and Communication Technologies (ICTs)
- protection of intellectual property rights (IPRs)
- regional policy
- regulatory reform
- research and development (R&D)
- taxation
- trade

Each of these issues was the focus of a short background paper discussed at a HLWG meeting. The first of the HLWG meetings provided an opportunity for a review of the whole process being undertaken.

The three following meetings were additionally presented with case studies. (In two instances these cases were related to the region in which the HLWG was held, which allowed us to bring local actors into the discussions, and to allow them to present their perspectives and comment on the case study reviews prepared for the HLWG.). The three cases considered dealt with:

(1) communications between government departments in the UK during policy formulation concerning tax incentives for R&D;

(2) the generation of innovation-relevant policies in Finland, relating this to the historical, entrepreneurial and cultural reasons for the country's economic success through innovation; and

(3) innovation policies and strategies in Catalonia, an example of a European region pursuing an innovation strategy with a fair degree of independence from its national context.

ACKNOWLEDGEMENTS

The authors of this report would like to thank the members of the High Level Working Group for their contribution and support. We also thank the case study presenters and interviewees who openly shared their thoughts and experience during the preparation of the three case studies:

UK CASE STUDY

Department of Trade and Industry (DTI)	■ Tony Pedrotti (Future and innovation unit) ■ Mark Conaty ■ Ken Worth ■ John Barber ■ Martin Ridge ■ Kathryn Waller (Future and innovation unit – Roberts' review)
HM Treasury	■ Andrew Page (Enterprise unit) ■ Graeme Fischer (European economic reform) ■ Matthew Stevenson (European economic reform) ■ Emilie Rutledge (Productivity and structural reform team – Roberts'review)

FINNISH CASE STUDY

Science and Technology Policy Council of Finland	■ Esko-Olavi Seppälä, Chief planning officer (Science policy) ■ Kimmo Halme, Chief planning officer (Technology policy)
Academy of Finland	■ Pr. Reijo Vihko, President ■ Lea Ryynanen-Karjalainen, Senior adviser
Technology development center (Tekes)	■ Jari Romanainen, Executive director, strategy
Nokia group	■ Erkki Ormala, Director technology policy
University of Oulu	■ Pr Lauri Lajunen, Rector
Culminatum Oy	■ Eero Holstila, Managing director

Ministry of Trade and Industry	■ Timo Kekkonen, Director General ■ Antti Joensu, Deputy director general
Confederation of Finnish industry	■ Hannele Pohjola, Head of department industrial affairs

CATALAN CASE STUDY

Directorate general of Industry Government of Catalonia	■ Antoni Gurguí i Ferrer, Director General
CIDEM (Catalonian center for innovation and entrepreneurship development)	■ Raimon Albiol, Innovation and Technology Director
Inter-ministerial commission on Research Innovation and Technology Government of Catalonia (CIRIT)	■ Antoni Oliva I Cuyàs, Director
Parliament of Catalonia	■ Miquel Barceló Roca, President of the Industry Energy Trade and Tourism Commission
Strategic Plan of Barcelona Association	■ Francesc Santacana i Martorell, General coordinator
Polytechnics University of Catalonia (UPC)	■ Joaquim Casal, Chemical engineering and Vice-Rector
Science Park of Barcelona – University of Barcelona	■ Marius Rubiralta i Alcañiz, Vice chair of the Science park and vicerector for research of University of Barcelona.
Catalonian Institute of technology	■ Clara Torrens, Associated Manager for Corporation development
Editorial Vicens Vivens (Publishing)	■ Pere Vicens, Director General
EMC (Engineering and maintenance in integrated circuits)	■ Carlos Martin Badell, Director General

We would also like to extend our warm thanks to Andreu Mas-Colell, Commissioner on Universities and Research, Catalonian Parliament, who accepted our invitation to participate in the debate during the third HLWG meeting held in Barcelona in April 2002.

1_Innovation policy and the regulatory framework - an analytical overview

The Lisbon European Council: Presidency conclusions of March 2000 provide a standpoint against which discussion of innovation and regulatory frameworks can be located. The conclusions indicated that the European Union faces a "quantum shift resulting from globalisation and the challenges of a new knowledge-based economy." The Lisbon summit set the European Union a new strategic goal for the following decade. This was "to become the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion."

Innovation is a core characteristic of the knowledge-based economy. It is a major source of competitiveness for firms and industries. **It is important for public-sector organisations (to deliver their services to society)** as well as for private businesses (to commercialise goods and services in markets). It is also important for clusters, networks, cities, regions and nations. Knowledge is a key ingredient of innovation activity – not just technical knowledge, but also knowledge of markets, organisations, financial systems – and of regulations. With new knowledge comes the possibility of new products, processes and services. **But innovation is not just a matter of new economic sectors or revolutionary new technologies. Traditional sectors can be innovative.** Furthermore, **incremental innovations** – and the diffusion of new products and processes – **are probably more common and often more immediatly influential than breakthroughs. Often incremental innovations stem from efforts to adapt the great new inventions to the needs of users in specific real-life industrial or consumer circumstances.** They turn the technical potential into socially useful practice, they "join up" complementary technologies.

Innovation in a knowledge-based economy is diverse and pervasive. It is not just based on research or science and technology, or even on enterprise and ingenuity (entrepreneurial skill and knowledge). It also involves managerial and marketing skills, organisational, social, economic, and administrative knowledge. Intellectual and artistic creativity can be called into play – for example in cultural products (which may be "intangible" ones such as TV programmes, or very "tangible" ones such as new architectural designs and buildings). Is the nature of innovation itself changing in the knowledge-based economy? There is still a great deal of scope for further 'traditional' innovation in industry practices, and via entrepreneurial business ventures and scientific advance. But it appears that there are also important changes underway, which we consider later in this report. For instance, as the importance of innovation is more widely recognised, it is becoming more of a strategic priority for many firms, and subject to new management principles. As the types and sources of knowledge required for major innovations become more diverse, there is more stress on collaboration and a tendency for innovations to be produced in networks of actors rather than by gifted individuals or pioneering solo companies. Other changes will be highlighted later. For now, let us stress that innovation and a knowledge-based economy are inextricably intertwined. Innovation helps knowledge generation and exploitation and increased knowledge-intensity facilitates innovation.

Innovation is a complex and evolving phenomenon, and the same can be said of innova-

tion policy. Even were there not changes in the innovation process to contend with, our understanding of innovation is continuing to evolve, and policy is bound to take account of this. Innovation policies are not standardised and uniform across Europe. Varying national policies reflect national innovation systems and regional circumstances, though there is also much learning from the policies being tried elsewhere. The variety in experience and practice creates opportunities for monitoring and benchmarking innovation performance and policy effectiveness in the context of the European research and innovation area.

Because innovation is pervasive, many policy areas have an impact on innovation and innovative capabilities. Policies for education, environment, and Intellectual Property (IP) all have implications for the conduct of innovation, for example. Examples: education produces human resources for knowledge generation; environmental concerns may "force" some types of innovation while ruling others out (because of detrimental environmental impacts); IP rules influence the diffusion of knowledge and the ability of people to imitate innovations. Some policies have deliberate goals to affect innovative performance – such has been the case for research policy for many years now. But policies whose fundamental concern is not innovation, have effects on innovation processes. Though these relationships are often poorly understood, at least some accommodation between these fundamental concerns and innovation goals has been reached, even if this may not be a very satisfactory one. Indeed, it may be that the success or failure of this accommodation contributes to the uneven performance of different national innovation systems.

The accommodation is under pressure, and not just because of changes in innovation processes. No policies are dealing with a static world. The topics to which policies are addressed – in demography, corporate behaviour, environmental problems, and so on – are themselves evolving. These changes imply the need for policy change. (An analogy: when the weather changes, the policy of always carrying an umbrella might better be substituted by that of always having sunglasses to hand.) All policy areas are under such pressure – including innovation policy, as already noted.

Change is an expected feature of modern economies. It is found in our economies, both production systems and patterns of consumption. It is found not only in the policies that seek to influence these systems and patterns, but also in the principles of policy design. Assessment of policies, and the goals they seek to achieve, is one source of such change. Change is not sought for its own sake, here, but to help adapt and innovate policies so as to better meet (changing) social needs - and to improve economic performance, which generates the wealth with which more needs can be met.

Policy change often results in new regulations. But a growth in the number of regulations and the complexity of the regulatory structure can make for uncoordinated action, mismatches, complication, difficult administration, implementation and enforcement. Pressures for assessment of regulations, and for regulatory reform to simplify systems, have come from businesses as well as from governments. All policy areas - including innovation policy - are subject to such pressures, which form another source of change.

Change in policies can affect innovation then: how can we it more likely that it will have positive implications for innovation? Evidently, consideration of innovation needs to be built into the policy design and reform processes at an early stage. This will make it more likely that positive impacts will be maximised, and that ways of dealing with the unevenness in such impacts (across sectors, regions, etc.) will be enhanced. This strategy means that, as policymakers in each policy area become involved in dialogues about the design and structure of policies, they will need to take innovation into account. Thus they will need to work together with those responsible for innovation policy more narrowly understood. They will work to better understand the impacts on innovation of policies and policy reform, and vice versa. This is a challenging task, which has only been taken up in localised instances to date.

Since there are opportunities for various policy areas to benefit from innovation activities, it is in the interest of policy makers in those areas to be informed about trends in innovation and to exploit them as appropriate. These potential interactions between policy areas imply co-ordination in policy design. Common understandings of the meaning and importance of innovation across all policy areas will need to be articulated and communicated.

The task, then, will be to explore the detail of each policy area and its interfaces with innovation. This will reveal the complexity of these interfaces and the potential to enhance innovation. The present study is able only to point to the broad outlines of these relationships. Much more exploration remains to be done. Policy analysis by innovation researchers and other scholars (and consultants) will be helpful here. But the most revealing, and the most effective, learning is likely to be achieved through bringing together the major players here – and by attempting to build innovation explicitly into reform processes.

The core message of this report is that the relationships between innovation, innovation policies, and regulatory reform processes (across diverse policy areas) are changing with the emergence of the knowledge-based economy. The report illustrates these changes from what is essentially a "top-down" perspective. In other words, it proceeds from an analysis of key features of the knowledge-based economy, and of the established relations between innovation policy, innovations, and various other policy areas, On this basis it identifies emergent problems and some avenues for identifying solutions. However, in keeping with the philosophy of the knowledge-based economy, the report also suggests that an adequate analysis requires a "bottom-up" approach. Knowledge of how the process of regulatory reform is generally affecting different policy areas, and the relation of each policy area to (changing) innovation processes and policies, requires case-by-case examination, and substantial knowledge inputs from policy designers and relevant practitioners. Indeed, it requires interactive learning, which involves dialogue between policy designers informed by knowledge of policy impacts on innovation.

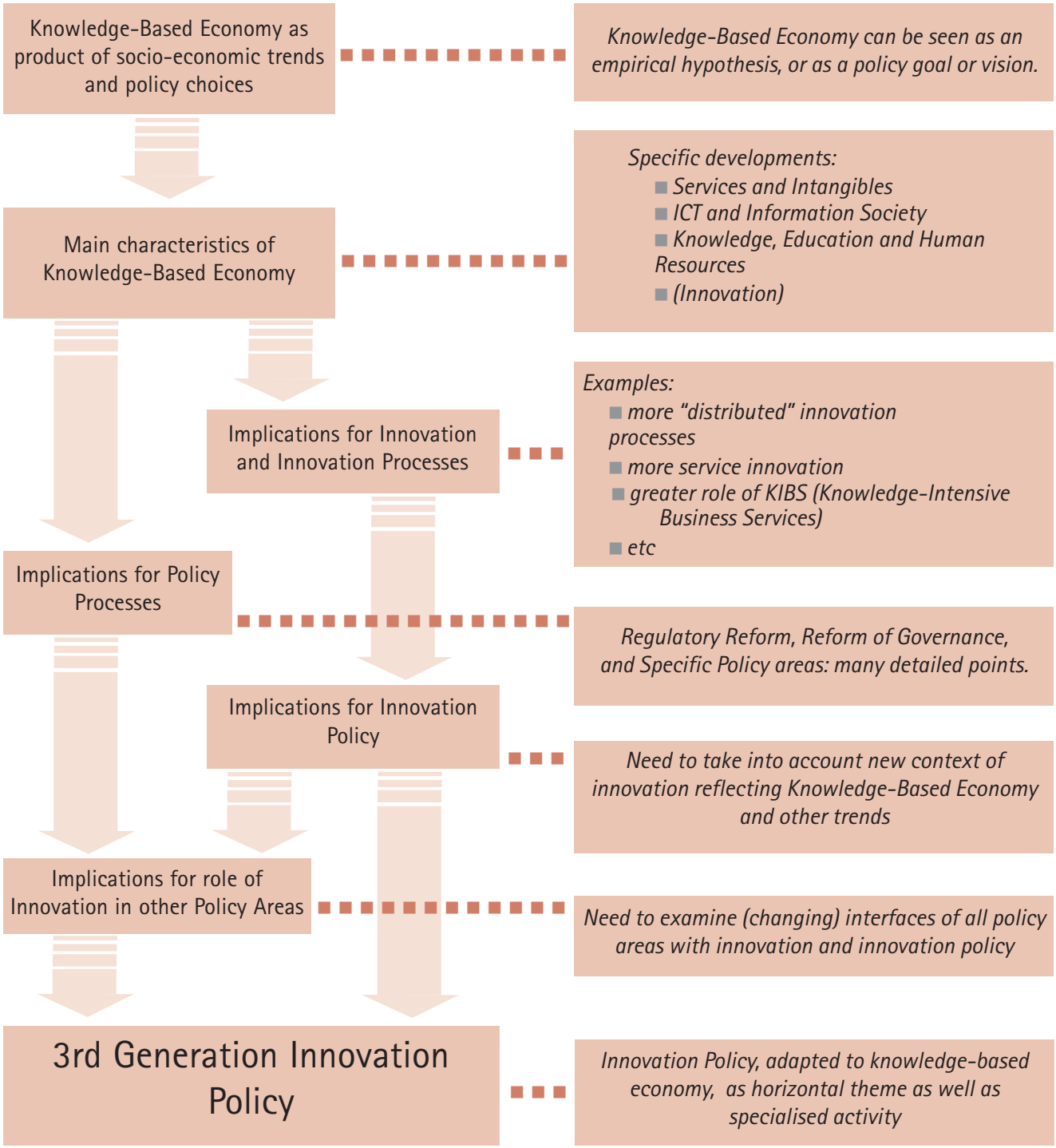
There have been a number of highly revealing studies of innovation in the knowledge-based economy (for example the MERIT study, Cowan and van de Paal, 2000 and an ear-

lier report synthesising TSER projects, Lundvall and Borras, 1997). These studies have amassed a good deal of the empirical evidence that informs our understanding of the knowledge-based economy and the changing innovation process. It is not the purpose of this report to reproduce or summarise this material. Rather, it is intended to move on - to considering the role of regulatory policy and change in such policies in the light these of such developments. (Of the two reports mentioned above, the Lundvall study comes closest to addressing these themes.) As described below, this was achieved by means of a small number of studies and intensive discussions with a High Level Working Group.

The study was able to obtain some "bottom up" insights through a small set of case studies, and these confirmed the need to foster such dialogue. Regulatory policies have numerous, and complex, links to innovation processes, and these are undergoing changes that are only poorly understood. The likelihood is that many changes are problematic, though those developed under the banner of "regulatory reform" are likely often to be to the benefit of innovation. However, even these impacts are likely to be unevenly distributed across types of innovation, firms and sectors, in ways that policy designers have not anticipated.

Figure 1.1 presents an overview of the chain of arguments on which this report is based. We shall reproduce elements of this figure in following chapters, to indicate the stage in the argument that has been reached at particular points in the report.

Figure 1.1: The Knowledge-Based Economy and Innovation Policy



2_INNOVATION POLICY AND THE REGULATORY FRAMEWORK – TOWARDS A MORE DETAILED ANALYSIS

2.1 INTRODUCTION : THE STUDY'S BACKGROUND AND APPROACH

This Report is based upon case studies, discussions and analyses conducted for the European Commission, DG Enterprise, in 2001 - 2002. The overall purpose of this study has been:

- to synthesise the new approaches to innovation policy required by, and being implemented within, a knowledge-based and creative society

- to identify and review the links between innovation policy and other policies, in particular those policies relating to the legal and regulatory framework for innovation, with a view to providing analytical pointers for further co-ordination.

The move into a creative knowledge-based society has implications for innovation policy and a number of other policy areas. It is necessary to study these implications, and associated developments, in order to be better assured of reaching the Lisbon objectives, and so as to prepare for innovative economic activities beyond 2010. It is important to examine the extent to which relevant policy areas are already being utilised to advance innovation policy in Europe, and how they might become more useful in this respect. Pressures to introduce regulatory reform reinforce this objective.

The study proceeded by relating together a number of methods. Literature review was used to identify issues, debates and relevant evidence. Case studies were used to examine concrete cases of the intersection of these policy areas and innovation. A High Level Working Group (HLWG) of senior academics, industrialists and policymakers, was convened to meet and discuss these issues and to comment on the reports prepared in the other streams of work. A series of policy areas were specified by DG Enterprise, each of these being the focus of a short background paper discussed at a HLWG meeting:

- competition
- education and culture
- employment
- enterprise
- environment
- financial services and risk capital plans
- governance
- policies fostering Information and Communication Technologies (ICTs)
- protection of intellectual property rights (IPRs)
- regional policy
- regulatory reform
- research and development (R&D)
- taxation
- trade

The first HLWG meeting provided an opportunity for a review of the whole process being undertaken. Three subsequent meetings were also presented with case studies (in two instances these cases were related to the region in which the HLWG was held. The three cases considered dealt with:

(1) communications between government departments in the UK during policy formulation concerning tax incentives for R&D;
(2) the methods used to design innovation-relevant policies in Finland, relating this to the historical and cultural reasons for the country's economic success through innovation; and
(3) innovation policies and strategies in Catalonia, an example of a European region pursuing an innovation strategy with a fair degree of independence from its national context.

2.2 THE ISSUES

Knowledge-Based Economy as product of socio-economic trends and policy choices

Knowledge-Based Economy can be seen as an empirical hypothesis, or as a policy goal or vision.

This study is intimately related to the Lisbon European Council: Presidency conclusions of March 2000. These put at the core of current challenges to the European Union *the "quantum shift resulting from globalisation and the challenges of a new knowledge-based economy."* These changes require a programme for *"building knowledge infrastructures, enhancing innovation and economic reform and modernising social welfare and education systems".* The Lisbon summit set the European Union a new strategic goal for the following decade: *"to become the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion."*

The knowledge-based economy is thus at the fore of the strategy. It is both an interpretation of current socio-economic trends, an empirical hypothesis; and a vision of what Europe could become, a policy objective. Innovation is positioned as a central characteristic of a knowledge-based economy that is successful in terms of being socially and environmentally sustainable. We will elaborate on the features of the knowledge-based economy below, but for the moment let us sketch out the problematique that is posed for the present study.

Policy areas of all sorts are subject to pressures for change in the knowledge-based economy. These pressures reflect change in the objects of policy themselves – e.g. change in the nature of innovation processes, in employment practices, in environmental

problems. They also reflect changing philosophies concerning how policies are to be formulated, implemented, and evaluated. **Regulatory reform** - the effort to simplify and modernise regulations – is one such pressure for change. The aim is to be able to identify more accurately where goals are best achieved through regulation, self-regulation, market or other mechanisms. A related aim is to be able to streamline the processes of creating regulations appropriate to changing circumstances while forging such regulations on the basis of the best available understanding of the problems being addressed. Another set of pressures involves reform of **governance** – essentially to make policymaking and policies themselves more open and transparent. These pressures reflect three features of the knowledge-based economy – over and above the pace of change in effectively all areas to which policy is applied:

First, there is a growing emphasis on basing policies on knowledge ("evidence-based policy", for example) and on building in monitoring and evaluation mechanisms, and learning from this experience. Policies that are ineffective should be dropped. New policies need to be based on understanding of the problems they are addressing and the solutions that are available. If such an understanding is not available, it may need to be developed, in part through policy experimentation and learning by comparing (not simply benchmarking).

Second, the complexity of modern economies creates challenges. Even the most sophisticated states cannot marshal all of the knowledge that is vital for the functioning of the components of the economy. This has been a major rationale for deregulation and the pursuit of market-based solutions. But what to do when regulation is still required? Limited knowledge means limited policies, and thus the likelihood of policy failures. A common response to problems associated with existing regulations is to introduce new regulations to try to compensate for these failings. But this can lead to a baroque, cumbersome, and often self-defeating morass of policy details.

Third, European citizens have increasing awareness of social and environmental trends, and the ways in which these are influenced by policy, The public often has considerable knowledge as to possible implications of policy changes, and may require persuasion as to the wisdom of specific policies. Two-way communication between policymakers and those governed is required if policies are to reflect social concerns and be acceptable to those regulated.

As already noted, innovation is also a core feature of the knowledge-based economy. Though there are social and economic developments that have only indirect links to technological innovation, innovation is one of the main sources of change. Scientific and technological knowledge – that is knowledge of how to transform our world - is continually developing. With new knowledge comes the possibility of new products and processes, in other words innovation. Innovation is now recognised as a major source of the competitiveness of firms and of innovation systems. It is also clear that environmental problems can often best be tackled by changing the way we produce and use things, and thus innovations (of particular sorts) are required. Innovation policy has accordingly grown in significance. It is recognised as highly relevant to economic performance and

sustainability, and thus is gaining more support and attention. This does not mean that innovation policy is immune from pressures for regulatory reform, shared with other policy areas. Innovation policy also needs to draw on evidence, to be evaluated, to be based on the best available knowledge and to be a learning process.

A further element needs to be considered. Policies are not dealing with a static world. New policies are introduced in order to address new issues – for example in demography, corporate behaviour, environmental problems, and so on. All policy areas are subject to change and innovation policy is no exception. The importance of innovation is now more readily acknowledged and is more widely perceived as a strategic priority for firms and governments. But in addition the nature of the innovation process is also changing qualitatively. There is more emphasis, for example, on collaboration and a tendency for innovations to be produced in networks of actors rather than by gifted individuals or pioneering solo companies.

Furthermore, **innovation is a phenomenon that is relevant to a wide range of policies.** For example, policies areas such as education, environment, and Intellectual Property all have implications for innovation, Policies whose fundamental concern is not innovation, nevertheless have effects on innovation processes. **These relationships are often poorly understood and this may have resulted in policy designs that are sub-optimal.** They need to be examined more carefully and pro-actively. The interactions between regulatory reform in all policy areas, and the changing nature of innovation processes and the changing content of innovation policies need to be continually explored. **There has been little systematic analysis of these issues to date** (the main exception is Määttä, 2001)

This report sets out to examine the themes addressed above in more detail, and in the context of specific policy areas. It is not intended that each analysis is comprehensive and authoritative but instead that it is sufficiently illustrative of the scope and potential for enhancements, interactions and synergy.

The core message of this report is that the relationship between innovation, innovation policies, and regulatory reform processes across diverse policy areas is changing with the emergence of the knowledge-based economy. The report illustrates these changes and provides some tools for thinking about them, and their implications for public policy.

2.3 TOP-DOWN AND BOTTOM-UP APPROACHES

The study was designed, and thus the report largely draws upon, what is essentially a "top-down" perspective. In other words, it proceeds from an analysis of key features of the knowledge-based economy, and of the established relations between innovation policy, innovations, and various other policy areas, On this basis it identifies emergent problems and some avenues for identifying solutions.

However, in keeping with our understanding of the knowledge-based economy, an adequate analysis requires a "bottom-up" approach as well. Knowledge of how the process of regulatory reform is affecting different policy areas, and their relations to (changing) innovation processes and policies, requires case-by-case examination, and substantial knowledge inputs from practitioners. Indeed, it requires interactive learning through dialogue between practitioners. The present study, while being in large part oriented around a 'top down' approach, did encompass "bottom-up" elements, through the dialogue within the HLWG and the input of material from case studies, where we could examine the interfaces between innovation and other policy areas in a number of concrete instances.

One main conclusion of the study is that there is a need to foster the sort of dialogue implied in the "bottom-up" approach. It would be most desirable for knowledge to be accumulated from the confrontation of innovation policymakers and those responsible for policies in other areas, in many countries. From this it would be possible to identify common and specific themes and problems, examine the ways in which these have been articulated and tackled in different contexts, and develop some ideas about what good practice could be in addressing these problems. By setting out the framework and perspectives developed in the present study, dialogue can be stimulated and the results of such dialogue can be collated.

What does this mean for innovation policy? Both approaches might usefully be related to visions of future innovation policy – to what we term below "third generation innovation policy".

The "top-down" approach requires a vision of future innovation policy to be derived from various lines of analysis and commentary. These include such sources as:

- innovation studies (providing new theories about the economics and management of innovation and informing our understanding of innovation performance and impacts),
- analysis of socio-economic change more generally (providing improved conceptualisation and data about the role of innovation in knowledge based economies),
- and policy analyses (evaluation studies, and the benchmarking of policy trends across member states as in The Innovation Scoreboard).

Such a vision of change in the innovation process and trends in innovation policy should generate opportunities for considering links between innovation and other policy areas.

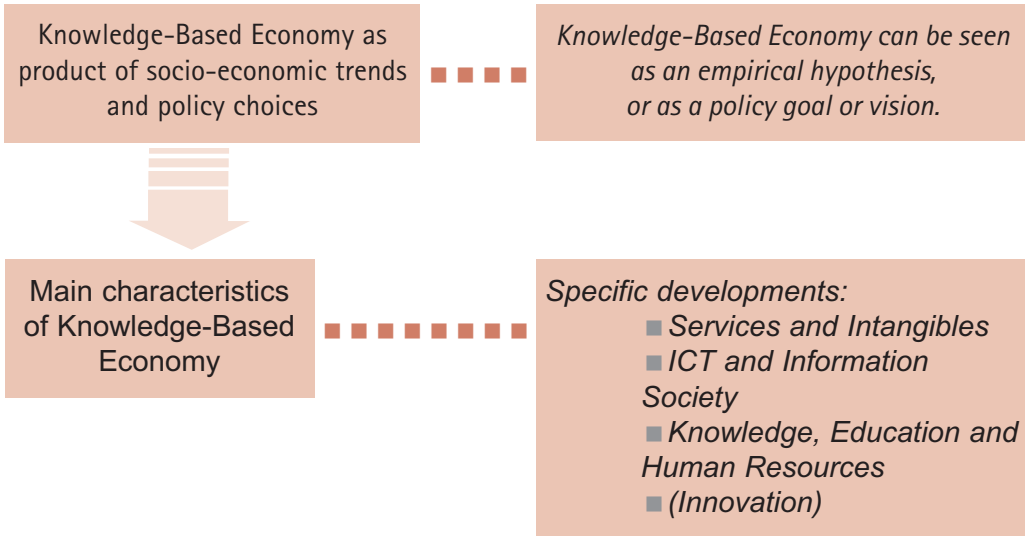
The "bottom-up" approach also requires development and testing of ideas for improvements in innovation policy. But in this case they would be identified from links, or potential links, between the various policy areas and innovation policy. Instead of imposing a grand vision of change, the practitioners would elaborate their understanding of new policy dimensions on the basis of experience with the interface between these areas. This approach would allow for much more input of considerations arising from the pressures for change that stem from within each of the different policy areas, and allow for analysis of the tensions that can arise between innovation policy goals and the goals of other policy areas.

One word before concluding this chapter. *Enlargement and enlargement policy* have explicitly not been taken on board in the present study, To address these themes would have increased its scope considerably. However, these are certainly issues on which the present report bears strongly, and which will shape Europe's innovation landscape and knowledge-based economy in dramatic ways. Future work should explore these considerations in depth.

3_Innovation and the Knowledge-Based Economy

3.1 Introduction : Key Features of the Knowledge-Based Economy

3.1.1 Three Key Characteristics



Knowledge has risen to the fore in social and economic analysis, in policy thought and management philosophy, in recent years. This is in part a product of the trends to a knowledge-based economy. Furthermore, some of the practices that arise from this growing awareness of the role of knowledge reinforce these trends. All human societies have, of course, relied upon knowledge and information. Three trends that underpin the contemporary knowledge-based economy, and that in combination make the case for using this terminology, are:

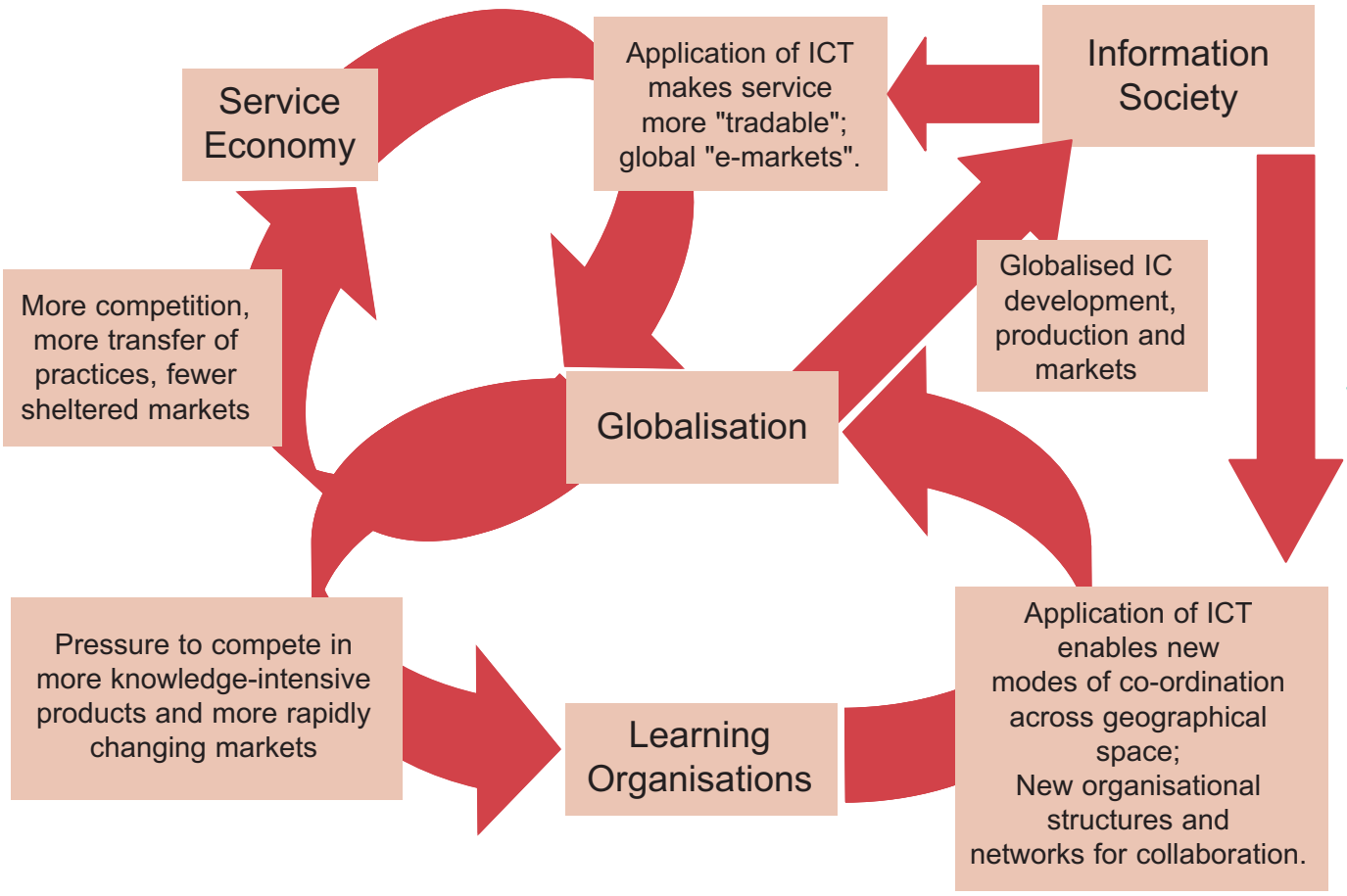
- The rise of the "service economy" and intangible investments;
- The emergence of new Information and Communications Technologies and the Information Society;
- New requirements for, and approaches to, knowledge, in "learning organisations".

These three areas will be discussed in the following sections of this chapter. There are other features of current developments that also bear on the knowledge-based economy, one of which might be expected to gain treatment in its own right - **globalisation**. The reason for not treating globalisation in this way is that it is an intrinsic element of the three areas we have just outlined, as the diagram below (Figure 3.1) makes clear. Aspects of globalisation will be discussed in our analyses of each of the three areas.

Each member of the set of trends mentioned has implications for the innovation process and the nature of innovation itself. We shall outline these in the rest of this chapter.

Innovation is itself an important element of the knowledge-based economy, and given its centrality to the current study we will treat it in particular detail.

Figure 3.1 Globalisation and Characteristics of the Knowledge-Based Economy



3.1.2 Structural Indicators

The Lisbon conclusions called for production of indicators (and reports) to be used to assess EU progress towards the Lisbon Summit's strategic goal that Europe should become "the most competitive and dynamic knowledge-based economy in the world" by the end of the decade. The Commission accordingly presented a Communication on structural indicators in September 2000 (this was adopted by the Nice Council in December 2000). This first set of indicators covered four policy domains. In December 2001 and in a synthesis report presented to the European Council in Barcelona in March 2002, a revised list of 63 indicators was adopted, covering five domains:

- employment;
- innovation and research;
- economic reform;
- social cohesion.
- environment.

A further Communication on structural indicators is expected in October 2002.

The set of structural indicators tends to deal with performance of the economy, rather than shifts to a knowledge-based economy per se. Thus there is little evidence presented here concerning the shift to a services-based economy, the role of intangibles (other than human resources), or the new approaches to knowledge. The indicators do focus on some relevant topics, however.

- ICT issues are considered. Internet access and business expenditure on ICTs are included in the innovation and research group of indicators. (Telecommunications is considered also under economic reform, where data on market share of the incumbent in various telecommunications activities are included).
- Also in the set of **innovation and research indicators**, Human Resources inputs are considered. These include public expenditure on education as a proportion of GDP; and Science and Technology graduates from tertiary education as a share of the population. Lifelong learning is included in the "employment" indicators - arguably it is at least as relevant to innovation as general education. (Business expenditures on innovation-related training is a neglected topic, where reliable statistics would be welcome - the Community Innovation Survey)CIS) does offer some evidence on which estimates might be based, but probably more detailed enquiries are necessary.)
- Business and government R&D expenditures are also included. Other innovation expenditures are less easily grasped, though again the CIS would be a source of preliminary estimates. Non-R&D innovation expenditures appear to be highly important in many sectors, and of course the diffusion of innovations may require little if any R&D on the part of users. A good share of ICT expenditure, too, is liable to be innovation-related, but this is hard to disentangle from more routine expenditures on the technology (even if these almost inevitably involve purchases of more advanced equipment and software!).
- Data on venture capital are also included, but again this is not specific to innovation or research.
- The only measures of innovation outputs are patent data. As discussed below, these only capture a fraction of innovations, and say nothing about the impacts of innovation on performance.

These shortcomings reflect the real problems in developing useful indicators of innovation activities, especially ones that are internationally comparable. Useful efforts in this direction such as the Community Innovation Survey are restricted in terms of sectoral coverage, and of uncertain reliability where it comes to expenditures on various forms of innovation. Ironically, the emergence of the knowledge-based economy involves social and economic changes that are often hard to track statistically, precisely because new activities are rarely readily captured via existing statistics. We will draw on the structural indicators below, where they can help to illuminate our discussion of specific policy areas.

3.2 Services and Intangibles

The knowledge-based economy is also a **service economy** (see Andersen et al, 2000). Four elements of this are especially relevant:

1. The bulk of economic activity, employment, and output is taking place in service sectors of the economy. This is the case across industrialised countries in general, and reflects the growth of marketed services as well as public services.
2. Service-type work is prevalent in all sectors. White-collar work (and higher skill work in general) has grown as a share of employment compared to blue-collar (and low-skill) work within practically all sectors, as well as in the economy n the whole. More knowledge-intensive work characterises most sectors.
3. The notion of service extends to all sectors too, as an important management principle. This means that firms are oriented to providing services – whether their products are raw materials, goods or intangible products – focus increasingly on what their users are achieving. Their commercial strategies are oriented to achieving markets and customer loyalty by responding to user requirements – which means understanding of these requirements, i.e. knowledge.
4. Finally, specialised services are providing critical inputs to organisations in all sectors on a vastly increased scale. One major source of growth of service sectors has been the expansion of business services. This has reflected in part the outsourcing of functions from "leaner" organisations, and in part business needs to access and use new knowledge (or at least knowledge that is new to them). Some Knowledge-Intensive Business Services (KIBS) play important roles in facilitating technology choice, diffusion and implementation; others support organisational innovation and adaptation to changing market and regulatory circumstances, Technology-based KIBS, such as computer and engineering services, technological training and consultancy services, and R&D services, play important roles in generating innovations, and in improving the quality of innovation-relevant knowledge around the economy, as they grapple with the problems of their clients

The shift to a service economy has implications for innovation and innovation policy which will be considered in more detail later. Services have traditionally been discounted as noninnovative, and there is continuing concern about the apparently slow improvement in productivity displayed in several service sectors. **In contrast, it is apparent from sources such as the Community Innovation Survey that many service firms are actually highly innovative, and indeed some service sectors (especially technology-oriented KIBS) are especially so.** Innovation research and policy is only just coming to grips with these enhanced roles of services in innovation processes.

Closely related to the rise of services is the awareness of intangible assets in economic life. Corporate investment and related expenditures have gradually been shifting away from investment in plant, machinery and other forms of fixed capital and toward Intangible Assets. Many such assets involve the availability of services, or capacities to produce services, within organisations. The notion of Intangible Assets remains a subject of dispute, and some authors prefer other terminology (such as intellectual assets or

knowledge capital). The OECD (1992) sees Intangible Assets as "long term outlays by firms aimed at increasing future performance by means other than the purchase of fixed assets". Assets are things that are valued, and intangible things lack physical dimensions, according to Petrash and Bukowitz (1997) who thus see Intangible Assets as valued features of people or of organisational processes, systems and culture. Examples cited by the OECD include R&D expenditures, patents and licenses, training and other investment in human resources, customer lists, products and service brands, and software. Some of these assets are resources (e.g. brand name, patents, skilled workforce), and some are activities intended to develop such resources (e.g. advertising, R&D, training). Some of them are intimately linked to the development or use of knowledge.

The argument is that these resources are quantitatively more important - and more central to determining competitive performance. We have thus seen numerous efforts at improving statistical and accountancy techniques for recording the degree of investment in Intangible Assets, and the development of management systems designed to monitor and assess the effectiveness of their use.

3.3 Information Technology and Information Society

The knowledge-based economy is an Information Society. Information society rests upon the large-scale diffusion and utilisation of new Information and Communications Technologies (ICT). ICT allows for unprecedented capabilities in data capture and information production, and in the processing, storing, and communicating of data and information. Since all economic activities involve these functions, the new technologies are used across the economy. They have been particular important in many service sector activities that were previously affected only to a limited degree by technological change.

They allow for near-instantaneous communication on a global scale; much greater access to people in previously unreachable locations and circumstances; copying and sharing of information at very low cost; ability to process huge amounts of information in little time, and so on. This allows for transformation of established business processes, and the development of quite new products and business models.

The Information Society is in many ways the infrastructure of the knowledge-based economy, although we should not overestimate the power of the new technology to substitute for human presence. While many routine processes can be handled by online databases and automated telephone systems, learning often requires face-to-face interaction. The need for tacit knowledge and expertise has meant that the Information Society changes the significance of spatial location, not that it renders space irrelevant.

The use of ICT itself is something that involves substantial learning. Notably, it has been common for the new technology to initially be used to automate existing tasks without any overall redesign of the business process and division of labour. Thus, the PC has often

been treated as no more than a superior typewriter, rather than a completely new sort of tool that happens to enable typing - alongside numerous other capabilities. The possibilities of restructuring organisational processes around the capabilities of these new tools has often been grasped only slowly - and at the same time, it has been becoming progressively easier to exploit such capabilities as the sharing of data between communicating PCs. This learning process may be part of the explanation of the "productivity paradox". (This paradox refers to the apparent lack of correlation between ICT investment and economic performance. This is- a phenomenon that is much argued over, for example with strong proponents and critics of the view that it is all really down to inadequacies of our statistics.. The correlation may, in any case, finally be showing up in US macroeconomic statistics, as well as in data on company-level performance. Whether it will also emerge in EU data is a topic of great interest.) One result of the need for learning about ICT use is the development of a wide spectrum of KIBS who provide specialised ICT services. Examples of these services to indicate their range of activities: include:

- consultancy as to what sorts of systems may be used (for example, in electronic customer relationship management systems),
- help with systems integration (e.g., putting together front- and back-office hardware and software from a variety of suppliers),
- training of staff (e.g., to maintain software or the content of databases),
- facilities management and systems design and operation (e.g. creating and running a web or e-commerce portal).

ICTs have diffused increasingly widely, from back-office applications in large organisations and process control in some areas of large-scale manufacturing, to being used in practically all business units in firms of all sizes. Mobile and networked communications – voice and data – are moving Information Society on from a phase dominated by personal computing to one where networked computing is evermore central. Commentators and ICT innovators often see the contours of a new phase based on ubiquitous computing as beginning to become apparent. The characteristic ways in which ICT is used now are quite different from those prevalent a decade ago, and continuing change is likely.

The **globalisation** of economies is facilitated by new ICT. The technology allows more coordination of economic activities on a wide geographic scale. It also increases the tradability of many services – or elements of services that are informational ones, at any rate. (Much of the globalisation of services takes place not through conventional exports, but through a variety of investment-related methods. Facilitating these where ICT can enable management control of far-flung branches.). Many firms and sectors – especially services -that have so far been relatively sheltered from international competition are now having to confront it; this in principle should stimulate more innovation-based competition.

One implication of these developments is that new ICT can be applied to innovation itself – from automated gene sequence equipment and other scientific and technical instruments, through groupware to support collaborative R&D projects, to databases to store and communicate intelligence about research results and patents.

These developments spur the pace of innovation, and allow for rapid diffusion of innovation-related information around the world.

3.4 Learning Organisations: Knowledge and Human Resources

The knowledge-based economy involves changes in the production and use of knowledge. Organisations are confronted with an increase in the volume and variety of information, and of the knowledge with which to effectively use this information. More sorts of knowledge are required, as well as deeper knowledge of traditional areas of business. (We can call this an increased complexity of requisite knowledge.) This is especially true for innovations, where many new products and processes draw on very diverse bodies of knowledge. For example, microelectronics is routinely built into products of many types - consumer appliances, medical equipment, industrial tools, vehicles of all sorts. Knowledge of electronic engineering and software - not to mention control systems and user interfaces - is thus required in many sectors of manufacturing industry. It is also required in services such as banking and health, that are often active in specifying and developing new systems themselves, as well as "simply" using those supplied by manufacturing on a turnkey basis.

Some authors go as far as to claim that a new mode of knowledge production has emerged (Gibbons et al, 1994). Here, there is a closer connection between science and technology, with traditional distinctions between pure and applied research breaking down. The problems that drive research, and the theories that guide it, are increasingly derived from practical problems (e.g. in microelectronics, genomics...). Many scientists adopt a strategic approach to their own careers – they become ' scientific entrepreneurs'. Furthermore, this analysis also indicates that knowledge production, informed by a context of application rather by the concerns of traditional disciplinary communities, is forced to become more transdisciplinary.

Organisational knowledge of course is far more than just a matter of scientific and technical (S&T) knowledge, nor even of knowledge to enable innovations, either. Knowledge of markets and user requirements, of regulatory systems and trends, is vital for business practices in general. Globalisation promotes demand for better understanding of diverse cultures and regulatory systems, and allows for new avenues of learning from the experience of other organisations and countries. While innovations do rely on new knowledge or new application of knowledge, not all innovations are S&T-based - some are more a matter of aesthetic, cultural, social or organisational novelty. (An example of the latter is the ombudsman. In attempting to introduce such an organisational innovation, it is very helpful to have knowledge as to what constitutes good practice in terms of the rights and duties of such a figure, knowledge of what problems have been encountered and solutions generated in different contexts, and so on.). **Governments** also find themselves dealing with increasingly complex knowledge, and regulatory reform is one element of their response. Another is the effort to work much more as a facilitator rather

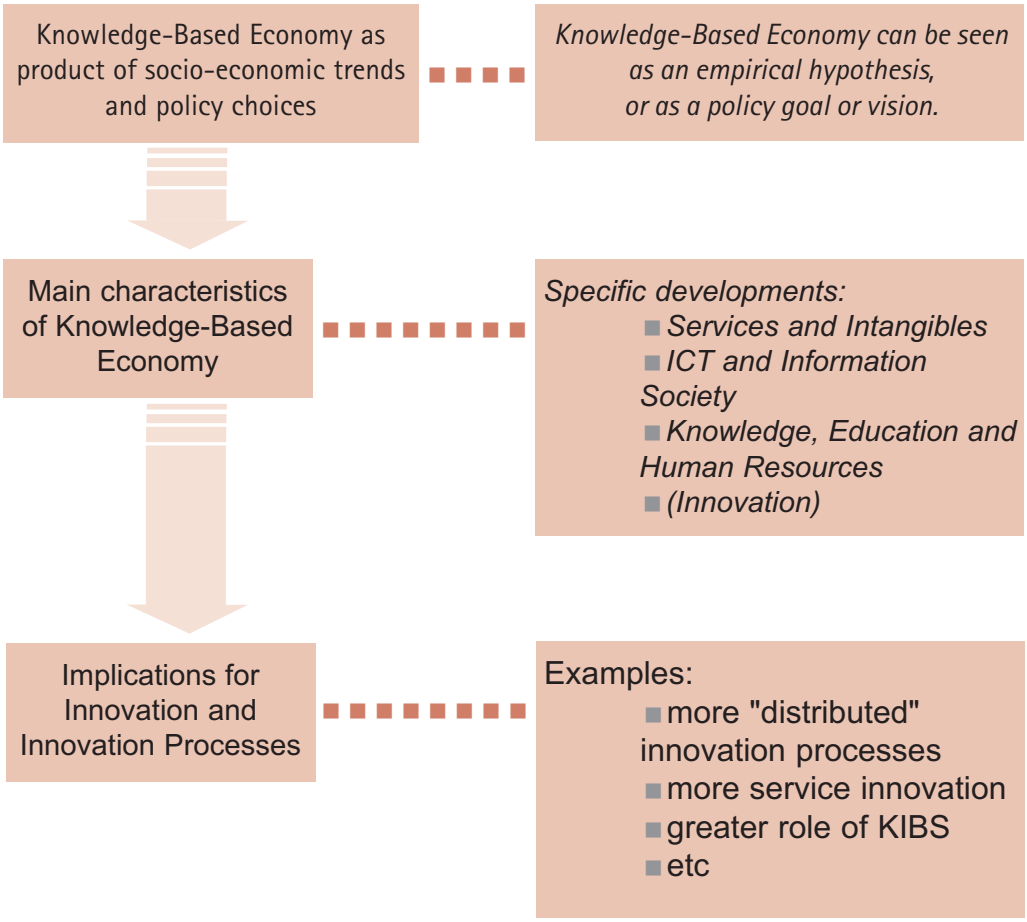
than controller of change, and to bring together different sets of knowledge - for example through Foresight programmes.

The growing complexity of knowledge means among other things that companies have to collaborate to access the knowledge required to enter new markets and to confront new challenges. This applies to innovations too, where collaborative R&D has become more important. Another result of the increased complexity of knowledge is that inter-disciplinarity, and the capacity to manage multidisciplinary teams and dialogues, are highly sought after capacities

Knowledge Management takes us a step beyond the recognition of the importance of Intangible Assets. This recognition has led to efforts to promote the conversion of tacit knowledge embodied in expert workers, into information resources that can be shared among relevant sections of the workforce. Many of the methods developed here are formal and based on ICT. Such methods for example are applied by organisations to make more effective use of their data resources (e.g. data mining), information assets (e.g. Enterprise Resource Systems) and expertise (e.g. groupware and collaborative systems). Valuable information itself may be processed and used to inform decisions; tools and problem solutions developed in the organisation may be archived and made accessible; guidance may be provided as to how to locate and access expertise possessed within the organisation. Quite different approaches have been followed in different organisations.

But there are knowledge management practices centred on human resources management that are less technology-. For example, methods such as mentoring and project debriefings can be used for the purpose of sharing knowledge about organisational processes or markets. Organisational learning is more of a central concern, and government agencies, too, seek to learn from their experiences, through such procedures as programme evaluation. Management (and measurement) tools are being developed to help improve the quality of decision making. Among these are tools to identify the returns to investment in intangible assets - including R&D and other innovative efforts.

3.5 Innovation and the Knowledge-Based Economy



In addition to the three sets of characteristics discussed above, the knowledge-based economy is generally seen as featuring an enhanced emphasis on innovation - especially technological, but also organisational innovation. We are focusing specifically on this element for the present study, for very good reasons: innovation is increasingly recognised as a vital element in corporate and national competitiveness. The public sector, too, increasingly sees innovation as central to strategies for increasing its efficiency and effectiveness - as do voluntary organisations. Innovation is a key factor in securing economic growth, improving quality of life, attaining environmental sustainability.

Innovation is not just a matter of "high-tech" companies creating radical new products. It is something that concerns companies in all sectors, including so-called traditional industries, and, of course, services. This has led to increased emphasis on investment in innovative activities and capacities. In terms of activities, there is much emphasis on

investment in Research and Development (R&D). However, in keeping with the analysis above, attention also needs to be paid to the diffusion of innovations, and to their successful implementation. Traditional measures of R&D activities are believed to considerably understate the scale of innovation efforts - even technological innovation efforts. Innovation in service firms may depend more nowadays on ICT and other equipment, but there is still great need for organisational and human resource development. These latter Intangible Assets carry much of the knowledge required for invention, commercialisation, and successful uptake of innovations. Human capital, and the fostering of learning, become critical competitive resources.

3.6 The Changing Innovation Process

The nature of innovation, and how it is managed in business, is changing in the knowledge-based economy. This naturally has implications for Innovation policy - and for how other policy areas relate to innovation. Taking the features of the knowledge-based economy outlined above, we can point to various aspects of the changing nature of the innovative process, and the new demands that are put on innovation policy. Let us outline just a few examples, in relation to the features of the knowledge-based economy discussed above:

3.6.1 Services and Intangibles

- Innovation studies, measurement techniques, and policies need to be oriented better to the rise of innovative service firms, and of KIBS. These can be important sources, as well as users, of innovation.
- Innovation in all sectors - including traditional services, utilities and manufacturing, needs to be fostered. Some firms in these sectors have developed sophisticated approaches to innovation. Others have yet to recognise its importance to them as they move into less sheltered economic environments with more global competition.
- The growing importance of service components in manufactured products and manufacturing processes suggests that these are also areas where innovation needs to be examined. One reflection of this is the growing attention being paid to intangible assets and intellectual capital.
- Innovation is more market driven than in the past, with efforts to achieve better "service" through new products. Needs for knowledge about markets and skills to acquire and deploy such knowledge have grown.

3.6.2 Information Technology and Information Society

- Information and communication technologies interact with the development and availability of human capital. Knowledge that can ensure that the human element is not

subordinated to technological potentials is required in order to enhance creativity and sustainable development.

- With globalisation, and the availability of ICT resources to competitors, firms are being forced to innovate more rapidly and more efficiently.
- Access to advanced ICT infrastructures and skills is vital for the innovative capacity of firms and regions.

3.6.3 Knowledge, learning and human resources

- New tools for innovation management are becoming competitive assets.
- The concept and therefore the scope of innovation are broadening as organisational and market innovations are given more attention.
- Intellectual Property Rights and other Knowledge Management tools are posing highly significant strategic challenges.
- The innovation process is more global and has a broader variety of sources of knowledge.
- Research is increasingly related to application areas and is increasingly transdisciplinary. "Scientific entrepreneurs" have roles to play in welding together teams to work across disciplines, and in relating theoretical and practical knowledge.
- Human capital that supports exchange and fusion of knowledge across professional and disciplinary boundaries is a critical asset.
- The role of business in funding innovation has increased, even in public sector organisations in many countries.

Coombs and Georghiou (2002) have recently summarised trends in industrial R&D in a helpful manner. They report greater ability to afford R&D in favourable economic conditions. But also, rapid growth in R&D in the 1990s (in part fuelled by a large increase in venture capital funding in the USA) is apparently being sustained in large companies, at least during the present economic downturn. They conclude that innovation policy per se has had little to do with these trends - especially given decreases in government support for business R&D. Rather, the trends reflect developments related to the knowledge-based economy, including, but also going beyond, the increased competitive pressure to innovate. There is a wider range of technological opportunities (related to continuing breakthroughs associated with ICT and other knowledge-based new fields such as genomics and nanotechnology). Also, the productivity of R&D appears to be increasing as new tools and methods (including the knowledge management methods discussed above) are applied to it, and stronger and broader intellectual property rights regimes permit increased returns to it. In addition to these drivers, Coombs and Georghiou identified some qualitative changes in R&D, namely:

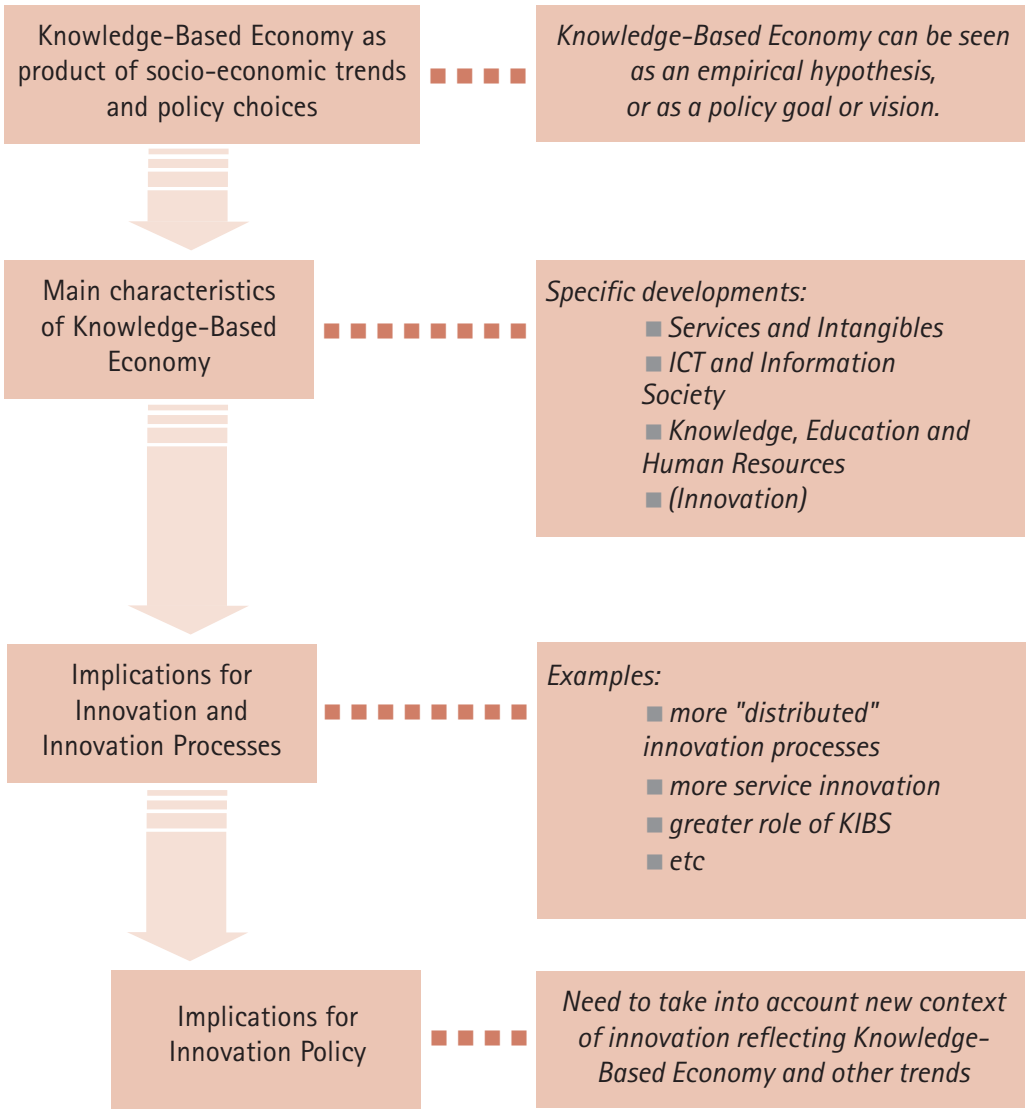
- Increased acquisition of technology rich smaller companies emerging from the venture capital sector;
- Growth in outsourcing of R&D to specialist firms and universities;
- Globalisation making R&D facilities more "footloose"; and
- Continuing high significance of technological alliances.

All of these changes involve relationships among companies, or between companies and other innovation actors. The new focus on collaboration is a critical element of any systemic view of innovation, and has to inform third generation innovation policy. The goals of policy will need to encompass the strengthening of such relationships, or at least the provision of an environment conducive to them. Relevant elements of innovation policy will include fostering industry-academic links, promoting the commercialisation of public sector research, and supporting venture capital, especially where it seems to be deficient (notably at the seed funding stage).

Innovation is key to competitive performance, and is ultimately a vital part of the solution to medical, social and environmental problems. Support for innovation underpins continuing improvement in the human lot and dynamism of the economic system. The form that such support needs to take in the changing global context is the theme of the present study. But this is not to say that all innovations are desirable. From crack cocaine to handguns that are undetectable by airport X-Ray machines, from computer viruses to ozone-layer depleting aerosol sprays, there are innovations whose use carries serious negative consequences. In some cases these are designed into the innovation (weapons). In some they are the result of user ingenuity in exploiting functionalities of the products (e.g. electronic fraud, hacking). And in others they result from unanticipated "side-effects" of use (e.g. environmental damage caused by emissions). Sometimes enough knowledge exists at the time of invention to foresee such problems and take action about them. Often this is not the case. This may reflect limited scientific understanding, or failure to anticipate the scope for user "reinvention" of the product. (This in part is a matter of limited social scientific understanding, and in part is a failure of innovators to mobilise available social scientific knowledge).

Innovation policy cannot hope to select among "good" and "bad" innovations to support. Indeed, given the inherent uncertainties mentioned above, the question will usually be one of how good or bad specific **innovations are for whom, by what criteria**. There can be very few **black-and-white cases. Innovation policy may hope to steer broad** trajectories of **technological development**. (For example incentives may be provided to work on technologies that are more environmentally sustainable in terms of resource use or pollution emissions, or that are explicitly oriented to the needs of underresourced social groups such as disabled people, victims of tropical diseases, etc.) It can promote institutions conducting technology assessment or enhancing awareness and social dialogue about the course of scientific or technological development. But other social institutions - including regulatory policymakers - will need to be active in defining what innovations are used, and how. These bodies and policymakers need to be informed about innovation and its potential consequences, and about specific lines of innovation and their possible outcomes. Since innovations are liable to challenge many policy areas, it is beholden upon those responsible for these areas to be aware both of the impact of their policies on innovation, and the implications of innovation for their areas of concern.

3.6.4 Innovation Policy



With innovation at the fore in the knowledge-based economy, it is no surprise that innovation policy has risen in prominence. Policy-making processes are also evolving as a result of governance and regulatory reform issues and other influences such as increased interest in benchmarking and comparative or trend analysis. This is illustrated, for example, by the European Innovation Scoreboard[i] (Commission Staff Working Paper SEC(2001) 1414) and The TrendChart project[ii] (this provides numerous reports at its website). Such activities allow examination of the innovation performance of member states, and of the infrastructures, capabilities, processes and strategies with which states attempt to enhance it.

Accordingly, as the European economy becomes increasingly knowledge-based, and innovation processes are transformed, new approaches to innovation policy need to be considered. The MERIT report (Cowan and van de Paal, 2000, p5) identified a number of policy priorities for the knowledge-based economy. This study stressed the need to support diffusion and effective use of innovations by increasing the "distribution properties" of European innovation systems - in other words, breaking from a "linear model" view of policy as being mainly focused on fostering upstream R&D. Their priorities are:

- ICT exploitation. Advantage should be taken by European firms and institutes to exploit the possibilities and opportunities that ICTs offer. These ICTs enable increased interconnectivity between knowledge agents through (virtual) networking.
- Knowledge Mobility and Training. The importance of tacit and specialised knowledge calls for greater mobility of knowledge workers and investments in training and education.
- Intellectual Property Rights (patents, copyrights, design registration) can be important instruments to codify and commodify knowledge and hence, the diffusion of knowledge. Their dissemination and use should be further stimulated, while keeping in mind the limitations of IPRs as a dissemination mechanism.
- Funding conditions (financial and fiscal) should be geared to more innovative risk-taking and better rewards thereof.

These general directions remain valid. The present study suggests that emphasis should also be given to the connections between a broader range of regulatory policies than suggested above (the MERIT study effectively mentions ICT, education, IPR, and financial policies). The EU's current Innovation Policy, based on the Innovation Action Plan, arising from the December 1995 Green Paper on Innovation (COM(95)688), already points in this direction. Its proposals are classified according to three principal objectives (each containing up to six "themes"):

- to foster an innovation culture,
- to establish a legal, regulatory and financial framework conducive to innovation,
- to gear research more closely to innovation.

The present report focuses especially on the second of these bullet points, and within this on the needs to reconcile regulatory policies and innovation objectives. This requires us to think about a new generation of innovation policy. A core feature of this "third generation innovation policy" is that it places innovation at the heart of effectively all policy areas. This is not just to say that all policy areas need to be innovative (though they do - and in many cases there is considerable scope for technological innovation to support organisational and policy innovation). In addition it requires various policy areas to work strategically towards the Lisbon objectives, preferably taking innovation into account as a factor that is influenced by the policies and policy reforms that are being pursued.

The accompanying Box 3.6.4 represents a position statement - The Tuusula statement - developed by members of the HLWG for this project. It specifies their views concerning these requirements, and was a helpful guide in the preparation of the present report.

Innovation policy and the regulatory framework

Making innovation an integral part of the broader structural agenda

Box 3.6.4 The Tuusula statement

Foreword :

A High Level Working Group has been established in the framework of a study carried out on behalf of the Innovation Unit of the DG Enterprise of the European Commission on the above subject. The Group, bringing together European experts and policy-makers, has met in Tuusula (Finland) on January 10 and 11 and has expressed the wish to collectively prepare this brief statement*, in view of the forthcoming discussions to be held over the next weeks which will contribute to shape the future of the European Innovation Area according to the Lisbon ambition: "to become the most competitive and dynamic knowledge based economy in the world, capable of sustainable growth with more and better jobs and greater social cohesion"

Statement

The vision, the promises and objectives of Lisbon are in danger. Many of the national and European efforts have insufficient momentum. There are only eight years until the 2010 deadline, dictated at Lisbon. From a program perspective, this is a very short period of time and immediate measures are necessary.

The European Union exists today in a global market and quality of life is directly related to success in that market. If the EU wishes to remain globally competitive, it will urgently need to take effective measures that support and reinforce its ability to compete.

The Heads of Government are advised to consider the following four actions:

Create a European Innovation Policy

The ambition of the EU to become the world's most competitive and dynamic economy requires concerted action focused by one European innovation policy. For instance, scientific research is necessary but it is only part of the kind of innovation envisaged in Lisbon. The output of this research is the raw material that industry uses to create

innovation. After all, innovation does not only require knowledge, it also requires resources and entrepreneurship.

ACTION: *A European Innovation Policy should be more than the collection of innovation policies of the individual member states. The common innovation policy must contain the shared strategic vision of the European innovation system, and must provide a common framework for the national and regional initiatives.*

Remove bottlenecks and national barriers

The current regulatory framework has not been designed with the innovation process in mind.

ACTION: *Review existing, and purge redundant, regulations and new directives in all policy areas based on whether they provide incentives or hinder innovation*

Speed-up strategic measures

The present generation of students, young researchers and young industrialists is now being prepared to take over positions in an innovative industry. They will have to create the Europe envisaged in Lisbon.

ACTION: *Steer European education (curricula directed towards innovation, emphasising strategic knowledge and creative entrepreneurship), European vocational training (focussing on innovation management) and European research (emphasising cross-disciplinary programmes in strategic areas) in order to create a sustainable European Knowledge and Innovation Area. Improve also the structure of public-private partnerships to facilitate effective technology transfer between R&D bodies and companies at a large scale.*

Increase cross-border, cross-policy synergy

Innovation should become a prominent goal for all other European policies. There is a need to identify and review the synergy between innovation policy and other policies, in particular those related to the legal and regulatory framework.

ACTION: *Now that the Euro has been introduced, complete the Single Market in the area of innovation. The European Union must view itself as one single country (cross-border synergy) with one single innovation policy that is enhanced by all other policies (cross-policy synergy). This means that we should generate a EU knowledge portfolio that is matched with the high European technological ambitions: synergy between science and industry. And it also means that we must establish a EU patent to speed-up the process and reduce the cost of creating and protecting IPR.*

Members of the High Level Working Group, present in Tuusula:

Guus Berkhout
Professor of Innovation Management
Past Vice-President Research
Delft University of Technology
The Netherlands

Donald Hillebrand
Research and Technology Division
Daimler Chrysler
Germany

Reinhold Enqvist
Managing Director
Nordic Industrial Fund
Nordic Countries

Davide Diamantini
Director Fondazione Rosselli
Italy

Raoul Kneucker
Head of Division, 'Scientific Research and International Affairs'
Federal Ministry of Education, Science and Culture
Austria

Juan Mulet
Managing Director
COTEC Foundation
Spain

John Barber
Director of TESE
Department of Trade and Industry
UK

3.7 A Third Generation Innovation Policy

At the time that innovation policy emerged as a distinctive "flavour" in industry and research policy, it was still widely believed that innovation flowed naturally and unproblematically from scientific discovery. According to the "linear model" of innovation, research would generate new knowledge of how the world works, and this knowledge would be picked up by innovators and entrepreneurs and applied in the form of new products and processes. The linear sequence is one that starts with research, moves through development and design to production for the market, and then on to marketing and sales, and (though these received little attention) after-sales service, actual consumption, and product disposal. Scientific endeavour was seen as fairly autonomous and largely a public enterprise; innovators were heroic individuals with the vision to relate new knowledge to commercial opportunities. Furthermore, innovators operated more or less as economic islands, isolated from each other or linked by arm's-length contracts. They were seen to offer their innovations into markets that operated very much according to the idealised principles of neoclassical economics. These markets were anticipated to select the optimal innovations. The role of public policy was to support research; the result would be a steady flow of innovations into the market, which would select those optimal for their intended purposes.

This is a very simplified account of **"first generation innovation policy"** and its conceptual underpinnings. It should be recognised as a clear step forward from simple projects of supporting national champions or specific sectors of the economy. Its analysis, though widely appealing, was very limited. **By the mid-1990s, this approach had been widely discredited.** At least, it had attracted a considerable volume of critique from innovation researchers, and was often being overtly repudiated in official statements about government policies with respect to innovation. In practice this first generation policy was still extremely influential, but best practice was now seen as residing in a "second generation innovation policy". This was intended to recognise two weaknesses of the traditional approach:

- The "linear model" failed to recognise the multiple links and feedback loops that interrelate research, development, commercialisation, and uptake of innovations. New research problems, for example, are often inspired by experience of the application of knowledge in real-world situations, and there is much interchange between research managers, sources of finance for R&D, regulatory agencies, entrepreneurs, marketing experts, and the like. Thus,
- Innovation need not start with research.
- The firms that are most successful in pioneering new products may not be the first movers. They well be those firms that have the "complementary assets" required to market or distribute the product, or to mobilise producers of complementary products to work in line with their standards.
- The connection of R&D staff to production, marketing and other staff, can be vital. It is an important element in the ability to gauge the likely success of innovations, and thus to design them so as to correspond to user requirements.
- Furthermore, links to sources of finance are vital. The decision whether or not to pro-

vide finance for a particular line of innovative development is a "selection process" that operates well before the market has a chance to select among innovations.

■ **Innovation is rarely a matter of heroic individuals pursuing their visions.** Indeed, very few innovations come "out of the blue", and there are typically several teams working on any particular class of innovation at any moment. (A major reason for failure of some policies designed to support innovations (and, in the past, national champions) has been that they have been tied to specific technical solutions. They failed to recognise that numerous other innovators were pioneering alternative solutions, with which these products would have to compete in the market.) Equally importantly, innovation typically happens in networks of innovative agents - often collaborating between firms, across the University-industry interface, and so on. These may reflect collaborations through supply chains, but often the relationships of the actors are more complex, as they involve bringing together different types of technical (and non-technical) knowledge (and other complementary assets, such as market access). Such collaborations are especially important for small firms working on major innovations, but are of course also pursued by larger companies. There has been relatively little attention to the complex contractual arrangements that characterise collaborative innovation strategies, except where they have raised concerns in some areas of competition and IPR policy.

The "second generation innovation policy" (and its underpinning innovation systems model) has been very influential. **Policy attention has increasingly been focused on innovation systems and clusters:** on improving the networks within which groups of innovative actors can coalesce to create and forward new projects. This is not only true for national and EU-level policy. It also applies to regional innovation policy, especially since it is recognised that many systems and clusters are effectively tied to limited geographical areas. (Our case studies, below, indicate that the key areas are often, in fact, cities: their role in the wider regions where they are nested is crucial.)

However, despite official endorsement of systems approaches, and frequent acknowledgement of the failures of the linear model, it is still common to find many elements of that old model appearing in policy documents. Thus the HLWG for the present study suggested some caution was required. **There are dangers in announcing the imminence of a 'third generation' policy, when progress still needs to be made to make the second generation a reality!** This is not a reason to refrain from looking ahead to where future directions in innovation policy might and should emerge. But it does caution against assuming that new policy directions will be taken up as readily in action as in rhetoric.

The acknowledgement of the importance of multiple knowledge sources and feedback loops in innovation processes fits well with the features of the knowledge-based economy outlined earlier. However, this does not go far enough. In particular, the increasing importance and pervasiveness of innovation in the knowledge-based economy require innovation to be broadly supported and encouraged. **Innovation is too important and too ubiquitous in a knowledge-based economy to be addressed only by innovation policy. The concept of innovation must be embedded into other policy areas.** When knowledge generation and exploitation processes are dispersed (as they increasingly are in a knowledge-based economy) and as enterprises and institutions become increasingly

knowledge-intensive then much of the economy and society is part of that innovation system. Policies must be changed to respond to the existence of innovation at this level and should aim to leverage and exploit it as a characteristic. Regulatory reform processes should actively seek out opportunities for fusion with innovation factors and influences.

3.8 Policy Making Processes

To implement the above suggestion, collaborative and consultative processes must be used on an ongoing basis. This is consistent with the principles of governance for European policies as outlined in the White Paper.

For several years innovation has been treated or described as a horizontal theme within certain policy areas and in European Commission innovation programmes. **The third generation policy model takes a further step.** Ways must be found to emphasise, integrate and embed innovation thinking in policies to create Europe 2010. Thus, we need to think about the wider contours of a "third generation innovation policy". A new generation of policy needs to be designed, which can widely communicate the importance of innovation, and thus reflect the ongoing changes in innovation processes. The promotion and acceptance of such a model would facilitate achievement of the Lisbon objective of European success in the transformation to a knowledge-based economy. And the policy design process will itself need to be creative and innovative.

The period up to 2010 will need extra effort and energy in order to strengthen the European innovation area (and member states' innovation capabilities) as well as to achieve all other necessary objectives. Then innovation will need to be sustained beyond 2010, where the innovation policy needed in Europe might be different from that needed to reach the desired vision of 2010.

Some of the management and leadership techniques used in business for restructuring and transformation exercises are now being adapted in public services and government departments. For example, performance benchmarking is prevalent, as are tools such as roadmapping and foresight. (Some of these techniques are being brought to bear on the design of innovation policy itself.) Market forces are seen as strong stimulants of responsiveness to customer demands. Partnership schemes are promoted and the recruitment of business managers into public sector organisations is encouraged. Different attitudes and incentives and reward systems may be introduced but sometimes the experience and dedication of workers can be neglected. Many of these changes have not yet fully permeated public organisations. They concern the ways that policies are formulated as well as the ways that policy actions are implemented and monitored. There is a business precedent for governance in policy in the form of corporate governance. (For example, practitioners here focus on such issues as those of involving stakeholders in the process, making activities transparent, and rendering data in the form of well-understood frameworks. The recent scandals in US businesses, with their impacts on the US and

world economies, demonstrate equally the dangers of failing to follow such guidelines.)

Of course, there are also precedents in the policy field itself. In 1986, the EU put in place its Business Impact Assessment (BIA) system, intended to assess the implications of proposed legislative proposals for business practices. In September 2000, following the Lisbon European Council's call for a simplified regulatory environment, a pilot project was launched to review the BIA. This explored better ways of assessing the costs and benefits of regulatory proposals on business. (The results are documented in an Enterprise Working Paper from March 2002, **"Business Impact Assessment Pilot Project - Final Report: Lessons Learned and The Way Forward".**[iii]) This reports that the Commission intends, during 2002, to establish methods which can integrate environmental, social and economic (including business) impacts. **Among the criteria to be included in this analysis, appropriately enough, are costs and benefits in terms of impacts on firms' abilities to innovate.** These are, however, considered to be indirect effects that are hard to quantify. The report does notes that it is important not to neglect such effects unjustly in favour of a focus on more direct impacts those that can readily be expressed in monetary terms (financial costs of compliance, etc.). In light of the arguments being made in this study, we can only underline this warning. Indeed, there is a strong case for developing BIA approaches that can place impacts on innovation at the fore of the analysis, even if the sorts of quantification that have to be employed will necessarily reflect the uncertainties and unpredictabilities inherently related to innovation.

4_Lessons from the Case Studies

The "bottom up" characteristic of the case studies has to be emphasised, as a contrast to the top-down analysis of policy interactions found elsewhere in this report. "Bottom up" refers to thoroughly informing, if not leading policy analysis, with a growing emphasis on implementation issues which needs to be fully understood in order to anticipate incentive effects and levers that could be enhanced by a new policy design.

On an empirical basis, lessons that can be learnt from the three case studies reflect that innovation related policies are revealing new practices and design methodology that are based on a bottom up approach of complex interactions at the local level.

- **An ongoing transformation in the policy making process is taking place in the UK** - case study 1.
- **Business-oriented university and public private partnership in R&D are one of the main growth drivers in Finland** – case study 2.
- Science-based dynamic interfaces and **entrepreneurship lead the Catalonian catching-up process** –case study 3.
- Finally, City **Council and urban planning are new areas where the third generation innovation policy was implemented both in Finland and Spain.**

This section on case studies sums up the key features of these promising trends, demonstrating that the same interactive model is at work both in highly sophisticated countries such as Finland and in quickly expanding research areas such as Catalonia. It is worth mentioning that some aspects of traditional linear policy for technology transfer (what we have labelled first generation innovation policy) can still be found in these European case studies. The cases demonstrate mainly a successful approach in giving equal access to innovation to SMEs rather than in contributing to the innovative edge of the economy.

The three case studies – included in their 'stand-alone' format in the annex- do not seek to clearly set out the precise details of the changing situation but rather to extract valuable and clear lessons for better practice in innovation policy making in Europe.

4.1 Public Governance in the UK Small Business R&D Tax Credit

The UK case study was focused on the theme of collaboration between government departments. The policy instruments that were introduced were also associated with consultation documents that were widely circulated and discussed.

Reforms should not and cannot be totally planned in advance so that design changes can be embedded in policy instruments; **innovative policies are the result of negotiation between conflicting requirements.** Simple objectives (e.g. to increase the levels of R&D undertaken by small firms) can be stifled by implementation difficulties. Even the definitions of R&D and small firms can be obstacles. A persistent challenge concerns how to create sufficient awareness of the scheme being introduced.

If a discussion about collaboration between government departments is to be fruitful

then questions need to be asked that explore how such collaboration can best be stimulated and nurtured. Individual personalities (or champions of change) may be important. Early 'involvement' or shared ownership in a problem may be more useful than 'meetings', especially if the latter are likely to be 'confrontational'. Free dialogue and open attitudes need to be fostered.

This case study report is primarily based on discussions with the Ministry of Trade and Industry - DTI – and Ministry of Finance - HM Treasury - on the case of a small business R&D tax credit in the United Kingdom. While the focus was on co-ordination in UK policy and not on innovation policy per se, some complementary insights were also given to further illustrate specific aspects. The Roberts' Review was mentioned as a good example of consultation with stakeholders at an early stage.

This description is also an attempt to describe the whole process of innovation policy making into tasks and sub-tasks, providing a better grip for policy makers who are seeking to shape any new policy:

Task 1 – Coupling perspectives
Sub-task 1.1 - Improving co-ordination of agendas Sub-task 1.2 - Establishing a small core group of 3 to 4 people. Sub-task 1.3 - Publishing a consultation document to share knowledge on customer needs
Task 2 – Meeting stakeholders expectations
Sub-task 2.1 - Searching for consensus : A move towards "Evidence based policy" Sub-task 2.2 – Targeted practical conclusion : Finance Bill Act Sub-task 2.3 – Focused implementation efficiency
Task 3 – Focus on innovation performance to create a feedback loop

The SME R&D tax credit focuses on technologically sophisticated SMEs and not only on high tech SMEs. Such a scheme had been requested for many years by the CBI (Confederation of British Industry). An unsuccessful first attempt to set up an R&D tax credit was made in 1995. This new scheme was eventually adopted in April 2000 and is new to the UK. However, similar schemes have been available for 25 years in the US and 15 years in France.

The consensus within all interested parties acknowledged that tax incentives let the government step back from the day-to-day activities of firms and that increased productivity can be driven by innovation. The consensus also spread out on R&D being very important because of wider spill over effects.

In the UK R&D intensity is approximately half that of Japan and the USA. The idea for a UK R&D tax credit in SMEs as a spur to greater R&D came from the DTI but was taken up and led by the UK Treasury and supported by the Inland Revenue.

Beyond policy makers consensus, knowledge and information on the tax credit implementation scheme is key to its take up by SMEs and therefore its potential impact. The key measure of success for the tax credit will be the extent to which it is taken up as shown by tax receipts. An example of the type of difficulty to be overcome is that SMEs use small local accountants – do those accountants know about the tax credit? Developing clear guidance on what can be claimed as R&D spending for tax purposes was based on very wide consultation. This definition of R&D will be tested in the UK Courts on a case by case basis to see in detail what may or may not be claimed, but this clear definition is important in enabling SMEs claim the credit and tax inspectors deal with the claims efficiently.

4.1.1 Task 1 - Coupling perspectives

In this case study the changes are all incremental improvements to existing innovation policies, which have traditionally been primarily the concern for the Ministry of Trade and Industry. Co-operation between departments at an early stage in policy development leads to a smoother introduction and a more effective and successful scheme. Committees are less likely to achieve the level of understanding and openness that a taskforce team can establish.

At government level, the role of the DTI is to interact with industry on innovation policy and innovation practices affecting innovation. As regards the Tax Credit established in April 2000 the DTI began to look at policies affecting innovation from the point of view of firms in 1997. This is a cultural shift for the DTI. It is looking at issues affecting companies, which traditionally, in terms of governmental responsibility, would have been covered by other departments. In this respect, the DTI now works closely with the Treasury but has also strong links with the Inland Revenue and DFES (Department for Education and Skills)

From the Treasury point of view, this scheme interacts with both lines of action which merge in the same law. It is responsible for 'tax policy', for ensuring that taxation remains broadly uniform and that its burden is spread equitably. And it is responsible for the 'tax system', for determining how tax instruments can be used to promote the wider aims of government policy. The new SME R&D Tax credit also demonstrates HM Treasury interest in focussing on R&D within the UK, to capture for the UK the many spill over effects from research activities. Productivity at Treasury refers to more than the economic concept of total factor productivity. It is very similar to competitiveness and innovation in DTI microeconomic policy.

- Sub-task 1a - Improving the co-ordination of agendas

In a close working relationship, each partner keeps its own agenda. As a first appraisal to improve the co-ordination of agendas, each has to learn about the concerns of the other partner and how they are expressed. HM Treasury is increasingly looking at microeconomic policy and innovation. Traditional levers such as the annual spending review (now a tri-annual event) and setting of interest rates (the responsibility of the Bank of England) have been reformed and are no longer such a powerful instrument as they used to be. Thus a convergence with the DTI as regards the use of microeconomic tools is an unexpected effect of the change in the macroeconomic policy context.

While the DTI and HM Treasury are willing to work together in the same policy areas, the Treasury is oriented towards large firms and organisations, whilst the DTI can offer a better small business services. This is marked by an increase in direct lobbying of HM Treasury by large businesses and organisations, whereas in the past they would have sought to influence government primarily through the DTI. Therefore, a key issue is to identify the biggest divides between Departments, e.g., the Treasury wanted a simple tax system when DTI wanted the best incentives to perform R&D, and Inland Revenue wanted to raise revenue. By identifying the agendas of each Department and accepting the key differences, the departments were able to create a shared vision of the co-realities of the tax system.

- Sub-task 1b - Establishing a small core group of 3 to 4 people.

No specific requirements are made to assess how learning loops between departments are functioning. Ad hoc working groups are quickly put in place to avoid the risk of wasting time in useless meetings. To deliver what is needed, the starting point is to set up a very small core group of 3-4 people, which will structure information before disseminating in a draft format to a wider circle. The challenge for the core-team is then to proactively develop a networking activity (with the most appropriate actors).

At the first stage, when structuring the core group, inward looking (within the interested departments) is necessary to accommodate divergent views and agendas. At this stage, the goal is not to generate knowledge but to understand the parameters in which the project must be constructed if it is to retain the support of the key ministries / departments. When an issue identified as being important, a discussion takes place on what resources will be needed to get the expected / desired outcome. Resources are allocated on this basis. The Consultation document has to be written very quickly. **The need is to stimulate demand from customers** and not to provide a comprehensive view, which would also not be possible. To make sure that all parties are working as one you have to try to satisfy everybody. The DTI, HM Treasury and similar organisations are not monolithic. People involved in teamwork between ministries / departments sometime have more in common with other members of the team than with other colleagues from the same organisation.

The exchange of staff is a good way of anticipating further co-ordination and bridging cultural barriers between departments but you have to make sure you send better people every year. This process is also a valuable way of bringing in expertise from outside government, and sending civil servants into industry / business. Nevertheless, beware of Governments not being so good at evaluating teamwork. Amongst civil servants and officials a fear is often encountered of being badly assessed in case the process fails. This is the reason for success stories being only for dissemination.

- Sub-task 1c – Publishing a consultation document to share knowledge on customer needs

Perceived problems can differ from actual problems: the starting point is to introduce an opportunity for joint-involvement because the first instinct will be to say "no", we do not need to work together. There is a need to circulate consultation documents to a network of partners before the document is finalised and the key decisions are taken. For consultation to be of value it must contain options and be really open to new ideas and comments. A strong joint involvement from the major stakeholders is necessary at this early stage in order to underpin strong support at the implementation stage. What each party can and will bring to the joint-work must be clearly stated. Then, joint-assessment in teams of the information arising from the consultation can be very productive.

The role of the core group is in finding facts to produce a consultation documents. Academics can play a strong role in reviewing existing materials. In the case of the SME R&D tax credit, IFS – The Institute for Fiscal Studies – played a prominent role by collecting the existing evidence in favour of an R&D tax credit and showed in a series of studies how good the cost-benefit ratio could be. HM Treasury was open minded (due to political pressure from the Chancellor) but it was very sceptical about public intervention (historically and intellectually). Before a new decision could be taken, HM Treasury also wanted to research a wider range of different views on R&D because it was not familiar with R&D issues.

Furthermore, a consultation process raises expectations outside government that departments are going to 'do something'. They are therefore a good way of getting reform started and create pressure for it to be seen through to fruition.

4.1.2 Task 2 – Meeting stakeholders expectations

Sir Gareth Robert's review[iv] of the supply of scientists and engineers for the UK economy aimed to examine the supply of scientists and engineers. The aim is to see if this supply is sufficient for the government's policies of encouraging R&D with a tax credit for SMEs, improving links between university and business and investing in the UK science base to be successful. Using extensive consultation, the review set out to better understand how well does business communicate its requirements regarding scientists and engineers to higher education institutions? And how well do higher education institutions communicate their offer to business? The consultation is less about identifying 'the problem', but

about better understanding the system through which scientists and engineers are educated and whether there are any barriers in the system that prevent government, business and higher education from achieving their wider goals. This work has been done in the premises of HM Treasury because the Chancellor of Exchequer first raised the issue. A team from HM Treasury, the DTI and the DFES (Department for Education and Skills) worked on it as a single unit (a core team of 5 people supporting the independent Sir Gareth Roberts).

- Sub-task 2a - Searching for consensus: A move towards "Evidence based policy"

There is a strong need to design new policies in a process that is open and inclusive to other stakeholders. A model issued for consultation can be modified by government regulators involving 8 or 9 departments in order to obtain a more comprehensive model of innovation.

It was suggested by the DTI and HM Treasury that a facilitator between the different parties should not be used. It is better to get the different parties to engage with each other directly in the debate, not mediate by a consultant or other specialist. To go beyond state of the art on policy matters, Peer-pressure on European countries to co-operate can come through sharing information in different trans-national constituencies.

- Sub-task 2b – Targeted practical conclusion: Finance Bill Act

A purposeful discussion is required to move from conceptual design of policy to cope with real world tough expectations. This must be driven by the establishment of the project's / initiative's clear goals to be achieved through the implementation practical mechanisms. In the case of the R&D Tax Credit the goal of the discussion was to prepare a new regulation to be passed in a Finance Bill Act. Following through implementation and using the data issued to inform policy makers would be conducive to more innovation and policy development by the feedback it could give.

- Sub-task 2c – Focused implementation efficiency.

The new regulation for SMEs R&D tax credit has been designed using the previous experience of a 100% capital depreciation measure. 2 key questions had to be dealt with: How to make the new scheme known by small accountancy firms which have the capacity to spread and disseminate to the expected 10 000 SMEs? In response a marketing strategy is planned for a quick awareness of the benefits the tax credit gives to SMEs. And how will it be interpreted at local level by tax inspectors? Extensive rules and guidance have been published to describe what is eligible and what is not. It gives a wider interpretation of R&D than usual. The Inland Revenue has trained tax inspectors to ensure the proper assessment of the new tax credit.

4.1.3 Task 3 – Focus on innovation performance to create a feed back loop

A feedback loop using new knowledge and information generated on innovation performance and the ongoing process has to be created. Other causes can suffer from the new measure and other reforms can be needed to make the new law successful. An example has been given. How to assess information on insolvency: 2 months of very intensive meetings where each participant explains his rationale made it clear. **This achievement was reached only because sharing the goals made possible to start sharing relevant information.** Some sort of interdisciplinarity can help achieve a new policy. It must combine legal views, economic effects and engineering requirements. An example has been given. What is R&D? The answer given, in that particular case was, R&D is a set of rules, which defines eligible costs for tax inspection. Furthermore, in SMEs there is a blurry line between product development and research that needs to be assessed before setting up guidelines to establish how to quote innovation related research and distinguish from accounting creativity.

4.1.4 Wider Issues

- EC Role in focus:

The Lisbon agenda reveals being a real driver for innovation policy in Europe. It is based on an implicit understanding of what innovation systems are. It calls for a more explicit and more formal definition of innovation, innovation system and innovation policy. Interactions always occur in a given context that differs from country to country, from innovation to innovation. More and better stakeholder consultation is needed at the EU level. The EU is in an appropriate position to help describe the policy context i.e. how people work in practice. Early stage opening to limited number of trustees is a way to increase productivity in decision making process.

The key for the European Commission in co-operating with national administrations is **consultation. This consultation should not begin with a fully-fledged directive** – it should begin at the development stage. Otherwise, national administrations have to fight to change the directive in Council – a process that creates distrust and misunderstandings between the different actors.

- Towards a new definition of co-ordination of policies

The difficulty of overcoming the status quo is often more of an obstacle to change than the proposed instrument. The importance of blue sky thinking to revise the fundamentals was **emphasised often** during the case study. Different Member States have different requirements depending on the policy area. Whilst it is necessary to identify generic similarities across the EU, Innovation policy should recognise differences and diverse priorities and be more customisable according to the context, rather than uniform for the whole EU. It becomes much more difficult to act on **innovation because it is demand driven when public policies used to be supply driven and top down.**

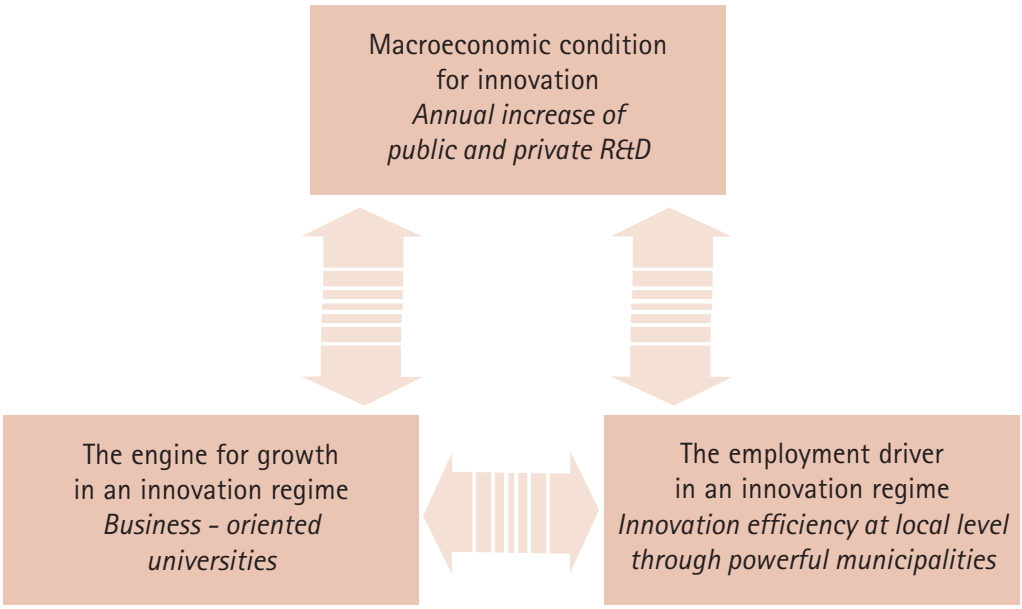
(Top down refers to a centralised approach to policy making in which policy rationale is designed by policy officials and experts, and then delivered and implemented at the level of users and beneficiaries.) Tighter regulatory environment and safety standards can go alongside looser regulation in other areas. Co-ordination therefore becomes very subject dependent.

Co-ordination is about selling a business model at European level when launching a new measure. Major external events can be necessary to force collaboration when institutional barriers prevent it. "Yes minister" officials change their mind only when political change or major events occur. Adequate competition, i.e. not preventing co-operation, with the right level of liberalisation drives innovation. The demand side stimulates innovation and is supported by economic and institution reform. So far, due to insufficient co-operation between governments in innovation policymaking, the actual supply of reforms and new regulations do not meet the demand for regulation and institution reform.

4.2 Macroeconomic Conditions, Growth and Employment in the Innovation System in Finland

This case study discussion report is based on a series of meetings and interviews with representatives of the Science and Technology Policy Council of Finland, the Academy of Finland, the Tekes Research Centre, the Nokia group, the University of Oulu, Culminatum Oy, the Ministry of Trade and Industry and the Confederation of Finnish industry.

How to take advantage of the Finnish experience?
Several books have been written to describe the popular Finnish system of innovation and its evolution. The purpose of this case study is neither to add a new contribution nor to discuss the validity of the Finnish model. The aim is to take advantage of the Finnish experience to propose a set of pointers, which deserve attention in order to "make innovation a part of the structural agenda". In a way, successful achievements in Finland appear to be somewhat unexpected to the Finns themselves and the outcome may have come out of a set of local circumstances and talented people. However, lessons learnt should be used by every national government in Europe. They could form the basis for a shared vision and collective learning at European level.



4.2.1 Macro economic condition for innovation : expanding R&D

■ Long term development of research and continuity of public sector commitment

"Invest in research" and always "focus on research facts" are two key messages derived from the Finnish case study. The structural debate has always been focussed on stronger and faster increase in public and private investment in R&D. As a matter of fact, since the '50s, investment in research has increased continuously year after year. A shared vision of the necessity to change in order to survive the economic depression of the late 80s has been seen as a key factor to remove barriers and to make people feel that things had to be changed radically. The rationale is the need to continuously improve the quality, relevance and impact of research. It is recognised as a strategic resource and asset by ministries. A law was passed in 2000 to make compulsory increasing the deflated volume for university research funding.

Budget constraint has to be overcome. Easier to say when the virtuous circle is at work, i.e. successful research calls for further research, the issue for the budget law is to keep up with private R&D funding. A ratio of 70% funding by the private sector versus 30% for the public sector must be maintained. This investment in public R&D is necessary to maintain the right level of collaborative R&D between multinational firms and national R&D infrastructure. Public research funding is used to strengthen the links within the knowledge base, collaborations are strongly supported. Only a few cases of very academic or promising research are funded as such. Quality of collaboration and interactions can be measured by assessing the risk-sharing process. On the other hand, subcontracting may not be preparing promising interaction but to compensate an unbalanced partnership.

■ A range of adequate institutions is required to shape the knowledge competition

The ability to take controversial decisions through a shared strategic vision is a key factor for competitiveness in the Finnish example. A constant policy in the long term, the courage to maintain the level of research investment in the crisis period in the early 90s when everything else was cut, the decision made in 1996 to increase public research funding by 25% over 3 years. These are many facets of a multi-partner consensus for R&D support. This hands-off top-down approach (an approach which is government lead in a soft non-interventionist manner) created an environment conducive to innovation letting businesses decide how to create economic welfare by selecting the more appropriate research.

Nowadays, the national innovation system is mainly driven by a cluster of 7 institutions: Science and Technology Policy Council – STPC, Ministry of Trade and Industry, Ministry of Education, Parliament, Academy of Finland (funds for university and academic research), Technology research centre (Tekes), Sitra. In all bodies, stakeholders and industry have members in their Board.

■ Informal networking of policy makers is an essential part of the innovation policy. Broadening the scope of innovation policy can only be achieved by building up new informal networks

The science and technology policy council of Finland is a strategy building body. It develops a consensus approach to prevent different ministries counteracting each other. Innovation policy integration is prepared by a limited number of persons. Each person participates in several bodies. Informal but dense networking and intense exchange of information is achieved through these cross participation. "Natural co-ordination is achieved when as many people as possible know what you do and what you need. All stakeholders must be involved from the beginning to be able to reach a consensus by smooth settlement of dispute". In the current situation, Academy of Finland supporting university research, Tekes supporting generic technology, Sitra exploring new areas and new incentives, complement each other. This modern way of working by personal contacts and frequent interactions is time consuming. Broadening the co-ordination takes time because you need to build up informal networks before an open exchange of information based on short messages and clear target setting can take place. As an example, STPC meets 2 to 4 times a year. One out of four is a longer seminar for in-depth discussion; 2 sub-committees meet once a month during the academic period. Altogether 20 meetings a year are taking place to co-ordinate policies and settle disputes.

■ Law and regulation must set reasonable standards and have incentives to enhance innovation.

The goals of any new legislation must be long-term oriented. Strategic targets must be clearly set. Limitation of law-originated rules and conditions should be part of the regulation itself. Another principle for policy setting could also be that governments should not interfere when they cannot clearly understand what is at stake.

Whatsoever they should not implement a too detailed approach because no doubt they cannot anticipate all possible situations.

Unions are seen as strong but also tuned to the needs of society. However, the will to keep the spectrum of wages very narrow brings about less flexibility for competitiveness. The trade-off is that it helps overcome a recession or downturn: Unions want a policy tuned for bad times; industry wants to reinforce economic growth and wealth creation whenever feasible.

4.2.2 Business oriented universities, the engine for growth in the innovation regime

How does research affect growth in Finland? After the deep crisis Finland faced in the late 80s, the R&D-based recovery is uneven. 5 universities can be identified as national growth centres: Helsinki, Turkku, Tampere, Oulu, Jyväskyla. The Oulu University paved the way. It was Finland's first regional university established to serve Northern Finland about forty years ago. Jyväskyla has been the fastest growing over the recent years after a declining period. Together with 5 other universities, they form the bulk of Finland economic success.

Innovation policy debate goes back to the 1980s when the country recognised that it needed to be more competitive in the global market. Nokia's conversion from tyres and TV sets for the USSR to an ITC company competing for world-wide market has been key to the renewal of Finland. Strong investment in US was accompanied by strong revival of the Finnish public research system in order to remain an attractive site for a worldwide company. The Oulu style of business oriented university has been key to the success. Oulu recruits about 70% of its students from Northern Finland and about two third of its graduates stay in the Northern region.

Before the Oulu success, the academic world thought it was not proper to work with industry. The mindset changed gradually and nowadays co-operation between university and industry is good. University and business agree on education and innovation going hand in hand. Research facts are always part of the innovation process and economic performance: innovation is turning ideas into profits.

■ Make innovation a vertical policy, driven by enterprise success and entrepreneurship.

Government programs, based on a shared strategic vision supplied by the STPC, have been key drivers to innovation and innovation policy in Finland. This can take place by not dictating or planning the desired outcome but by creating an environment conducive to innovation. As an example, in 1996, it was decided by the ministry of Trade and industry to reinforce the Finnish research capacity. Based on privatisation funds, public investment has been designed to reinforce firm driven success: the growth of Nokia was turned into on-going growth for Finland.

Sitra funds were increased as a consequence of Nokia growth and subsequent spin-offs from Oulu University. At the same time, public funding was greatly increased (3 billion Finnish marks) in both other channels. This synchronisation of sudden increased effort created a new environment conducive to research and PhD training. Everything became easier and more flexible. A lot of new thinking found its way. Adaptation to globalisation took the form of enterprise-driven restructuring of the innovation system in terms of openness and competitive partnerships building. Search of attractiveness for all partners involved has been and still is the key driver, instead of the traditional distinction between public and private research.

■ Shift to post-medieval university by stopping the cloning of professors

A new approach to knowledge and learning is needed. The shift from the medieval "cloning" approach where professors teach and students are taught towards a new paradigm based on multi-clonal approach where learning from several clones is more important than being taught how to clone new adepts, opens the way to structural reform. First, to gain success from multi-cloning approach you need multidisciplinary programs: have technology, science, education and business administration under the same roof is the recipe of Oulu university. Second, create focus teams to support research programs where you are strong. Build up connections between research programs. In the Oulu University example: IT, Biotechnology, Environment technology, Northern issues, four faculties are in the same campus. You must become the experts on the changing conditions, which are dependent on your context and background. The knowledge base specialised in the inter-linkages and interactions, which shape your own experience. It then shapes the ground on which to deliver worldwide competitive advantage. Third, the University has to be internationally recognised in order to bring economic development. They can also create virtual university to seek partners sharing the same research concerns. Fourth, they must give more resources to fewer people/projects to significantly expand their knowledge base and idea marketplace. It is also worth mentioning that only researchers can become applicants for Science and technology policy council grants. And fifth, finally, professors compete for PhD students and doctorate training.

For its own sake, Industry has to know what it needs so that the university can help by launching adequate research programs, training skilled people, providing industry with world class researchers and engineers, strengthening technology and innovation in the SME supply chain.

The University has to remain competitive when mobility can be both an asset - by providing a strong new network of partners - and a weakness - when successful departments loose their main researchers as they are being hired by business. Industry can help by supplying resources for equipment and professors recruitment. 87 out of 235 professors at Oulu University are totally or partly funded through the support of industry (only 2, 8 years ago).

■ Focus more on research quality by introducing the adequate level of competition for funding

Self-adapting mechanisms, rather than solutions, need to be prepared for the unknown future. However, quality is still often assessed based on previous successes. There is no reason to believe that newcomers with an unseen strategy must be assessed by looking back at previous success. There is a need to find a methodology to discover promising facts in research plans: to discover the new instruments needed in order to have the kind of effort expected to be successful.

4.2.3 Powerful municipalities: The employment driver through innovation efficiency at the local level

■ Promotion of social, economic and cultural development

How does research affect employment? Impact of R&D on employment has been evaluated positively by all parties involved in the public debate, including the employees' organisation. It is a precondition for maintaining and developing the welfare society in the years to come. Business enterprises need supportive measures from the public sector in certain areas. Cluster-based activities constitute a new form of support for social and economic development: Ministries, research and financing organisation, and business enterprises together have created research entities in support of technological and industrial development

Education guarantees employment and salaries. 17% of young Finns, i.e. 10, 000 a year, do not end up with a higher secondary degree. Public and private partnership must bring them to that level through adult education, lifelong learning and vocational training.

■ Expand and develop knowledge cities on the basis of university and public-private partnership

Municipality and privately owned polytechnic institutes have been created by upgrading existing vocational establishments. They offer limited R&D opportunities and are geared towards delivering teaching programmes. Centres of expertise and regional economic development agencies are local level task forces for setting up innovative partnerships between universities, cities, science parks, chambers of commerce. It can be seen as a task force to implement the networking capacity. Their role is to raise money for science parks and surroundings. From a planning perspective, there is also a need for working on improving local infrastructure by promoting better communication (road/rail) links to better connect science parks and local industry to develop some sort of test bed for innovation. This is a new kind of Urban Policy programme and a fight against social deprivation.

Social competitiveness i.e. the role of social structure, social distances between people, plays an important role in the transmission of tacit knowledge which sets out the foundation of every innovation (it must be made easy to get in contact with anybody for good reasons).

Because this local embeddedness is seen as a key factor to better distribute wealth creation, it is a case to focus more on micro-geography of innovation. In the knowledge driven economy, urban policy could be one of the more powerful drivers to prevent social segregation and poverty. Hence, local strategy could become the key thinking to shift from traditional welfare social policy to an approach based on the distribution power of innovation policy. Action-based research projects in the city context have to be developed.

4.3 Entrepreneurship and the Culture of innovation, Relationship between Industry and Science, and R&D and Innovation Activities in the Catalan Region

This case study report is based on a series of meetings and interviews with representatives of the government of Catalonia – Directorate general for industry, Center for innovation and entrepreneurship, Commission on research innovation and technology, Parliament of Catalonia, Strategic Plan of Barcelona, Universities – Polytechnics of Catalonia, Barcelona Science Park, Catalonian institute of technology and SMEs.

How to take advantage of the Catalonian experience?
Catalonia offers a remarkable situation to watch considering its unusual background:

1. From the 19th century, Catalonia has developed manufacturing valuable knowledge. Catalonian experts are in industry.
2. Spain used to be a closed and collusive economy until the mid 70s
3. What several Catalonian officials named a "democratic chock" led to a quickly upgrading economy to become an open one at the edge of this century. People suddenly understood that business had to radically change.
4. Catalonia belongs to the Spanish model of "Autonomy", a subsidiarity principle bordering state government power to what is written in an explicit manner in the constitution law. Everything else is for the national government of Catalonia and similar bodies from other Spanish regions to deal with.
5. Spain and Catalonia are fast growing areas in Europe in the field of technology and research.
6. Hence, the Catalonia system of innovation shows specific features that have demonstrated strong efficiency in a catching up economy in Europe.

That case study has in focus local conditions and policy. Nevertheless, it must be acknowledged that the central government strongly reformed its own framework towards innovation in recent years:

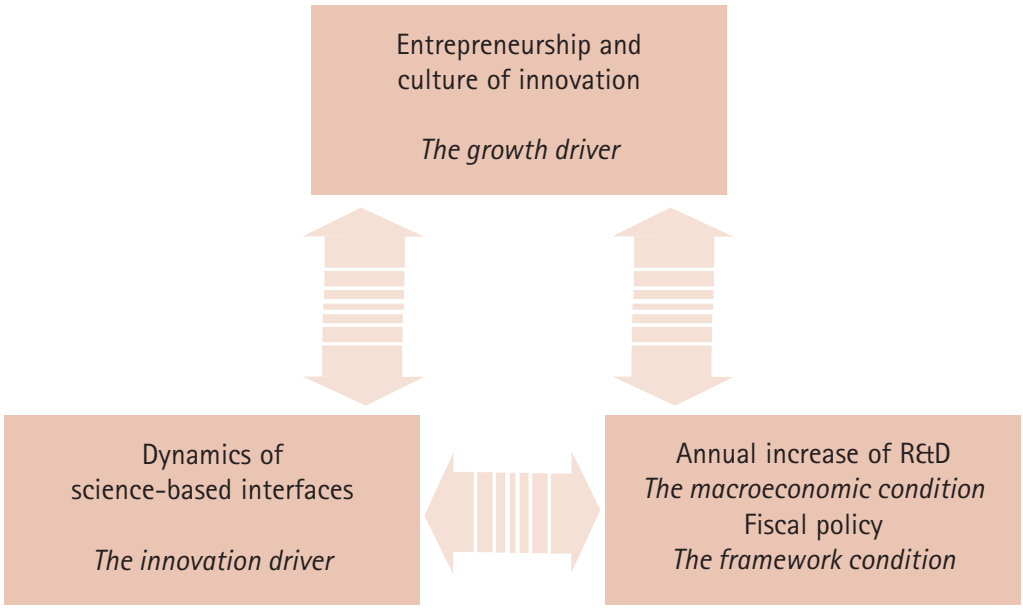
- Tax credit for technological innovation was introduced on January the 1st of 2000. Beyond the existing law on tax credit for research and development, tax rebate is permitted for technological innovations which have an outcome in terms of new products or processes, or which significantly improve existing ones. Rate is 15% of the eligible costs.
- This tax reduction is part of a wider National plan for scientific research, development and technological innovation (2000-2003)
- Ramón y Cajal program (Name of a famous Spanish Nobel prize winner) was introduced by the Ministry of science and technology to hire post doctoral researchers, who had spent at least 1 1/2 years abroad, on five years contracts to be full time researchers, 80% funded by the ministry to widen human resources of universities. So far, 200 out of 800 post-doctoral individuals who have benefited from the scheme, have gone to Catalonia.

The aim of this case study is to take advantage of the experience of Catalonia and Spain to focus on a limited number of basic conditions for innovation that need to be met to enter structural reform to promote innovation. In the case of Catalonia, the role of public policy is to systematically support every valuable aspect of each condition for innovation to be promoted and only these.

Compared to most European countries situation, Catalonia's successful achievements are somehow unexpected, given the fact that regional achievements are mainly based on regional entrepreneurial behaviours that came out of a set of local circumstances. Catalonian entrepreneurs take advantage of framework conditions given by both the Spanish and Catalonian government.

As this case study was the third to be met under the umbrella of this study, it became accepted to mention a real convergence between regions and countries in Europe, when considering global competition and global innovation. While having a different set of circumstances and background, Finland and Catalonia demonstrate converging features with different emphasis and weight to achieve different trade-offs in terms of regulation of risk and uncertainty. It is also worth paying attention to the growing importance of cities and metropolitan area planning in the innovation process. Innovation "just happens" thanks to local conditions for clustering and networking both in physical and virtual terms. Conditions for living, working, transportation and availability of commodities must be seen as conditions for innovation.

To summarise, innovation policy in Catalonia focuses on three major conditions to create an environment conducive to innovation: entrepreneurship and fostering the culture of innovation, dynamics of science-based interfaces, budgetary and fiscal policy for R&D & Innovation:



4.3.1 Entrepreneurship and culture of innovation

■ Catalan Entrepreneurs and SMEs

Catalonia can be described as a highly entrepreneurial and family driven economy. It is not a surprise that achieving self financing remains a strong option for entrepreneurs and that the banking system is very conservative and risk adverse. However, the current changes in the economy are calling for more partnership, networking and shareholders: the challenge for Catalonia is to shift from an open economy to an innovative economy able to compete globally on worldwide markets.

It is not usually expected that Metropolitan area co-ordination networks are welcomed by industry as a relevant mean to better deliver co-ordination of activities, services and commodities such as stable electric power supply. This is a strong lesson to be learnt from the Catalonian case: a pre-requisite for innovation is to bring up physical conditions where you want innovation to "just happen", i.e. to implement facilities and commodities because at the end of the story, in the self adapting society innovation is calling, people have to live, work and meet, at least sometimes, and certainly somewhere.

Hence, to move towards the innovative economy, industry is calling for new interesting movements outside the traditional institutional way. To give an example, at the present stage of development, innovation may come out from what you see in Fairs and Exhibitions and from what you learn from suppliers. This part of the micro-economy of innovation is often underestimated. Creativity is then the process of matching parts of information collected to the ability to understand what best fits business competitive assets and tacit knowledge of the company.

New schemes for in house training and validation of knowledge acquired are needed: training is the most important tool to support innovation capacity at low skill level. The Institute of Catalonia for Technology – ICT - is one of the main providers of training and lifelong learning.

■ Commitment to foster the culture of innovation

Catalonia has a strong tradition of entrepreneurship. Therefore, the innovation policy aims at strengthening would be entrepreneurs and local conditions, making an idea a project, labelling innovative entrepreneurs, promoting and supporting existing capacities. The Catalonian model of entrepreneurial spirit is based on project attraction, project consolidation and project selection leading to enterprise creation

The 1st Innovation Plan of Catalonia (2001-2004) was adopted recently, showing that global competition policy, call it innovation policy or total factor productivity, can only be set up when the first steps of an open economy based on quality and productivity have been achieved. That is why Innovation policy is understood as a set of measures and public actions aiming at enhancing the innovation capacity of firms. Innovation policy must understand how firms innovate so as to define the appropriate supporting tools. The supporting actions must have an incidence on the environment to promote business innovation both at domestic and international level. **The Catalonia Innovation plan spans 5 lines of actions to improve the innovation capacity of enterprises: innovation management, technology market, entrepreneurial spirit, digitalisation of companies and manufacturing and logistics**

■ Support project maturation and promote deal flows: Quasi companies

From idea, i.e. non-existing innovation, to a consolidated project, the strengthening process is supported by Cidem (the Catalonian centre for innovation and technology). Before the market exists, there is no venture. A project is the developing of a technology, which could form the basis of a marketable product. Projects up to 2 Million euro and with a high element of risk can be supported. Public support ranged from 60 000 to 120 000 euro and is given by an ad hoc Committee whose 3 out of 4 members are venture capitalist or industrialists. 24 projects were supported in 2001. To give an example of the limited amount of support given and its important advantage, the Catalan government can provide funds to hire a project manager and help find him or her. It can be than no other support will be given making high the cost/benefit ratio of the public incentive. This scheme is called the "Technological trampolines network". It refers to technology jumping "springboard" actions to close the cultural gap in Catalonia between researchers, private investors and senior managers by networking them. The entrepreneurship Centres involved are not incubators but "deal flow" generators. The process is also decreasing appraisal costs for investors by giving more visibility to a list of consolidated projects.

■ Boost the trend-setters: 42 groups of university researchers are supported:

Based on existing capacities and groups and entrepreneurial behaviour of professors, government of Catalonia policy is designed to help and to promote. It labels and supports professors having contractual agreements with industry in order to promote that existing behaviour. To boost existing capacities it can fund 50% of the cost incurred by technological research centres contracting with the industry.

■ Develop commercial system of university

These 42 technological research centres are to be further developed to sell university capacities. Nowadays, most contracts come from person to person contacts. Professors are negotiating low prices, i.e. price covering only extra people involved and additional equipment, no overheads, no margin. INOVA program was launched to improve the entrepreneurial mood of researchers and university people. It offers good conditions to create a company: a new entrepreneur can remain part time professor. It is jointly run by the Catalan Institute of technology – ICT and Polytechnics University of Catalonia – UPC.

■ Support medium size companies that go very fast and form the backbone of the regional economy: The 254 Gazelles (Springboks) companies.

Innovation is not an in-house process. According to a Catalonia survey, on average, innovation is made of 25% of outsourcing for the so called "Gazelle" companies. Incentives related to outsourcing research and technology development and other functions should be promoted. The goal of the Catalonian government is to clearly understand what SMEs are trying to achieve to deliver them the best surrounding environment. The "Gazelle companies" have developed sales and exports alongside healthy profits in the 90s (and they are based in Catalonia, including affiliates of multinational companies). They have been able to achieve success in different ways at the same time for a lasting period of success. Competitiveness is the main driver of Gazelle companies. The reasons for high growth are frequently found in a change of entrepreneurial strategy in order to get closer to new markets, new products or new services. A new director general or executive officer is usually nominated before a company becomes a Gazelle, showing the importance of relevant Human resources for innovation. Outsourcing and subcontracting is one of the fundamental factors for growth: marketing, Investment funds and investors, non executive advisors can be outsourced when appropriate.

■ Develop trans-national partnership to support start-ups

Barcelona, Milan and Munich committed themselves to a Pyrenean-Alpine network of entrepreneurial liaison – **Panel**. This network addresses policy makers and focuses on mutual learning based on practices and experiments in the field of support to new firms, and the need of shared infrastructure of support and direct co-operation between start-ups and SMEs. It is supported by the Innovation and SME program of the European Commission. Many other initiatives could have been quoted showing an important trans-national networking concern.

In respect to the policy framework for innovation, the role of the European Commission is to constantly review how the basic conditions operate: updating is preparing the next generation of innovation policy. Make people aware of how others think to apply technology to business: as an example, the first road transportation company to use the GPS in Europe, applied to truck movements, was Pedrosa, a Catalonian company based in Figueras, north of the country. Which regulation, lack of skills, barriers had to be overcome to innovate and which existing trade-off let it happen? What lead the development of innovative capacity at Pedrosa? What lessons can be learned that could be used to promote self-enhancement of innovative capacities of European enterprises? How to synthesise the mix between in house capacity and the ability to access additional competencies through outsourcing? What business services can help sustain such a process?

4.3.2 Building science-based dynamic interfaces

■ Densification of knowledge flow surrounding firms

To inject innovation is to inject knowledge into business. The major needs to develop innovation in Catalonia can be summarised as a complementary mix of better infrastructures based on joint public-private funding and use, new programs to promote innovation in enterprises and agreement with multinationals to support innovation drivers.

This densification of knowledge flows is a strong rationale of the policy conducted in Catalonia and several examples of this "Gateway to knowledge" are underlying actions to promote innovation.

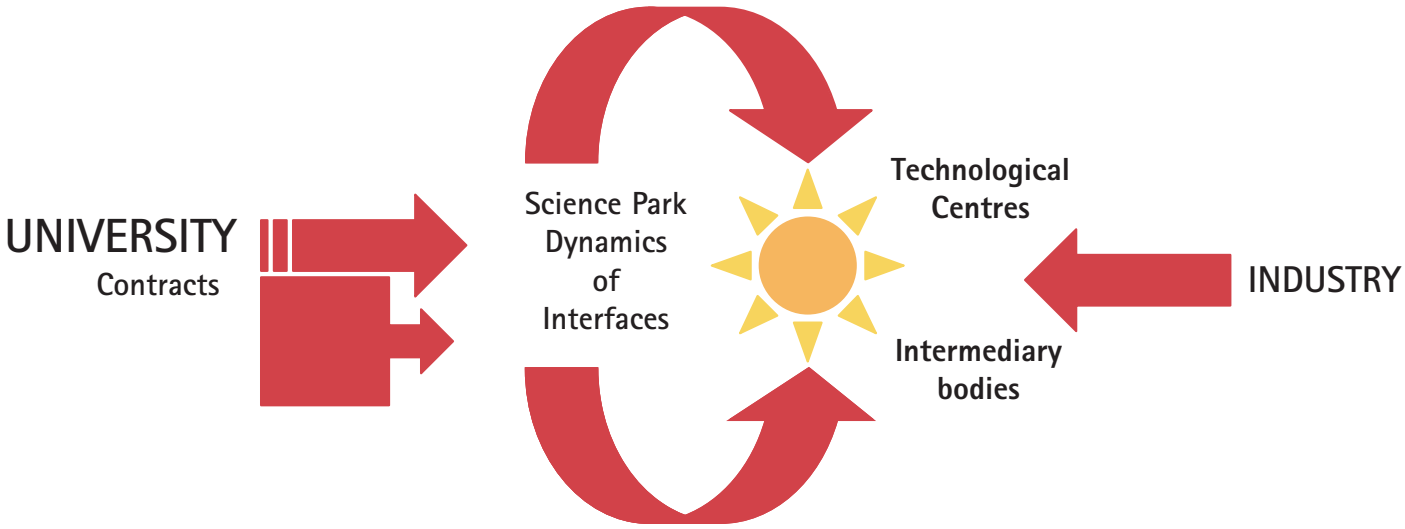
■ Barcelona science-park: Gateway to knowledge

These "Intelligent square meters" were funded by ERDF - European Regional Development Fund - from 1994. The Science Park of Barcelona was designed to be a tool making science closer to industry and developing the absorption capacity of industry.

To promote technology outsourcing, to consolidate emerging technological markets, it is necessary to guarantee the professionalism of universities. In this science-park Catalonia took the option to develop dynamic interfaces and services at university level. This approach can be benchmarked to industry intermediary called technological centres that are usually set up in other Spanish regions. The Barcelona Science Park creates favourable conditions to develop the ability to recognise the value of external resources through direct contacts and business services. This approach is a distinctive feature of Catalonia. It shows clear commitment to promote science-based innovative industry when European innovation survey (CIS) shows that Spanish industry is not highly innovative. The trade-offs between science based activities and industry driven technology demand reflects a complex issue when scaling up is the challenge.

The Barcelona Science-park is designed as a research centre of excellence. Its activities are based on four integrated pillars: public R&D & Innovation to shape a critical mass (in biomedical research); private R&D & Innovation to host business R&D and start-ups; technological platform to set up multidisciplinary thinking (social sciences, humanities, bioethics, public health,...); and innovation services (transfer of technology and know-how, business development, spin-offs, risk capital support services, consultancy services, patents centre, technological trampoline networks). Other programs such as BILAB - Business laboratory – driven by business schools analyse the relationship between university and economic development in a feed-back loop to better understand how science and business interact. The industry participation made the science-park a reasonable success when students were somehow reluctant to that shift. Nowadays, they consider it a good tool to support their research work.

THE CATALONIAN FERTILISER



■ The next step: Barcelona Science and Technology Park.

University of Barcelona Science-Park and Polytechnics University of Catalonia Technology Park are settled back to back. A joint effort to launch a new area of research, engineering, technology and innovation in nano-sciences and nanotechnology is to be considered.

■ Barcelona: a knowledge city for the South of Europe.

At the end of the nineties, the institutions in Barcelona brought together by the Strategic planning association put forward a new strategy for the metropolitan area of Barcelona.

It focused on innovation, entrepreneurship and learning describing it as some of the driving forces for the new concept of the City of knowledge. Barcelona Economic and Social Strategic Plan (1999-2005) set up a map of knowledge in Barcelona. This strategic urban plan covers the Metropolitan area of Barcelona and not only Barcelona city. It targets becoming "a land of constant innovation". (territori d'innovació constant). It aims at shaping the future of the greater Barcelona and to build a consensus or shape a common vision from scattered initiatives. Similarly, "22@" is a new concept for a new urban zone. Over 7 million square metres are planned for new economic activities. Its rationale: in large cities it is difficult to create a climate conducive to innovation for activities related to knowledge. Clustering local competencies in one location to create favourable condition to new development and world level specialisation can only be achieved through a higher level of integration. Multi-level co-ordination (central and national government, municipalities and metropolitan area) can be sometimes difficult but should be considered as being mandatory. From the business and innovation point of view, Metropolitan areas should play a greater role in the next innovation policy framework.

4.3.3 Macroeconomic condition: annual increase of R&D

■ 12% annual increase of R&D investment

The rationale is the need to continuously improve the quality, relevance and impact of research. It is recognised as strategic resources and assets by ministries. Investment in public R&D is necessary. R&D to GDP used to be 0.6% in 1995, it is currently at the level of 1.1% and Catalonia government aims at raising it at 1.4% in 2004. A 12% a year growth is needed to be on target on time.

The Catalan government decided to have one plan for research and one for innovation. The decision was made not to merge both to have more multipliers to reach that ambitious goal. Anyhow, one of the major reasons for the research plan is the interaction between research, development and innovation. As a general rule, public funding is used to strengthen the links with the knowledge base and collaborations are strongly encouraged. Another example of this is the Catalan government also co-funds the Ramón y Cajal program of the Ministry of Science and technology in Madrid. The 3rd Research Plan - 2001-2004 – is focussing on 5 areas: stimulate the growth and quality of the Catalan science and technology system; boosting human resources dedicated to R&D; promoting the internationalisation of research carried out in Catalonia; stimulating a more active participation of business, multinational companies and SMEs, in research, development and innovation (Co-sponsored and co-management together with the Innovation plan); promoting better management and greater communication of R&D activities.

■ Increase the Human Resources for R&D

ICREA (Institute of Catalonia for Research and Advanced technologies) is fully funded by the government of Catalonia to contract with Spanish or foreign researchers willing to join or to come back to Catalonia for their research. They will receive a roughly 10% higher wages than in the public sector, permanent private contract to work full time on

research. They are paid by ICREA and used by universities providing that University offers the best working condition and equipment.

4.4 Conclusions

What lessons can we draw from these three case studies?

First, **we discover that policymaking is shifting from a rigid top-down approach to decentralised bottom-up practices involving stakeholders.** Hence, the role and practices of governments and administrative authorities are evolving rapidly. At the same time, innovation is not only seen as the horizontal policy it used to be, but also increasingly treated as a strong concern within, and indeed a driver to shape, any vertical or sector based policy.

Second, some specific policy areas were highlighted.

- **Tax incentives** are relevant for technological innovation (UK, Spain).
- **Internationally competitive university research is highly dependent on resources availability** (Professors and students, public investment and budgetary policy - Finland, Spain).
- **Governance based on consultation and Public-Private partnership** for projects, programs, law and regulation can build up consensus for change (UK, Finland).
- Policies to support or foster intrapreneurship and entrepreneurship are good ways of developing locally new self engineered business models to shape the innovation performance, sticking to existing implementation capacities (Finland, Spain).
- **Direct and dynamic interfaces** between actors create local conditions that stimulate mutual learning between peers (Finland, Spain).
- **Urban planning** is a relevant means to efficiently link activities together and to support wider access to innovation benefits (Finland, Spain).
- Finally, following the Catalonia experience, **an Innovation program could constantly seek to promote the trend-setters**, i.e. the people carrying out activities in an innovative and promising manner, and help them to achieve critical mass.

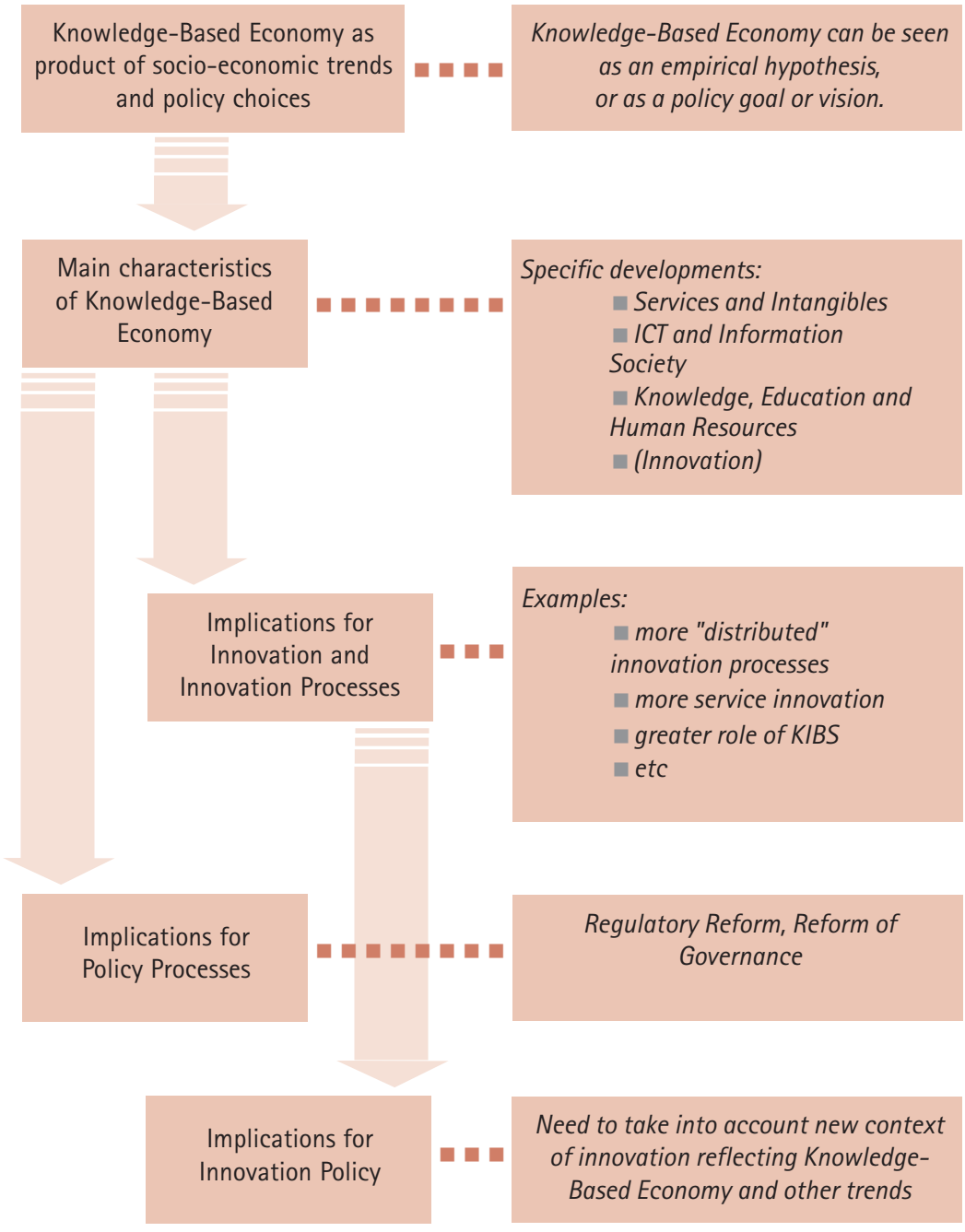
These are amongst the main areas for innovation policy, though it is always possible that further case studies would reveal other topics of similar interest.

One such theme that was only marginally evidenced in these case studies emerged in the course of our discussions and debates. This is that technology transfer and training schemes, oriented to driving the "distribution power" of innovation, could be also directed towards a new social policy. For years, based on the first generation innovation policy assumptions (the so-called linear model of innovation), it has been simply seen as a competitive policy. This is a good example where international consensus can lead to poor performance of the Economy. Benchmark and case studies are good tools when the real world is not meeting common sense and expectations.

This suggests an approach **to achieve better co-ordination and benchmarking of policies.** Here, the role of the European Commission could be **to gather detailed information on trade-offs and challenge faced** in implementing these policies in a unified European framework for innovation. **Diversity of environment conditions could explain conflicting** views between Member states. The role of the European Commission in enhancing innovation performance would be to help **stakeholders to identify and fine tune the key interactions.** Because the innovation regime is in constant evolution and adaptation, the European Commission could constantly review the basic conditions and circumstances where innovation seems to "just happen", which simply reflects that ultimate achievements have been using a different learning curve. **Studies and field work (via for example a group of senior officials)** could constantly update their understanding based on the actual impact of existing policies towards innovation. They should also focus on the rationales and the underlying paradigm-based thinking that may be actually hindering innovation.

5_Innovation and Change across Policy Areas: the Reform of Regulatory Policies and Governance Processes

5.1 Introduction



The case studies summarised in the preceding chapter illuminate many of the policy areas and issues that concern this study. But this was a limited set of case studies, and could not hope to bring to the fore all of the important themes that need to be considered.

To appraise a wider range of policy areas, and examine issues that may not have been highlighted in the local case studies, a "top down" approach was followed. Background documents on each area were prepared from literature reviews and discussed by the HLWG.
The major results of these analyses are presented in this and the following chapter. This chapter begins by considering the issues raised for policy change in general. One of the areas we were asked to consider was regulatory reform, and another was governance. These are processes that are experienced, to a greater or lesser degree, by all of the other policy areas, and lead us to consider some generic impacts of policy change.

Much of the literature on regulations focuses on policy instruments that aim to influence economic actors, especially firms. Such regulations may be aimed at improving the operation of markets, on the assumption that efficient and well-functioning markets will generate more wealth, which can then be applied to achieving private and social goals and enhancing the quality of life. Competition law, for example, aims to keep markets functioning in competitive ways, even if there is a structure dominated by a few large firms. Regulations may improve market functioning by stopping some sorts of abuse, by clarifying property rules, by providing information, and the like. Other regulations may be aimed at ensuring that factors relevant to quality of life but which would otherwise be neglected in market functioning will be taken into account. For example, there may be efforts to internalise the costs of environmental damage, or to introduce minimum wages.

However, it is hard to differentiate such market-related regulations from other policies, that are also likely to impact upon the behaviour of economic agents. Regulations in this wider sense are established with the goal of promoting behaviour that is consistent with overall policy goals. These can involve such diverse aims as economic growth, environmental sustainability, employment generation, social equity and cohesion, and so on. Some of the goals are aspects of quality of life, others are seen as means to achieving this
But regulations often face great challenges to fully achieve their aims: the instruments that are being applied need to be evaluated as to their effectiveness and efficiency. Also, regulations can often have unintended and sometimes negative consequences. Some of these consequences affect business performance; some of them affect the political legitimacy of regulatory structures. Some of these negative influences may impede innovation. They may do so by making it less easy for businesses to create new products and processes, by making it less attractive for businesses and consumers to adopt (and adapt) them. As increasing social complexity has led to a greater number of regulations, these issues are increasingly salient - leading to concerns with regulatory reform and governance. These concerns have substantial implications for innovation processes, and thus for achievement of the Lisbon objectives. But these links to innovation have rarely been addressed explicitly, and this chapter will seek to map out the territory that requires sustained attention.

The problems mentioned above often lead to an emphasis on the negative impacts of regulations. (This was especially the case in the boom years of the 1990s, when the unfettered market was seen by some commentators as the solution to all problems. In the wake of the scandals and crises of the early twenty-first century, there is rather more recognition of the need to regulate markets.) But it is simplistic to think of regulations as simply obstructing innovation. Many analysts have shown that the picture is more complex, that regulations are sometimes triggers or facilitators for innovation.

More accurately, **regulations** may:

- **Affect the resources available for innovation.** This is often a negative impact – regulations may consume resources through the costs of administration, reporting and compliance. Economic instruments, that impose charges on behaviour rather than prohibiting it outright, similarly remove funds from business. But some regulatory policies and economic instruments actually make resources available for innovation, e.g. in the form of research support or tax reductions for innovative activities.
- **Shape innovation trajectories,** by making certain directions of innovative effort look more or less promising. There are obvious examples of a "technology forcing" impact of regulations in the environment sphere, where incentives may be instituted to foster resource conservation or emissions reduction (see the discussion later). But many other examples can be cited. One is the UK's Disability Discrimination Act, which requires public organisations to adapt their services to the requirements of disabled citizens, prompted at least one major organisation to make large strides in the development of ICT systems that can interact with customers through sign language. The sophisticated technology offers commercial applications in addition to the obvious spin-offs in the form of aids to deaf and mute people in other situations.
- **Influence innovation processes, by rewarding or inhibiting particular ways of conducting innovative activities.** For example, R&D or training subsidies or tax breaks may lead to relatively more effort being put into these activities as compared to other innovation-oriented ones. Similarly – though perhaps less to do with government regulation than with self-regulation - accounting standards that take into account some elements of innovative performance but not others, or that value them in disparate ways, may encourage investors to support firms with particular innovation styles. A different class of influence may come from regulations governing collaborations – some types of innovation collaboration between firms may be deemed anticompetitive. Other influences may relate to rules about support for small firms, and about intellectual property.

5.2 Regulatory Reform

5.2.1 Background

The rationale for regulatory reform is essentially that regulations themselves are too numerous and too complicated, as are systems of monitoring compliance and assessing applicability. Regulations are also sometimes applied in an effort to achieve aims that could better be fulfilled in other ways. They are even more difficult for firms to deal with because of variations in regulations across member states. These problems create costs for business activity, consuming funds and time that might be productively invested elsewhere, impeding trade, and so on. Some activities are impeded by the costs of compliance, some are simply prohibited due to inappropriate regulations. Innovation is negatively affected, both indirectly (e.g. restricting market size) and directly (uncertainty about approvals processes, etc.).

Regulatory Reform has become something of a mantra across the industrialised world, and the OECD makes the case that regulatory reform...

> *"that enhances competition and reduces regulatory costs can boost efficiency, bring down prices, stimulate innovation, and help improve the ability of economies to adapt to change and remain competitive. Properly done, regulatory reform also can help governments promote other important policy goals, such as environmental quality, health, and safety. ..." (OECD, 1997)*

But regulatory reform is a very wide-ranging term. It can involve:

- The content of regulations (e.g. a great deal of current discussion of reform is mainly oriented to the liberalisation of markets in energy, telecommunications, etc.);

- the overall **structure** of regulations (e.g. the desire to reduce the regulatory burden by decreasing the number of regulations, and possibly by shifting to more market-based economic instruments);

- And the more general **process** of regulation (the ways in which regulations are created and administered – and where reform is often framed in terms of a more flexible regulatory approach, where responsibilities are shared through negotiated agreements between public and private partners).

- The latter point draws to our attention another way in which regulatory reform bears upon the present study. Regulatory reform can involve innovation in regulatory policy and policymaking, as is discussed later.

In recent years reform has included, and been provoked by, **the privatisation of state industries.** Privatisation has often meant the introduction **of new regulatory authorities** to ensure that monopoly powers are not exploited, and that social objectives can be met: this means a substitution of regulation for political fiat, which can make matters more transparent – but not necessarily less complicated. One reason for privatisation has been to improve the performance of the public sector, and this goal is also expressed in efforts to introduce more market mechanisms and business management practices into public sector organisations. **Innovation and hence innovation policies have rarely been the focus of attention**, though there have been hopes that innovation may be enhanced in such fields as telecommunications, in particular. But though innovation is rarely a central aspect of regulatory reform, reform strategies do have implications both for innovation, and for designing better innovation policies. Reform principles such as the simplification of procedures, collaboration between departments and agencies responsible for policy areas, the fusion and reengineering of responsibilities, and exploiting related policy areas and new approaches, are highly relevant here.

It is now widely argued that a more flexible regulatory approach is needed. This may mean simplifying regulations by replacing large numbers of regulations with fewer, more streamlined regulations. It may mean bringing regulations in different countries, or for different sectors or professions, more closely into line with each other. It may mean finding market incentives, self-regulatory mechanisms, or other means to promote the desired behaviour in place of traditional regulations. In some cases responsibilities may be shared through negotiated agreements between public and private partners.

Regulatory reform is thus also rather closely associated with governance. It is also a feature of the knowledge-based economy, as is evident in the OECD's efforts to generate a knowledge base for reform:

> *"Regulatory reform is an innovative and fast-moving field. The PUMA work programme on regulation has focused on helping governments develop new capacities and identify best practices for improving the quality of their regulatory decisions. The intent is to establish a longer-term basis for efficient and responsive regulation by changing incentives, capacities, and cultures in public sector institutions, based on market, juridical, and public management principles." (OECD, 2000)*

The regulatory reform programme within the European Commission is described as the most comprehensive programme of modernisation in its 44-year history. Within the overall strategy, there are four key themes: reinforcing standards; better use of limited resources; improving financial management; a new personnel policy. In addition to improving internal efficiency, motivations for reform include the improvement of service delivery, simplification, the reduction of confusion (e.g. about grants and incentives), and the reduction of administrative burden (e.g. in SMEs and other users).

The entire programme is scheduled to be in place by the second half of 2002, and is intended to contribute to the EU's achievement of the Lisbon objectives (as well as supporting the Commission's efficient management of the challenges associated with EU enlargement.)

5.2.2 Regulatory Effectiveness and Alternative Approaches

One argument for regulatory reform is that too much regulation impedes business activity. Another is that ineffective regulatory policies waste resources and fail to achieve policy objectives. Enhanced regulatory effectiveness may contribute to the simplification of regulations, and to limiting their proliferation. The OECD (2000) notes that:

> *"A key determinant of government effectiveness is how well regulatory systems achieve their policy objectives. Rapid increases in regulation and government formalities in most OECD countries since the 1970s have produced impressive gains in some areas of economic and social well-being, but too often the results of regulation have been disappointing. Dramatic regulatory failures tend to produce calls for more regulation, with little assessment of the underlying reasons for failure"*

Better innovation policies may be designed and installed using such principles as the simplification of procedures, collaboration between departments and agencies responsible for policy areas, the fusion and reengineering of responsibilities. (The value of combining resources and strategies in order to be more effective – or more comprehensive – is exemplified in the first case study of this project, where several government departments in the UK joined forces to consider innovation-related tax credits. Such a recognition of the multi-faceted nature of many policy targets can be compared with firms moving to business process thinking instead of functional thinking.) Other principles involve exploiting related policy areas for innovation purposes - and being prepared to adopt new approaches. The OECD (in the website for its PUMA study, *Alternatives to Traditional Regulation*)[v] suggests three such alternative approaches to enhancing regulatory effectiveness:

1. **Performance based regulation.** This involves specifying the outputs to be achieved, rather than the specific means to be used. The argument is that this provides greater flexibility for firms to meet the requirements of regulations: they can select cheaper methods and reduce their costs, for example.

2. **Enforcement innovations are vital.** Enforcement determines the effectiveness of regulation - the best-articulated policies are worthless without adequate implementation strategies. Better targeting of inspection activity is one route here; another is the contracting of inspection to third parties, with appropriate incentives.

3. **Process regulation requires instituting integrated processes.** An example described by the OECD is "Hazard Analysis Critical Control Points"(HACCP) methodology, as applied to food processing. This means less emphasis on testing the end product, and more on installing preventative systems to control critical points in food processing, where there are high contamination risks. When potential hazards are identified, systematic mechanisms are to be established for improving operations. The responsibility to determine and control for problems rests with the individual firm, which must demonstrate adequate understanding of risks and risk minimisation. Given this demonstration (not a formality!), risk can be addressed according to the specific circumstances. One firm may correctly determine that there is no reasonably likely hazard in a particular step of its production process, and no HACCP controls will then be necessary. But another firm processing a similar product might require controls for this step of production (for any of a variety of exogenous factors). The OECD (1998) suggests that such process regulation approaches can enhance effectiveness and lower costs, and should be considered where risks are difficult and/or costly to regulate via prescriptive controls.

We shall consider the relevance of these approaches to innovation shortly. But another important thrust of regulatory reform involves developing and applying alternative instruments. These instruments can be used in place of conventional regulatory mechanisms. The PUMA project website cited above outlines the following classes of such instruments:

- *Taxes and subsidies* (for appropriate behaviour).
- *Tradable property rights* (e.g. pollution control, allocation of slots at airports, allocation of broadcast spectra).
- *Voluntary or consent agreements* (these often go beyond regulated requirements. They can be a means of encouraging continuous improvement, e.g. in environmental protection, energy conservation and product safety.)
- *Self regulation* (members of an industry or profession work together to establish and enforce standards and/or provide redress for consumer problems.)
- *Insurance strategies.* (Insurance against risks that are seen as unpredictable and costly to reduce or eliminate. Policies may be required to mandate insurance, to help efficient insurance markets to develop, etc.)
- *Information strategies.* (In some cases it can be cost effective for governments to work directly to correct information asymmetries between producers and consumers in a market.)

Most of these instruments have already been used in one way or another to support innovation. We need to understand just how and when they are successful, of course. But in the light of 3rd generation innovation policy, the question also arises of what impact such instruments might have on innovation where they are primarily being used in pursuit of other regulatory goals.

As with other policy areas, regulatory reform may itself be the subject of policy innovation. The OECD, in its study *Reducing the Risk of Policy Failure: challenges for regulatory compliance* (OECD, 2000) notes two classes of innovations in the design phase of regulation:

- Problem identification and the use of non-regulatory instruments (see above);
- Government regulations that maximise voluntary compliance.

It also identifies five classes of innovations in the implementation and enforcement phase of regulation:

- Rewards and incentives for high/voluntary compliance;
- Nurturing compliance capacity in business;
- Targeting for low compliance;
- Restorative justice when voluntary compliance fails; and
- Responsive enforcement when restorative justice fails.

Open and creative processes of policy design may lead to further types of innovation being identified. Consultations with stakeholders are important. Policies do not have to be permanent but should be designed to be adapted as circumstances change, as experience of policy implementation is accumulated, and as the policy takes effect.

5.2.3 Regulatory Reform and Innovation Policy

Innovation is affected by regulations both indirectly and directly:

- indirectly - e.g. by affecting the funds available for investment, by shaping market size and structure, by demanding management attention (potentially from strategic investments);
- and more directly - by creating uncertainty about, for example, the outcomes of approvals processes, by changing the prospects for profitable returns to investment in particular lines of technology development.

Innovations, and changes in the organisation and processes of innovation may also undermine regulations and regulatory structures. For instance, the policy objectives to which regulations are oriented may be rendered obsolete by technological change; such change may additionally impact on the effectiveness of regulations for attaining objectives that themselves continue to be salient. (This is particularly apparent in connection with bioscience and genomics and their applications, at present, but similar issues arise in many ICT areas too.)

The need for a regulatory framework conducive to innovation is recognised by the European Commission. Thus, the Commission Communication "Innovation in a knowledge-based economy" (COM(2001)130[VI]) identifying areas with a strong influence on innovation. For instance:

- Rules and statutes can impede the diffusion and exploitation of research results obtained with the support of public funding. An example is rules dealing with the terms of employment of researchers in public service, that may inhibit commercialisation of the knowledge developed through their research. These should be structured so as to provide researchers and enterprises with effective means for the protection and exploitation of research results
- Unnecessary regulation which slows down the introduction of new products onto the market needs to be streamlined or removed.
- Measures to incite innovation such as direct or indirect state aids in accordance with articles 87 and 88 of the Treaty should be upgraded.
- Traditional methods for reporting and documenting companies' intangible assets probably undervalue innovative efforts, and new European accounting standards should address this.

Regulatory reform may also have an impact on innovation, in ways that are not immediately obvious. A liberalisation of markets, for example, might displace incumbent "national champions" from their role as performers of long-term and basic research, and "public good" functions such as standards-setting and metrology, as well as from their dominance as service suppliers. The directions of regulatory reform that were outlined by the OECD can be examined in terms of their implications for innovation, too. Thus:

- **Performance based regulation,** specifying the outputs to be achieved, rather than the specific means to be used, can directly impact innovation.
  Environmental regulations exemplify the way in which technological innovations may be hampered when regulations stress the means to achieve an end. Such regulations can curtail efforts to reach the end (solve the problem) by other technological means. Mandatory insistence on the use of catalytic converters forestalls other ways of reducing emissions, for example. In general, a focus on performance should enable search for innovative solutions along numerous technological trajectories. In contrast, a focus on means may lead to efforts being fixated on one single path. (Though this might have some benefits in terms of reduced uncertainty and increased economies of scale, it runs the risk of encountering diminishing returns to R&D and reducing knowledge o alternative solutions,). **Innovation in the form of technological progress in sensors and other instruments, making more things measurable and traceable, has increased the scope for performance-based regulation.** It used to be far easier to see whether equipment had been installed than to test whether it was performing adequately - this is now much less true in many areas.
  The application of such technological possibilities to performance based regulation still requires serious efforts at routine monitoring.

- **Enforcement** could be enhanced by better ways of targeting inspection activity and by contracting of inspection to third parties. This might not be thought to have great implications for innovation – after all such approaches seem to be mostly a matter of intensifying the effect of regulation more generally, and would thus simply intensify the positive or negative impacts of regulation. But there is more to it than this.

First, well-enforced regulations may need to be less draconian than poorly enforced ones. Second, more precise targeting may reduce the costs for industry associated with unnecessary inspections. Third, it is likely that compliance with weakly enforced regulations is unevenly distributed across firms and sectors - thus tighter enforcement will impact differentially. In turn, this will mean different distributions of the costs associated with, and the innovative efforts directed to compliance across firms and sectors. It might be that the effect would be to create more of a level playing field, where innovative and responsible firms are less liable to be undercut by competitors that compete more on low prices, achieved in part by laxness in meeting regulatory targets.

- **Process regulation** in some ways operates in the opposite direction to performance-based regulation, but actually mandates the implementation of solutions to problems at critical points in production processes, rather than necessarily mandating specific solutions. The implications for innovation are complex and contingent, but several general points can be made. First, a thorough analysis of the production process as is implied here may itself be a trigger for innovation, in the same way that Quality Control, Business Process Reengineering, and Computer-Integrated Manufacturing approaches have been triggers in the past. A fresh overview of the processes of a firm, and of the links between its elements and with suppliers and customers, is often an opportunity for challenging established methods of organisation (some of which may be impeding integrative innovations). Second, it is also likely that identification of areas of high risk will lead to innovative attention to focus on the associated problems. Efforts will be made to remedy the causes of problems or even to eliminate these steps in production. (This is similar to the focusing of effort on bottlenecks that innovation researchers describe in terms of "critical imbalances" or "reverse salients".) Thus, these areas are likely to become the focus of innovation in their own right.

In addition to the newer regulatory directions outlined above, the alternatives to conventional regulatory mechanisms that the OECD described can also be – and in many cases have been - used to support innovation. Furthermore, they may well have impacts on innovation even where they are being used primarily in pursuit of other regulatory goals.

Thus, *tax reforms* have been applied to giving support for R&D; and subsidies for appropriate behaviour have included insistence that R&D and other innovation activities are to be provided if a firm is to gain subsidies associated with goals such as regional investment. It is possible to build innovation requirements into the assignment of tradable property rights (e.g. the allocation of the broadcast spectrum may be partly determined by the innovativeness of the applications to which this resource is to be put).

Voluntary or consent agreements can be a means of encouraging continuous improvement (e.g. in resource use or emissions, or in product safety) - and this is believed to be an important influence on innovation.

The goal of continuous innovation provides **orientation to ongoing innovations** (where there are prospects for continual learning and discovery of new ways of doing things) **rather than one-off innovations** (to meet a specific goal or threshold). The result might well be greater emphasis on innovation trajectories that offer long-term rewards.

Self-regulation is particularly prevalent in established professions such as advertising, law and financial services, but it might also apply to some technology-related professions such as software, genomics research. The focus on ethical behaviour that is common here could affect innovation in various ways. For instance, they can help ensure that the technology choices of clients are made on the basis of impartial advice rather than reflecting undisclosed interests. They can make sure that experimentation follows ethical guidelines, which should prevent public disquiet about the processes of research. Ensuring that "whistle-blowers" are not penalised when they disclose fraudulent pharmaceutical trials or misreported environmental pollution is also a significant step. Fraud and disreputable accounting in general, as the debacles over Enron, World.com, and the like tell us, can result in wrong information about performance and business models being fed to competitors as well as shareholders and employees. The misleading signals could well play a role in irrational investment in apparently booming areas of technology and innovation, and underestimation of those areas where growth is more securely based. Self-regulation needs ethical individuals and practices to ensure that it is performed effectively: whistle-blowers can help where these are missing.

Insurance strategies main impact on innovation may relate to the insurance companies themselves needing to upgrade their own knowledge of the technologies and risks involved (as they have done in such examples as the energy industry and climate change). There would be great benefits for European innovation systems were more financial analysts to be well-informed about such matters.

Regulatory reform thus has numerous, and complex, links to innovation processes. (See also Määttä, 2001.) In this study we have been able only to examine a few of these links, and caution must be exercised in generalising from them. In particular, just as it is unwise to think of regulations as exerting purely negative influences on innovation, so it would be premature, at the very least, to assume that regulatory reform will always be to the benefit of innovation. The likelihood is that this will very often be the case, though the impacts are likely to be unevenly distributed across types of innovation, firms and sectors. But the best way to ensure this would be to institute processes that mean that the potential impacts on innovation are taken into account whenever a major effort at reform is being launched. And this will best be achieved by involving policymakers who specialise on innovation issues in the design of regulatory reform, rather than simply relying upon the expertise of those dealing with the policy area that is being reformed.

There are some encouraging signs that the need for such a practice is beginning to be recognised. **The review of Business Impact Assessment methods, (Enterprise DG, 2002) included innovation as one of the issues to be considered when examining the impacts of proposed legislation on business, for example.**

This study also set out some helpful guidelines as to how to set about organising consultations to inform the impact assessment process. Nevertheless, if the review had begun by stressing impacts on innovation, rather then treating this as one of the "indirect" areas of impacts of regulations, it is likely that these guidelines would have included some more probing questions as to the implications of regulations for innovation resources, processes and trajectories. Impact assessment methods should be developed that put impacts on innovation at the forefront of their analyses, as befits the need to tailor regulations to the knowledge-based economy. The shift to a better-integrated European system of impact assessment is very welcome. But this must include impacts on innovation as a key element, even if it is one that is hard to fit into the constraints of cost-benefit analysis.

In conclusion, the review leads us to **the following recommendations.** Regulatory reform should be seen as an opportunity for efficient policy design processes to be introduced, especially where it is appropriate for efficiency and effectiveness to work across policy interfaces. Existing approaches to Business Impact Assessment need to be further developed so as to allow all reform processes to be designed and assessed (ex ante, wherever possible) with innovation criteria to the fore. (They should also allow for the impacts of reform on innovation in non-business organisations.) Systems for regular intelligence gathering, improved understanding, and benchmarking of contributions of reform to innovation should be installed. The major regulatory factors impacting innovation across all policy areas, and the relationship between different factors within and across areas, should be identified.

5.3 Governance

5.3.1 Background

"Governance" refers to rules, processes and behaviour that affect the way in which political powers are exercised, particularly as regards openness, participation, accountability, effectiveness and coherence. The reform of governance has arisen as a political concern alongside regulatory reform, reflecting in this case strong evidence of a growing loss of confidence in policy institutions. Poorly understood and complex systems of policymaking are not trusted to deliver the policies that citizens want, or to produce them in the way that they want.

The Commission identified the reform of European governance as one of its four strategic objectives in early 2000. The implication is that, within the existing Treaties, the Union must start adapting its institutions and establishing more coherence in its policies. This should make it easier to see what it does and what it stands for, and give its policies more political legitimacy and public support, as well as more practical effectiveness.

5.3.2 The White Paper on European Governance

The White Paper on European Governance [COM (2001)428] concerns the way in which the Union uses the powers given by its citizens. It proposes "opening up the policy-making process to get more people and organisations involved in shaping and delivering EU policy. It promotes greater openness, accountability and responsibility for all those involved... The quality, relevance and effectiveness of EU policies depend on ensuring wide participation through the policy chain: from conception to implementation...". Such reform must be started now, so that people see changes well before further modification of the EU Treaties. These considerations clearly respond to widespread expressions of dissatisfaction with remote and nontransparent policy institutions – and could be seen as another manifestation of the emergence of the knowledge-based economy and society.[VII]

Introducing change cannot be accomplished by the European Commission alone. It requires effort from all the other Institutions, central government, regions, cities, and civil society in the current and future Member States. The White Paper is primarily addressed to these actors – some of whom will be responsible for initiating reforms of governance in their own countries, regions and organisations. Proposals within the White Paper indicate:

- The Union must renew the Community method by following less of a top-down approach, and by complementing its policy tools more effectively with non-legislative instruments.

- Better involvement and more openness implies provision of up-to-date, on-line information on preparation of policy through all stages of decision-making.

- There needs to be a stronger interaction with regional and local governments and civil society. Member States bear the principal responsibility for achieving this, but the Commission has a role to play.

- **This kind of development (in Governance) does not initially appear to have a direct bearing on innovation** propensity. But it could influence the culture of public and private sector organisations, and how they work together. It could stimulate the creation and growth of new kinds of knowledge based companies that offer information, advice and support in the new enhanced democratic or stakeholder processes.

- To improve the quality of its policies, the Union must first assess whether action is needed and, if it is, whether it should be at Union level. This obligation ought to clarify and simplify proposed regulations and support schemes and determine if support can be decentralised, with consequences for empowerment at national, regional, sectoral and other levels. This should strengthen 'local' infrastructures where necessary.

The importance given to industry and technology clusters in recent innovation management thinking might be considered alongside these developments.

■ The Union must find the right mix between imposing a uniform approach when and where it is needed, and allowing greater flexibility in the way that rules are implemented on the ground. This should **encourage the diversity of European culture and systems**, an important strength of Europe's knowledge-based society. In the context of innovation policy it can be speculated that policies become customisable; customisation has in recent years been a strong trend in manufacturing industry and an intrinsic feature of service delivery. Internet technologies have greatly increased the capability to customise, and even facilitate the remote delivery of bespoke services. Not only might policies be 'delivered' in a customisable manner but they could be 'downloaded' and ope rationalised via interactive software programs or intelligent software agents.[see ICT policy area discussion]

■ Wider implications related to innovative potential might include the scope for enhancing organisational and financial innovation in service areas that transcend or fall in gaps between public and private sectors. The concept of 'social entrepreneurship' is used to capture this individual and community energy that can result in significant levels of activity without fitting a traditional business model. Not only is this directly beneficial but the concept might be transferred to innovation management within the business world. "Bootlegging" is already recognised in some companies as an important creativity ingredient. The culture or ambience of creative organisations is receiving attention and in some cases community work may stimulate or unleash employee creativity and morale. Innovation communities as distinct from collaborative networks are emerging in some areas (e.g. Linux software developments and support is via a community and academic research advances via communities). Steps that help establish such institutions might be expected to reinforce rather than deter innovation.

5.3.3 Innovation and Governance

The call for greater participation and openness is one that challenges traditionally bureaucratic and technocratic approaches to policymaking in all areas. Some specific issues are raised in the context of innovations and innovation policy. One particularly challenging set of issues is associated with the need to use expert knowledge, concerned with matters that are sometimes understood poorly by the general public (especially where S&T are involved). There is frequent confusion between the sorts of advice that such experts can give, based on their experience and hypotheses, and the evidence that is provided through research results; adequate assessment of either can be quite difficult. There is evidence that public distrust of scientific advice is growing, especially where there is a chance that through research funding or other avenues, advice is not as

disinterested as it might be. Policymakers themselves have displayed uncertainty and inconsistency in their use of advice, and while this has been most controversial around such food-related issues as BSE, it is having a substantial impact on biotechnology-related innovations such as the use of genetically modified crops and the use of human genetic material.

Many areas of scientific and technological decision-making have been relatively shielded from democratic accountability. Of course it is perfectly reasonable to seek to keep research results, and the formulation of scientific hypotheses and the testing of these through research, from political (and commercial) influence. There are other issues that are intrinsically a matter for political decision. These include, for example, criteria about how research is to be ethically conducted and technologies ethically used, judgements about the fields of study that society should prioritise, decisions concerning what risks are acceptable in the application of inevitably incomplete knowledge. Ways of ensuring that scientific and technical decisions are made according to the highest professional standards, and that political decisions are open and accountable, are required. This may mean that some avenues of research are regarded as financially or ethically unjustifiable, that some sorts of innovation are regarded as dangerous or antisocial. The result may be that particular avenues of development are impeded. Two points need to be made in this context.

First, it is often suggested that the solution to these problems – if they actually are, unambiguously, problems – **is better public education. The notion is that if people are better-informed, they will see the wisdom of expert advice. However, this is by no means a certain consequence. A more scientifically aware public may become more sensitised to scientific disputes.** Uncertainties are inevitably associated with the application of increased knowledge. We become more able to effect transformations of some features of the world. But this may well bring to the fore uncertainty concerning the workings of other features of the world (especially broader biological, environmental and social features). This uncertainty especially applies to how such features might behave in the context of the introduction of the innovation. There have been many experiences of unintended consequences, many not benign and some still poorly understood. The public awareness of the uncertainty that is intrinsic here is liable to grow. Whether this leads to more, rather than less, caution about such risks depends not just on an increased level of scientific literacy.

Second, engaging with public concerns may help avert some types of innovative failure. Early recognition of the problems associated with innovations may save considerable expenses that may be incurred down the line, once serious investments have been committed to rolling out the new products. There may be time to modify them to make them more acceptable or less vulnerable to critique.

The implications for innovation-supporting reform of governance deserve more study, and there have been various practical efforts to create new fora for public consultation and dialogue about major innovations and directions of technological change – ranging from consensus conferences to Foresight programmes.

Public trust in the integrity of regulatory institutions needs to be maintained (or regained where it has been eroded). This applies especially to those regulatory institutions which represent public interests and air concerns in respect of social and environmental issues (see e.g. the discussions of competition and environmental policy above), and those which deal with such technology-related fields as privacy, genetic modification, human fertility, and nuclear waste disposal. These will often need to be designed and revitalised to ensure maintenance of trust.

5.3.4 Conclusions

Debates about the political response to innovation date back at least as far as the Luddites at the beginning of the industrial revolution. Recent debates about biotechnologies, in particular, suggest that the knowledge-based economy may be associated with equally vociferous debate – and action.

The governance of technological change – insofar as it is a matter for politics rather than markets – is likely to play an important role in shaping this evolution.

The issue of 'governance' is a relatively new one, with the White Paper only being published in late 2001. However, it is central to thinking about policy-making and is likely to have a large impact across all policy areas. As previous discussion have highlighted, in thinking about innovation policy it is essential that consideration is given to other policy areas, and conversely that thinking about innovation should be a consideration in the development of policy in these other areas. The direction given by the White Paper should lead to policy-making processes becoming more open ones. It is difficult at this stage to be precise about the direct effect that this may have on innovation and innovation policy. But to the extent that greater co-operation between policy areas will be stimulated, there should be positive effects on innovation policy.

The reform of European governance presents challenges and opportunities for the development of third generation innovation policy. Among the points that emerge from the discussion above are the following. Informed public opinion about broad classes of innovation must be nurtured. One element in achieving this will be the improvement of systems of communication about RTD and innovation programmes - their design, rationale, evaluation, etc. - with public, greater public involvement in decision-making as to priorities, etc. Furthermore, potential areas of social or ethical concern identified and addressed. Trust in regulatory agencies must be earned (and seen to be earned), not assumed. Thus openness and participation are important, and multiple methods to achieve these ends will need to be instituted.

5.4 Overall Conclusions on Reform Processes

Regulatory reform, and reform of governance, are both inevitable consequences of the development of the knowledge-based economy. Regulatory reform recognises the need to allow the effective development and use of knowledge by public authorities, and by those who are regulated (or in whose interest regulations have been introduced). This requires simplification of cumbersome rules and procedures; rapid interchange of information (using new technologies where appropriate); learning from experience and basing policies on evidence; and similar types of initiative. Reform of governance recognises the need to treat citizens as (actually or potentially) knowledgeable and informed participants in policy processes. Their participation and consent is required for regulatory policies to be effective and robust.

These directions of reform are liable to have implications for innovation. There is a need for much greater understanding of how particular ways of implementing reform may impact innovation. Regulatory reform can be oriented so as to enable innovation – at least, as long as this does not run counter to the goals which the regulations are intended to achieve. Thus innovations that engendered high levels of environmental pollution, for example, should not automatically be fostered. The majority of innovations will promote wealth creation and/or higher quality of life. But there are always opportunities for application of knowledge to antisocial or unsustainable ends, and regulations that seek to limit this may well be necessary. Reform of governance may help orient regulations so that they are more attuned to social concerns about risks associated with innovation, and may also help promote innovations that are addressed to social need neglected by the market.

Knowledge-based reform should embody knowledge about the innovation impacts of the reform process. In the discussions above, we have been able to hypothesise about the implications for innovation of regulatory and governance reform (and/or about alternatives to regulation). But hypotheses are one thing, practical experience is another. It is apparent that the implications are often contingent on specific circumstances, which implies that:

- Much better intelligence is required about the patterns of impacts of regulatory and governance reform upon innovation, about the circumstances in which particular types of approach (and approach to implementation) have particular types of consequence.

- Such analyses need to be sensitive to the rate and directions of innovation, and the distribution of innovative efforts among different stakeholders. A body of knowledge should be established from which lessons can be drawn as to what constitutes good practice, where problems are likely to arise, and so on.

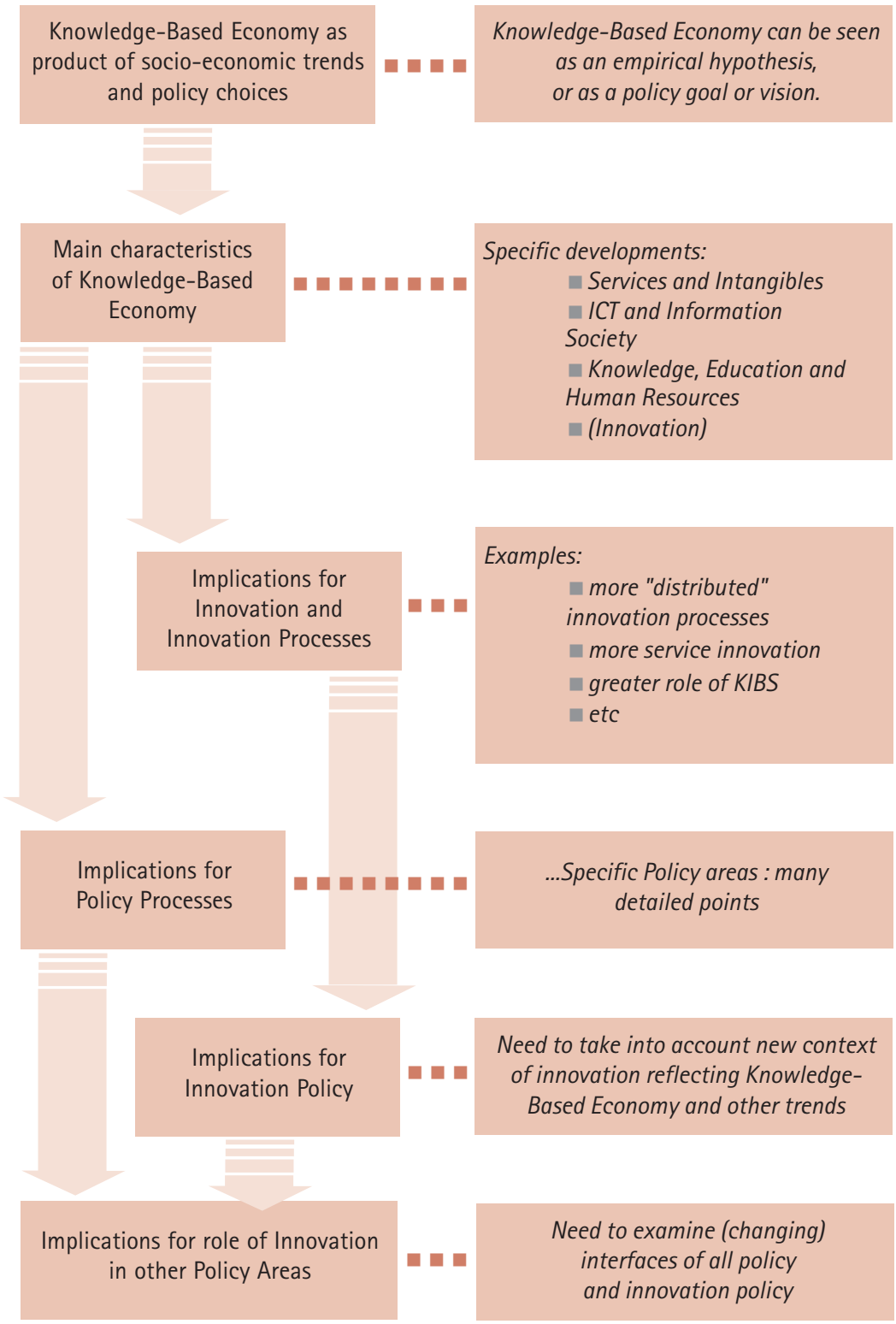
- It is important to establish good links between (a) those encharged with regulatory and governance reform in specific policy fields; (b) innovation policy experts (who would ideally be appraised of the body of knowledge being developed in relation to the first point above) and (c) those expert in the innovation processes and issues in the specific sectors or industrial processes that are the focus of reform efforts.

- Interaction between these groups should improve understanding of the links between reform and innovation in these concrete instances, helping policy design that can be innovation-enhancing.

- Exchange of experience between the agencies involved in the preceding points, nationally and internationally, will further enhance policy learning and innovation.

6_Innovation and Specific Policy Areas : Relations in Flux

6.1 Introduction



The preceding chapter discussed regulatory reform and governance in general terms. The present chapter moves on to consider the set of policy areas that DG Enterprise requested the project to study. For each policy area we attempt to discuss the rationale for, and instruments of, policy. We briefly analyse how (and why) these are changing. We examine how these policies are relevant to innovation, and how changing concepts of innovation and innovation policy may impinge upon and interact with them. The discussions are largely based on available literature, and reflect the uneven development of analysis in different policy areas. We also display relevant material from the Commission's structural indicators - which again is unevenly developed with respect to the policy areas.

Unlike the case study analyses, the discussions of **policy areas** that follow are not presented in the chronological order with which they were addressed in the project. They have been put in an order that is intended to enhance their value. The chapter addresses:

- **first, those policies that largely concern the factors that drive the innovation process (competition, trade, enterprise, etc.) – drivers that have much to do with the efficient functioning of markets.**

- **second, those that are more a matter of inputs into the innovation process (research, education, finance, etc.) – builders of capability.**

- **third, those that are more prominently a matter of outputs and influences from this process (environment, employment, regional policy, etc.) – ensuring the social and environmental sustainability of the resulting knowledge-based economy (including redistribution of its costs and benefits).**

This approach is inspired by a discussion in Lundvall and Borras (1997). These authors point out that there is something of a trend as we move down these policy areas. We move from those that are very much a matter of EU responsibility, to those that are much more the responsibility of the member states.

However, the distinctions drawn here are far from clear in practice, since the socioeconomic system is characterised by positive and negative feedback loops. . Many policy areas are both vital inputs to innovation and themselves heavily shaped by innovation processes. (Regional policy is an evident case: innovation may be, and increasingly is, at the forefront of such policy.) But the prospects for regions and thus regional policy are heavily shaped by innovations, especially those in the most dynamic regions. Much the same could be said about employment: a source of human capital for innovation, but where labour market policy also has to confront questions of uneven job loss and creation. Across sectors, areas, and skill levels. Or, to take another example, trade is a stimulus to innovation, and is prompted by innovation. Environmental concerns are very much a result of our use of technology, but increasingly shape directions of innovation. However, even a rough ordering of the policy areas in this way should be more useful than an arbitrary alphabetical or chronological listing.

The set of policy areas chosen here is somewhat arbitrary. Innovation and the knowledge-based economy are topics with relevance to every policy area. Analyses similar to those presented below could have been prepared for several, if not many, other groups of policies – for example, consumer protection, health, agriculture....

There are many differences between the various policy areas. Their objectives and their detailed instruments are extremely diverse. What all share, however, is the need for policy designers and implementers to be aware of current developments in the significance and processes of innovation. Some of the policies directly impact innovators - they are those regulated - and in such cases existing processes of dialogue need to be strengthened to take this into account. This means that dialogues need to be constructed with a focus on innovation built into them, and with the participation of innovation policy experts. Additionally, many of the areas involve intermediaries - for example, financial institutions who may finance innovation alongside their other functions, education institutions that may produce human resources for innovation as well as other purposes, and so on. Other intermediaries may be involved in implementing policies in courts and regulatory agencies, for example. Again, the implication of the material reviewed in this chapter is that these intermediaries need to be equipped with an up-to-date and sensitive understanding of innovation.

6.2 Competition

6.2.1 Overview

The general rationale for competition policy is simply that effective competition is required for markets to operate efficiently, delivering choice to consumers, allowing prices to be set fairly, and preventing monopolists from exerting undue power over business partners and competitors. In the EU context this is seen as essential to the operation of the internal market, allowing firms to compete on a level playing field throughout the Member States.

The relationship between competition and innovation is often characterised as a straightforward case of competition being a stimulus for innovation. As the introduction to competition policy on the Europa server states, "Competition policy seeks to encourage economic efficiency by creating a climate favourable to innovation and technical progress"[viii]. When the playing field is level then firms will try to gain a competitive advantage through innovation.

Going further, the relationship is not just one of competition stimulating innovation but also of innovation fostering more competition:

> "Support and protection of innovation is generally welcome also from the point of view of competition: new products, new services and new production processes are pro-competitive" (Jean-Francois Pons, Deputy Director General (DG IV), 1997).

However, competition and innovation do pose some problems. Competition policy needs to take innovation into account, for instance:

- Protection of the rights of the inventor must not impede competition in the markets concerned; and
- Mergers or alliances between firms active in similar R&D areas must not create dominant actors able to eliminate future competition in related markets, and thus slowing the innovation process itself (Pons, 1997).

Regarding the first concern, there is a tension between the desire of the Commission to promote rapid dissemination of technologies and innovations throughout Europe and the desire to protect the intellectual property of inventors (not least, to continue to offer incentives for continuing invention). Exemptions may be granted to licensing agreements that may normally be caught by competition rules. But in general the Commission works on the principle that firms with a strong position in a market cannot block the introduction of innovations that might benefit other firms, in particular innovative SMEs. In such cases the Commission can withdraw any exemption.

In relation to the second concern, the Commission's decisions regarding joint ventures have often been based on a pragmatic outlook,

> "the Commission is often willing to accept a joint venture or other restrictive agreement if it will bring a new competitor or a new technology quickly onto the market or create a counterweight to an existing dominant enterprise"

(Temple Lang, 1996, p.34).

Specifically related to innovation, the Commission will consider whether a merger or joint venture agreement is likely to restrict competition in R&D, potentially reducing the chances of consumers benefiting from future quality and price improvements. The implementation of this position has been contrasted with the US Department of Justice's stance, where it may be argued that the parents of a joint venture could enter the market separately in the future. More generally, US media like the Wall Street Journal argue that US policy is more inclined to consider that the market can decide on the firm sizes optimal for innovation and other benefits, while **their view is that EU policy is more weighted towards protecting the interests of incumbents.**

6.2.2 Main policy drivers and issues

A number of important issues can be identified as sources of pressure on competition policy and their points of intersection with innovations and innovation policies. Some of these are general drivers of policy change, such as globalisation and market liberalisation. Others, however, reflect the key elements of the knowledge-based economy. It is argued that the relationship between innovation and competition has become more problematic in the knowledge-based. Competition in highly innovative industries, and the "new economy" sectors, is distinct from competition in traditional industries. Encaoua and Hollander (2001) comment that for traditional industries the competition that matters most is that which takes place **in** a product market, but for innovative

industries what matters is the competition **for** the product market (p.4). "In contrast to mature industries where new participants gradually acquire market share, **successful entry in innovative industries often results in a rapid replacement of the dominant incumbent"** (p.4). The "new economy" proponents were keen to stress the way in which information products could be rapidly reproduced and delivered using new ICT, so that the marginal costs of expanding production approached zero. The strategy of new economy companies would be to try to gain as much market share and customer loyalty as possible, so as to establish their standards and habituate customers to their own ways of carrying out business. "[N]etworks, interconnection, compatibility, interfaces and intellectual property have become increasingly important sources of competitive advantage" (Shapiro, 1999, p.2).

These changes in perspective raise a number of issues, including:

- **The highly unpredictable and rapidly changing nature of high-tech sectors. One of the defining characteristics of the knowledge economy is rapid innovation.** Reflected the point made above about the need to establish the product market, competition is "best pictured as a sequence of races to develop new technologies. Victory in a race is often followed by the attainment of a leadership position in one or more product markets" (Encaoua and Hollander, 2001, p. 4). While dominant firms are unlikely to lose their grip overnight, if they do not continue to innovate then their market share can be rapidly eroded, in contrast to the situation in mature industries where new entrants may gradually acquire market share. **Performance tends to be driven by innovation rather than price.** Assessment of the effects of mergers or joint venture agreements on, for example, R&D competition is difficult enough in norma circumstances. The uncertain and rapidly changing nature of high-tech markets increases this difficulty. **When it is unclear how a market may develop, even in the near future, is it possible to inform competition policy with well-grounded judgements?** Pons (2001) outlines two responses. Some commentators believe that this pace of change makes competition policy not only impossible (regulators cannot keep up with rapid change and make well-informed or even timely decisions), but also effectively unnecessary (since the market should correct itself as incumbents are repeatedly challenged by innovators). Others argue that though it may be very difficult to apply competition laws to 'new economy' cases in particular, they should not be exempt from general rules and their underlying principles. The application of competition rules to the specific circumstances of individual cases should provide a way for them to keep pace with technological developments that may be more effective that more specific regulatory frameworks brought in to cover "new economy" activities.
- **Increasing collaboration.** In many cases firms do not have the necessary competences and know-how to undertake innovation alone. **The result of this is that networking and collaboration is increasingly seen as critical for the development of innovations in knowledge-based business.** This may be seen as necessary not only in terms of R&D but also in the setting of standards, overcoming regulatory hurdles or in helping to change public attitudes (as in

biotechnology for example). Laws intended to restrict oligopolistic behaviour and collusion can potentially impede technological and other innovation-related collaborations. An increased tendency towards what has been described as net work innovations is likely to test rules over competition in R&D. **Problems may arise over the question of what, in terms of collaborations and alliances, constitutes pre-competitive R&D.** While collaboration may be necessary to take an idea to a stage where firms can go away and develop it, where the line is drawn is unclear.

- **Network effects.** The utility of many new technologies, especially ICTs, increases with the number of users (an obvious example here is email). For cases of this type of technology, pricing behaviour that would be seen as predatory in traditional industries may be adopted for sensible reasons. Low initial prices could be necessary to help establish a market and expand the customer base (Encaoua and Hollander, 2001, p.8). Users of Adobe Acrobat are among the many who are familiar, too, with the use of "freeware" as a marketing tool. Here, basic software packages that are given free to users, on the assumption that this will lead enough purchasers to want the more sophisticated versions of the product, or complementary products, to cover the costs.
- **Technological complementarity, interdependency, and standards.** It is increa singly likely that innovations will not 'stand-alone' but fit into wider networks of other technologies. Related to the previous point, there may positive feedback effects where goods are complementary, with increased use of one good increa sing the value of other goods to users. This can lead to a time when the existence of different, incompatible products may become unsustainable and one product, or network of products, may become dominant. The control over central components in such networks is a pressing issue for competition policy. A dominant company could gain control over a network by redesigning central components (e.g. interfaces between products) so that competitors' products were no longer compatible with it.
- **A tendency to equate innovation with R&D.** Related to the previous issue, it is clear that innovation is a much broader concept that R&D. However, there has been perhaps a tendency when considering innovation in competition policy to equate it to R&D, missing out on the wider nature of innovation. Such a focus on R&D may have the effect of penalising firms that do undertake extensive R&D programmes and could, ultimately, stunt innovation.
- **The creation of e-markets.** E-markets can be seen as representing a new form of market, with new problems for competition policy. One aspect of this is in the increased use of business-to-business e-markets. Where these are established between a business and its suppliers for example there are issues over what this means for competitors of the suppliers. Other problems can arise in wider e-markets where major producers could be seen as exercising undue pressure on their suppliers. In relation to business-to-consumer markets there are questions over whether these markets have the effect of locking in consumers, limiting choice and in some cases misinforming them.

While the internet can be seen as opening up markets, allowing for much freer competition the resources required to establish and make a success of a web site are not inconsiderable – it is not a level playing field.

6.2.3 Implications

The relationship between innovation and competition policy is intimate. Competition policy's aim of fostering greater market competition should in general benefit innovation. But few intimate relationships are as uncomplicated as outsiders may think. The links between competition and innovation, especially in highly innovative and rapidly changing sectors, may be taking on surprising forms.

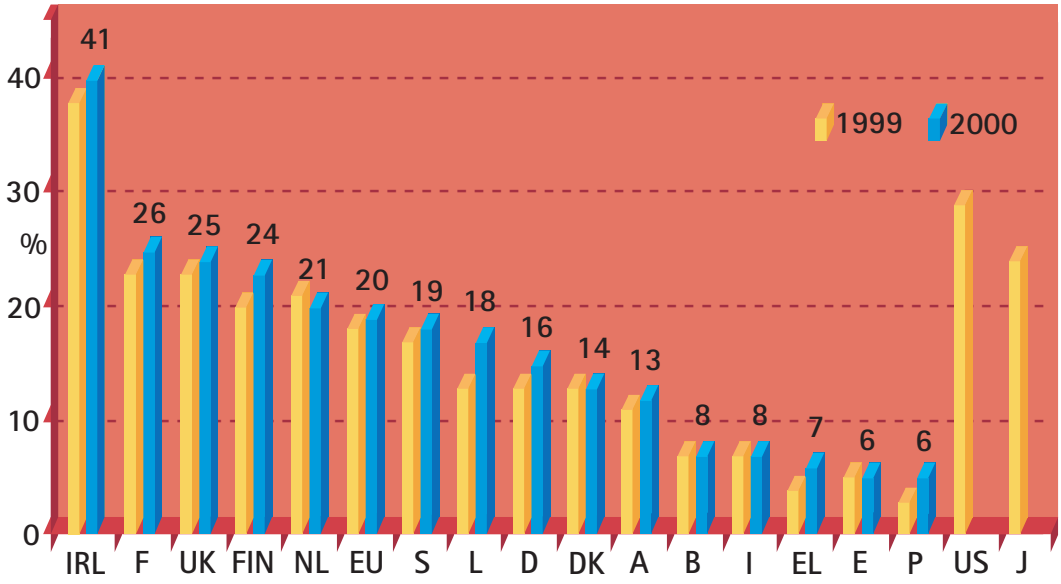
In the context of the knowledge-based economy, it is clear that the implications of competition policy decisions for innovation policy need to be examined closely. Not only do court rulings need to be informed by such considerations: the overall development and implementation of competition policy needs to be related to innovation. This complicated picture requires flexible design of policies around clearly stated principles that give high priority to innovation. **Regulatory agencies and other implementers and interpreters of policy (e.g. the judiciary) need to be better-informed about the innovation considerations associated with decisions concerning collaborations, monopolies and mergers.** These issues are also closely entangled with matters of Intellectual Property, too, and this needs to be brought into **the equation**. Policymakers will have to take into account the changing nature of innovation and of highly innovative industries and markets, and be prepared to design sufficiently flexible policies to deal with these changes. Otherwise they will have to be prepared to rapidly review and revise policies as they become counterproductive.

6.3 Trade

6.3.1 Overview

A major factor behind calls to increase innovation in the EU is the trade gap with both the US and Japan, particularly in high-tech industries. Figure 6.3a sets out some data dealing with the role of "high-tech" products in exports. The statistical specifics are problematic - "high-tech" here means, following the OECD definition based on R&D-intensity, only products of the aerospace, computers and office machinery, radio, TV & communication equipment, and pharmaceuticals sectors. But the positioning of the EU average here, well below that of the US and Japan, gives cause for concern. The trade balance in these areas has been some 20bn euro per year for the past decade.

Figure 6.3a Share of High-Tech Products in Exports, EU countries, Japan and USA



Source: Graph IV.4 from Commission Staff Working Paper SEC(2001), Benchmarking Enterprise Policy: Results from the 2001 Scoreboard available at: http://europa.eu.int/comm/enterprise/enterprise_policy/competitiveness/doc/sec_2001_1900_en.pdf

The main rationale of trade policy is that of ensuring the freer movement of goods and services, so as to attain the expected benefits in terms of increased competition, and, ultimately, lower costs more consumer choice, etc. The policy should simultaneously open up European markets to more outside competition and, at the same time, open up third countries' markets to European firms. The single market is a related issue, in that the access to a large market is seen as important in achieving the critical mass for many innovations to take off: Japan and the US are seen to have advantages in this respect. The result is that it is easier to establish a new product, standards, etc., in these markets – and thus easier for innovative firms to find finance and rapidly grow, to establish niches for new products, and to play a leading role in industry alliances, etc

These two aspects of freer trade should help create a stimulating environment for innovation. **As EU markets are opened up to greater competition from external countries, businesses will need to innovate to compete. Meanwhile, European industries need to innovate to enter many overseas markets.** Furthermore, they can benefit from access to wider markets for their innovative products, and potentially be able to exploit economies of scale. This can increase the returns from expenditure on innovation, and provide greater incentive to undertake what may be costly R&D processes. Innovation can act as the catalyst to not only producing new types of innovative goods or better quality products, but it also acts as a catalyst to increase investments in a new variety and better quality of manufacturing processes.

The increased interdependence between economies and societies should mean more efficiency in the allocation of resources and provide powerful incentives for innovation (Lamy, 2002). It also should tend to break down traditional prejudices and political rivalries, and reduce the chances of conflict by increasing their costs. However, there can be costs. Environmental costs, such as those associated with raw materials and goods being transported long distances, are prominent. But there may also be social costs associated with labour migration and threats to cultural diversity. And highly interconnected systems can be very vulnerable to the breakdown of specific critical components, as was apparent in the wake of 9/11, when many organisations began rethinking their assumptions about location, reliance on just-in-time systems, etc.

EU firms can benefit from international trade and related activities. They can enter global markets with competitive, high-quality products. (See the discussion of "quality competition" in the Competitiveness Report 2000. This rather convincingly argues that the EU's overall trade surplus in manufactures is largely a matter of being able to export higher quality goods.) Indeed, they should benefit from entering these markets, where they can be exposed to new ideas - challenging in the short-run, but far more productive in the long run than staying focused on sheltered but small and less dynamic niches. The Commission can facilitate such international presence in various ways. For example, it can promote co-ordination of activities dealing with a number of relevant issues. These include: technical standards, promotion of EU industry and its capability to deal with current and emerging social, environmental and other problems, exchange of information as to successful local, regional and national programmes of support for SMEs' international presence.

The establishment of a free trade area between the EU and the associated countries provides more trading opportunities between the Union and future members. As some of the 'candidate countries' have good links with their neighbours in the former Soviet Union, this could help EU-based firms to engage in increased trade and investment in the new member states. There are opportunities for these firms to use innovative strategies to gain market entry into the former Soviet Union countries via improved links with the candidate countries. Agreements in this area have resulted in industrial products having virtually free access to the EU from the associated counties since 1995 (with restrictions in some sensitive sectors, such as agriculture and textiles). This trade agreement also specifies that, as well as liberalising trade, when establishing and operating in the territory of the other party; enterprises must receive treatment not less favourable than that received by national enterprises. Trade and foreign investment are frequently closely associated, and services in particular frequently internationalise by means other than the tradition al import and export of tangible products.

6.3.2 Drivers of Change

Companies recognise the gains from trade and attempt to achieve an international presence – though there are many salutary cases of unexpected difficulties in breaking into other world markets.

Internationalisation is not just a matter of trade, but also of achieving a presence in foreign markets – and especially for services, this often means **foreign direct investment, franchises, partnership agreements and similar measures that can enable the sort of close** contact with customers that they require. International companies also tend to engage in a great deal of "intrafirm trade", which may be problematic for statisticians as well as regulatory authorities. One problem concerns just how transfers are organised where such activities are involved – since often there are no strictly comparable goods or services available on the market that could be used as a basis for independent pricing.

Practically all countries are committed to trade liberalisation, and this is forwarded through international agreements in the World Trade Organisation framework. The benefits are widely recognised. The dangers of cycles of retaliation and counter-retaliation, that could put the global economy (or at least the economies of contending nations) into a downward spiral, are well known. Nevertheless, protectionist measures of various types are often undertaken when governments confront serious local political difficulties in consequence of threats to particular industries. These threats may be to employment in particular sectors or regions, or to the goals of major corporations in global markets. A national industry may be unable to produce goods (or services?) as cheaply as foreign competitors – this is blamed on free trade. Or, national firms may be barred from substantial export markets because of concerns about the safety or compliance with standards of their products - this is portrayed as an attack on free trade.

E-commerce involves more than transactions and marketing. It can involve the electronic delivery of some informational services, and of informational components of other products (and of services). Aftersales support is an obvious case. Even firms supplying products whose design or customisation requires considerable interaction with clients have great scope to use the new media for advertising their capabilities, for engaging in market research and aftersales support, and so on.

As a growing number of products being marketed, sold and even delivered on line, E-commerce is becoming an important focus for trade policy. It has opened up new markets for traders, in particular SMEs, including those in developing countries. But it is not just that market reach is extended – the way in which markets function, and the ways in which businesses and supply chains are organised, are steadily being transformed. This has elements of the move to greater efficiency and more transparent markets that enthusiasts talk about. With **"the death of distance"** and rapid communication, the timeliness with which goods and services can be produced, brought to market or traded across borders can be improved. Purchasers can search for information from a wider pool of suppliers and acquire relevant information almost immediately. Information on designs, costs and markets can be shared widely and instantly. This has the potential to significantly influence the cost structure and relative competitiveness of firms and entire industries. Production can be integrated across many different time zones and borders.

However, "cyberspace" is not automatically a freer market. Large corporations and alliances of firms are setting up electronic markets to which access may be limited.

Small companies can sometimes achieve a global presence through use of the Web, but often they will not be able to afford the expenses of designing websites and other material to the levels of professionalism and effectiveness of larger and better-established competitors.

Trade in knowledge-based services is becoming a key characteristic of the economy, and these services seem to be particularly active in this respect (see essays in Miozzo and Miles, 2002, and the European Competitiveness Report 2000). The EU is one of the leading proponents of more liberal global trade in services and the removal of barriers to a global market in services. A first step towards this goal has been the Global Agreement on Trade in Services (GATS), which established rules and obligations regarding trade in services. The EU is one of the most liberalised trading areas in this respect. The available trade statistics (reviewed by Baker, 2002) show that while services dominate the economies of the EU, services account for only about 20 per cent of total EU trade. Factors involved here include regulations concerning professional standards and qualifications; need for understanding of local culture and for establishment of trust with local clients; need for substantial physical presence in the host economy, which can be difficult for SMEs to muster, in particular. While relatively standardised services can be exported much like goods - especially if telecommunications networks can be used to transport them - this does not apply to many more customised services. Investment, which is one route to establishing physical presence (others are partnerships and franchises), is another story. Services accounts for about 55 per cent of total foreign direct investment flows and stocks. This is a figure much more commensurate with the importance of private service sector activities in domestic economies. Mergers and acquisitions are also substantial activities in these sectors.

6.3.3 Trade and innovation

Knowledge-intensive business services are important vectors of knowledge supporting innovation. Trade in, and other modes of internationalisation of, KIBS is growing – they are some of the most internationalised services. In a study of employment in business services in a sample of EU countries in the mid-1990s, surprisingly high shares of employment were found to be based in foreign firms. Examples include: over 20% in consultancy and some other professional services, over 15% in labour recruitment, renting and computer services, over 10% in advertising and R&D services, and so on (Eurostat, 2000). More than half of this was, typically, employment in enterprises originating out of the EU. Barriers to do with professional qualifications and local market characteristics remain important in some KIBS (though typically these are the less technology-based ones).

"Trade" in KIBS should mean greater access to support for innovation and innovation partnerships. There are concerns, however, that sometimes these firms seek to **generalise inappropriate technology** or business models without sufficient regard for local contexts and related suppliers.

For example, they may propose knowledge management solutions for their clients that are based on US organisational culture and US software tools, without sufficient awareness of local contingencies and capabilities. Given the difficulties clients face in assessing the likely content of a service before it has actually been produced for them the assumption that transparent markets will automatically lead to the selection of practices that are best for local requirements is likely to be flawed. Exchange of experience among professionals supplying and using KIBS is part of the solution here, and efforts might be undertaken to boost awareness in the EU of European specificities on the supply and demand side. Such awareness should also help inform EU exporters as to the ways in which their products, and those of business partners, might need to be marketed or re-engineered to meet the requirements of overseas markets. It could also help them define their "unique selling propositions" to take into international alliances and networks.

New ICTs can be used for remote co-ordination of activities, reducing the need for direct or at least large-scale physical presence in service markets. There are limits to the extent to which specialised activities, requiring new knowledge and interactive learning, can be reproduced through such media. There is steady progress in the development of new ways of working and new organisational structures that depend on less face-to-face contact, and in new media and software tools to support these. But the current situation is that ICT best enables fairly routine activities to be freed of spatial constraints; nonroutine co-ordination can be facilitated by ICT, but requires a bedrock of non-virtual relationships and networks.

Trade often leads to an enhancement of innovation in certain leading geographical clusters rather than more evenly across the terrain of trading partners. This may have a lot to do with the "stickiness" of trade specialisation patterns, noted in a review of related TSER research projects by Fagerberg (1999). The implication is not only that it may be difficult to change European export performance in, for example, high-tech goods and services. It is also quite plausible that strategies aimed at so doing will effectively meet with a much greater response from certain regions than from others. Such uneven responses are likely in many policy areas, and the domain of regional policy (see below) will be heavily involved in reducing such inequalities – or coping with their consequences.

Despite trade agreements, trade conflicts are recurrent; and these conflicts are sometimes clearly related to innovation. For example, where **protectionist measures** intended to support a declining traditional industry may be met with by retaliation against high-tech exports from the country that has taken these measures. This may benefit high-tech industries in the retaliator's economy, at least temporarily – but it may also deprive them and others of important inputs for their own activities. Trade may be impeded for a variety of other reasons – **to prevent militarily sensitive equipment or information entering the wrong hands, for example.** European firms can fall foul of US desires to restrict commerce with particular countries, or to restrict the global diffusion of particular products.

Environmental and other concerns may also enter the equation, and one major challenge is disentangling trade restrictions motivated by protectionist reasons from those based on principled environmental or social concerns. The advent of the knowledge-based economy does not provide an automatic solution to such issues. Indeed, it is quite plausible that countries will experience more friction, as public and political concern about social and environmental issues may diverge (within as well as between countries). In particular, such frictions have been growing in the agro-food sectors, where a series of problems have been experienced - BSE, genetically modified seeds and foodstuffs. The latter case involves innovation, of course, and threatens to escalate into major US/EU conflict as large US firms put on pressure to allow trade in their products. Such reflections of cultural differences and local sensitivities need to be considered in a more measured fashion.

The variety of rules in different countries (e.g. regarding consumer protection, health and safety issues, environmental issues, IP, etc.) may be an impediment to trade, even when they do not form a source of acute conflict. One area where there are efforts to lower the barriers concerns intellectual property laws. The EU is currently assisting a number of developing countries to introduce or strengthen such laws. The argument is that this will help to increase direct investment flows, and facilitate the transfer of technologies from the developed to the developing world. This raises the question of IPR and development, which is dealt with in the IPR discussion that is the next section of this chapter.

6.3.4 Implications

In some ways trade is one of the policy areas whose relationships to innovation appear to be least contentious. More open trade and innovation are mutually reinforcing. Trade is liable to increase competition and customer sophistication, and thus the pressures on firms to innovate. Trade allows new products to circulate more freely, which fosters diffusion of innovations; it also allows for more exchange of knowledge of new technological capabilities, which should facilitate innovation. Innovations, furthermore, give countries more of a basis on which to trade. There is more scope for specialisation and niches, and new technologies make it easier to market products globally and deliver them more rapidly.

As usual, matters are less straightforward than they appear at first sight. Despite the economic orthodoxy, trade between countries of very different technological levels is unlikely to benefit both equally.

Trade liberalisation may mean restructuring rules and other practices in different countries – for examples rules governing professional practice and qualifications are often out of alignment. Trade conflicts are often entangled with political demands to protect certain industries (by allowing import of required materials and components, or export of their products), and this is bound to have implications for innovation. Barriers to trade in services remain significant.

They presumably restrict the transfer of innovative practices and services, both among service suppliers and their clients. But such barriers deserve careful attention, since services are often entangled with matters of cultural heritage and social welfare, for instance.

Problems are liable to persist where attitudes to risk and other social concerns associated with innovation differ from region to region - particularly from the EU to the US. The strains experienced around trade in genetically modified crops, and foods based on them, could well be harbingers of other strains to come. (For example, involving subsequent applications of genomics and biotechnology not only in agriculture, but also in medical and health fields, where there are signs of divergence on ethical issues such as animal experimentation, use of human foetal tissue, etc. Privacy and civil liberty issues may come to the fore with future generations of ICT, too.) Unfortunately, trade disputes are easily escalated into serious political tensions. It is apparent that efforts will be required to establish mutual understanding and shared norms as to how innovation concerns (including governance issues such as those connected with public acceptance of specific innovations) can be systematically incorporated into trade negotiations and procedures. The EU must play a leading role in these processes, since there are substantial differences between European and US experience of these matters.

It would be fruitful to explore such implications in more detail. The interfaces between trade and innovation will almost inevitably also require consideration of issues such as IPR and competition policy.

6.4 Intellectual Policy Rights (IPR)

6.4.1 Overview

IPR systems allow the creators or owners of products to receive due reward for their efforts, or to be able to control the way their creations are used. IPR instruments differ considerably in history, mode of operation, and precise intent. While patents are usually considered the IPR instruments most relevant to innovation, other instruments may well be applied here too. A wide range of instruments are applied in practice by many firms, although many smaller firms use few of these, and in some fast-moving sectors there is more emphasis on keeping moving – continual innovation – as opposed to protecting one's existing products.

Patents provide inventors with exclusive rights to make, use, and sell their inventions. The patent mechanism is designed to provide inventors with rewards for the useful new knowledge they have developed and embodied in (mainly industrial) product and process inventions. But the mechanism is also designed to provide a mechanism for the diffusion of this knowledge, by placing the underlying principles in the public domain. While the scope of patent protection has been considerably increased in recent years, many classes of innovation are not easily covered by patents, if at all. One of the main areas

of debate recently has concerned extending patent protection to cover more areas of software, and (following the US precedent) to cover business processes.

Patents are the only IPR to feature among the list of structural indicators. The data captured in Figure 6.4 below suggest that European firms (and other actors) manage to patent less in the important US market than do their main competitors, though these data should be interpreted with caution. Patenting levels vary considerably across sectors, there are cultural and strategic differences in patenting practice (for example in the extent to which inventions are covered in one big patent or in multiple smaller patents). But the overall picture suggests that either European firms are producing less in the way of technical novelty (some sectors like pharmaceuticals are exceptions here), or are less prone to seek IP protection for it.

Figure 6.4a Patent applications to the European Patent Office (EPO) per million inhabitants

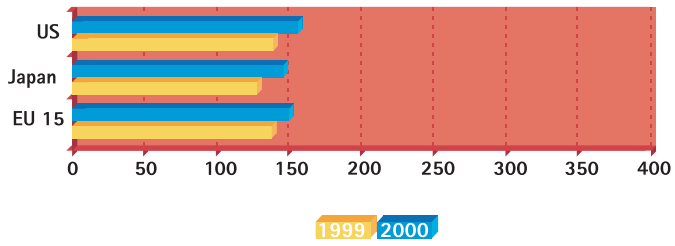
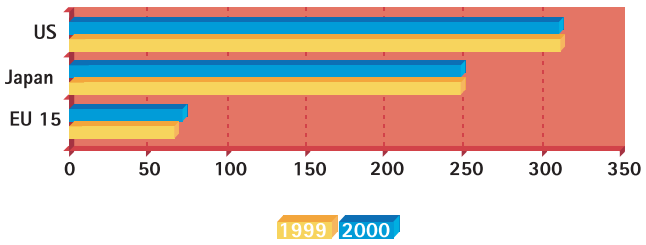


Figure 6.4b Patents granted by the United States Patent Office (USPTO) per million inhabitants



Source: Annexe 2 to the Commission Staff Working Paper in Support of the Report from the Commission to the Spring European Council in Barcelona COM (2002)14 final, "The Lisbon Strategy – Making Change Happen" Brussels, 22.2.2002 (note; qualifications to data - especially time periods considered are provided in the original source)

Another IPR instrument is **copyright**. This applies to certain kinds of symbolic material (e.g. texts, diagrams, and software - in the form both of content and instructions). It provides creators with legal rights to control the ways in which their material may be exploited. (Quotation and parody are allowed within limits).

Copyright has been used extensively to cover technical innovations in software, only a limited range of which may be patented. Other innovation-relevant materials may be copyrighted – training and instruction manuals, designs for buildings and other products, consultants' reports on technical options, decision-support tools, etc. **Much recent debate about IPR in information society has concerned copyright, because of the ease of copying and distributing material processed in electronic form.**

Similarly, **design rights** may cover innovative material, though the original intention was to restrict unauthorised use of original "ornamental" designs (usually of manufactured objects). .Another familiar set of instruments, **trademarks**, are used to distinguish, and indicate the source of, goods or services. New trademarks may not indicate any real innovation, other than a marketing one – they may be introduced to renew a product's image or to enhance product differentiation. **But innovative products are typically trademarked. Some researchers have used data on trademarks as a way of indicating areas of innovative activity or firms. and the success of this approach demonstrates the use of this mechanism in innovative contexts.**

An organisation's "intellectual capital" is not always protected through such IPR instruments. In fact, many small firms make no recourse to any of the formal instruments, and it is likely that many innovations in firms of all sizes are not protected by such means. **Critical technical knowledge is often protected by commercial secrecy, which may be enforced by employment law and contractual agreements among firms.** But there are many other techniques used, such as physical protection of assets, copy-protection of electronic data, etc. Trade secrets, and the other methods of protection, may also be applied to all sorts of knowledge and intellectual or intangible assets, not only to those most concerned with innovation. **The application of IPR techniques of all sorts has clearly risen up the agenda for many firms across Europe. This includes firms in sectors that have traditionally been regarded as not particularly innovative.** This is part of the evolution of learning organisations in the knowledge-based economy. Strategies of various kinds are being developed by companies (and public sector organisations such as Universities). These strategies are leading to an extremely complicated environment. How far the decisions made are optimal for the individual companies, let alone for the economy in general, remains unclear.

6.4.2 Drivers of Change

Several important factors are sources of pressure on IPR policy frameworks, and on their points of intersection with innovations and innovation policies. Many of these factors reflect elements of the knowledge-based economy. The use of ICTs and the importance of software (and data content – such as music and video content) are notable cases - in large part because of the large-scale "piracy" of software, recorded music, etc. Also important are the growth of services and service innovations, with the problems they have confronted concerning the patentability of innovations; while the modernisation of organisations is promoting changes in the strategies (especially of major firms) in the use of IPR.

And there are pressures for reform of IPR systems so as to render them easier for SMEs and others to use.

Some of the points of pressure on IPR frameworks, then, are:

- **Problems concerning the complexity of IPR systems.** There is increasing interest in and awareness of IP issues on the part of firms of all types (and also public sector institutions that find their knowledge to be of value). Policymakers have been keen to promote use of IPR mechanisms as a way of rewarding innovators (and, probably, of limiting the appropriation of value from inventions by overseas companies). But many aspects of acquiring and deploying IPRs are seen as too complex, costly, time-consuming, and slow to operate. These problems are seen as applying especially to SMEs, who are deterred especially from patenting, and who are seen as important agents in innovation, economic growth and employment creation. This has led to growing pressure to simplify and streamline IPR systems. Measures such as "petit patents" have been introduced in some countries in order to make the process of patenting easier.

- **Problems involving technical innovations that fall outside of conventional patenting mechanisms.** Some of these problems are associated with the shift to the "service economy". Service firms and functions are the focus of many innovations that are hard to protect by conventional patent means. The methods used to protect such innovations and associated intellectual property vary considerably, related to several features of the services and companies involved. **(For example, much IP in services is bound up with tacit knowledge on the part of employees, and so secrecy and employment contracts may be major modes of protection.)** Similar problems related to the pervasiveness of ICTs, where various aspects of software, services and network-related innovations prove hard to patent by conventional means. Copyright has often been invoked as a method of protecting such innovations.

- **Problems involving disputes about protecting technical innovations by use of conventional mechanisms.** The most prominent recent controversies, with ethical and political dimensions, involve biotechnology and genomics, and the ownership of human and other genetic information. One source of problems has been the patenting of innovations involving such information. (There have also been some - half-serious? – moves towards copyrighting genetic information!) Business process patenting, as adopted in the USA, has been seen by some critics as a potential impediment to organisational modernisation. Such critics have argued that it may slow the adoption of ecommerce. Other problems (and similar concerns) have been raised around application of copyright to cover aspects of software that are far removed from the codes and algorithms that it employs. Examples are the "look and feel" cases in the US, again, where efforts have been made to prohibit the use of "intuitive" elements of design modelled on everyday life.

■ **Problems associated with the rapid pace of change in technological knowledge.** As mentioned above, there have been concerns that the long lifetime of IPR mechanisms may slow the rapid development of technology in fields such as software and ecommerce. There have been suggestions that shorter terms for patent protection might be viable in these areas. Copyright, with its even longer temporal extension (for the life of the creator plus a period of decades) is seen as having come into play to cover technical innovations of a sort for which it was never intended. There is, additionally, a vocal community of activists and researchers in ICTs who argue against the extension of IPRs in this area, promoting instead "open source", "copyleft" and other alternatives to conventional mechanisms, arguing that this will permit greater innovation and more open competition. (A related claim is that open access to source code, etc., will allow the wider community to detect and respond productively to security and other flaws hidden within commercial software.)

■ **Problems associated with the increased ease of reproducing and distributing informational products by use of new ICTs.** The problem of "piracy" is not confined to the music and video industries, but is also widely experienced in the software and ICT content sectors. Illicit CD-ROMs are produced on an industrial scale in some regions of the world, and the expansion of broadband networks and Internet access has increased opportunities for the exchange of such material for free or at a price. Technical strategies to circumvent such piracy by means such as watermarking, required license numbers, registration with the supplier's website, etc., seem to be readily circumvented (as well as often irritating legitimate customers). (Additionally, efforts to use legal means to prevent other parties from developing tools to, for example, make it possible to disable copy protection, overcome regional restrictions, or allow cross-platform use of software and content, can themselves be argued to be impeding innovation.) Numerous other problems are emerging. There are conflicts around web domain names (under what conditions is it possible to use or refer to the trademarks of other parties). A related issue is "deep linking" (allowing users to access the contents of a third party's website from one's own site, circumventing editorial, advertising, or other material that was intended to be associated with the content).

■ **Increasing interest in using IP data as a source of commercial intelligence.** This is an issue of a different order. Many firms are now applying sophisticated methods of analysis to public domain information on patenting, in particular, as a source of intelligence about the strategies of other firms, the "hot areas" and general trajectories of technical advance in particular fields, and the like. Organised data about IPRs thus becomes a valuable asset in its own right. It plays a role in corporate decisions about building patent portfolios, for example, as more strategic vision is developed about how best to protect lines of technology development from incursion by competitors.

It might be suspected that these approaches are creating demands on the IPR systems to provide more and more timely information, and that they may make it harder to competition to emerge in some spheres of technological endeavour. However, SMEs too could benefit from easily available (online) information about IPRs.

6.4.3 Policy Perspectives

The need to simplify IPR systems, is widely recognised:

> *"The patent system must under no circumstances act as a further brake on the competitiveness of European companies. Ease of obtaining patents, legal certainty, and appropriate geographic coverage: these are all essential criteria for the effective protection of innovation in the European Union"* (European Commission, 1997)

Alongside this is a strong sense that, to quote from the Innovation and Technology Transfer newsletter from DG Enterprise of October 1999, "compared with the US and Japan, the protection of intellectual property rights in Europe is complex, costly and fragmented." (p12) Thus a current priority for the Commission is improving the patent system in Europe through moving toward a unitary Community system. (Currently there are still both national patents and a European patent, which does not create uniform protection rights but does give the applicant protection in as many Signatory states as they require.) A proposed Community patent

> *"would have the essential feature of granting patents with a unitary character that would have equal effect throughout the Community and could be granted, transferred, revoked or allowed to lapse only in respect to the whole Community"* (from Green paper). (European Commission, 1997)

Despite wide recognition of the salience of this case, and several years of concerted efforts to make progress, there have been serious obstacles to the introduction of the Community patent including:

- The costs of translating the Community patent into all the languages of the Community;
- Ensuring that disputes could be adequately settled at the judicial level (with no court to settle European disputes, courts in different Member States could hand down different rulings).
- The question of fees.

Policymakers have also taken account of the concerns expressed about the scope of patenting. Most visible has been the consultation about computer-related – i.e. software – patenting. While computer programmes can be copyright protected as literary works they cannot be patented in the EU unless they also consist of hardware. With differing interpretations of these rules throughout the Member States, the resulting confusion is believed to have discouraged European software developers from using patent protection, or taking out patents in the US (where more aspects of software are patentable).

This is, especially believed to be a problem for SMEs, who in any case find the costs and effort involved in patenting to be a deterrent. Europe has also been interested in the "business process" patenting developments in the USA.

There has been a great deal of attention about the role of copyrights in the knowledge economy. This has mainly addressed issues of piracy and the like. A major stimulus has been the rapid growth of illicit copying of music and video material through Internet-based file-sharing systems in particular. (New ICT has made it easy and cheap to reproduce such content. The use of computer networks has made it easy to locate and distribute material. To date the recording and publishing industries have made limited progress in establishing business models that encourage their customers to pay for the new services. Their response has been to pressure for much tighter and more rigorously enforced copyright laws – with the best-known example being the USA's DMCA (Digital Millennium Copyright Act).

In recent years US copyright law has been applied to extremely controversial effect by all sorts of organisations. Some companies have sought, for example, to restrict criticism of their activities (e.g. use of their names in Web pages), to control links to their own material on the Internet (e.g. preventing hyperlinks to their pages, so that users can only access material through specific channels designed by the organisation). There has even been curtailment of scholarly discussion about the nature of encryption and other methods of content protection. This is not the place to engage in a detailed argument about the rights and wrongs of such initiatives. The point is that the evidence already suggests that copyright law can significantly change patterns of use and further development of new ICT. Thus reform of copyright law needs to be carefully considered in terms of how it may both affect the protection of technical innovations through copyright, and how it may affect the evolution of innovations that bear upon the content of information systems. In this area, in particular, there is a danger that critical decisions that bear on innovation policy will end up being taken by judges and lawyers who have at present little reason to be concerned about these effects of their deliberations.

6.4.4 IPR, Trade and Development

There are many areas where "technology transfer" (the term is not really satisfactory) is as pressing as medical supplies and pharmaceuticals. The sick and destitute of many developing countries cannot afford expensive treatment. They need cheaper drugs and development aid to support medical care (and, of course, alleviation of the poverty which lets disease gain such footholds). The EU's programme for accelerated action on HIV/AIDS, malaria and tuberculosis in the context of poverty reduction seeks to respond to this global emergency (which most severely affects the poorest populations) over the period 2001-2006. A parallel goal for the pharmaceutical industry world-wide should be to discover, develop, manufacture and give patients access to medicines that improve human life by preventing, treating and curing such diseases.

The EU's position is that the World Trade Organisation (WTO) Agreement on the Trade-Related Aspects of Intellectual Property Rights (TRIPs) can be implemented in ways that simultaneously meet WTO members' public health objectives as well as the rights of pharmaceutical companies. The specific challenge is to establish a sound, rules-based, trading environment that encourages both innovation in medicine and medical treatment, and the wider sharing of the benefits of advanced medicine and better health care around the world. The more general challenge is to orient a greater share of innovative effort toward generating products that can address the needs of the developing world effectively and cheaply. This may mean finding new ways of rewarding innovators based in the richer countries.

A recent report by the Commission on Intellectual Property Rights (2002) to the UK's Department for International Development makes a highly relevant case, and goes beyond the question of innovations in health and medicine. This report argues that developing countries negotiate from a position of relative weakness, not just in the sense that they possess less economic power and fewer technological assets, but also because they are "second comers" in an IPR environment shaped by the "first comers" of the industrialised world These "first comers" shaped their IP systems to suit their own economic, social, and technological conditions, and these systems may not be optimal for the conditions now facing developing countries. In discussions of IPR between developed and developed countries, the interests of IPR owners and their political representatives tend to dominate. These are mostly tied up with the established IPR regimes of the developed world The Commission argues that, before further extending IPR systems to the developing world, policymakers should take an eminently knowledge-based approach. They need to consider the available evidence, as to the impact of IPR systems both on commercial interests and on poverty reduction. The global IPR system should evolve in such a way that it contributes to the poverty reduction in developing countries both by stimulating innovation and technology transfer relevant to them, and by making available technology and knowledge at the most competitive prices possible.

Among a wealth of proposals incorporated in the Commission's report, we can select a few as particularly relevant to the present study. Focusing especially on proposals directed at developed countries, these include, for instance:

- Appropriate incentive policies to promote technology transfer, for instance tax breaks for companies that license technology to developing countries.
- More public funds to promote indigenous scientific and technological capability in developing countries through scientific and technological co-operation.
- Commitments should be made to ensure that the benefits of publicly funded research are available to all, including developing countries.
- Public funding for research on health problems in developing countries should be increased. This additional funding should seek to exploit and develop existing capacities in developing countries for this kind of research, and promote new capacity, both in the public and private sectors.

- The IP system can help to establish differential pricing mechanisms, which would allow prices for drugs to be lower in developing countries, while higher prices are maintained in developed countries.
- Public sector research on agriculture, and its international component, should be strengthened and better funded. The objective should be to ensure that research is oriented to the needs of poor farmers, that public sector varieties are available to provide competition for private sector varieties, and that the world's plant genetic resource heritage is maintained. Nations should consider the use of competition law to respond to the high level of concentration in the private sector.
- Accelerate the process of ratifying the Food and Agricultural Organisation's Treaty on Plant Genetic Resources for Food and Agriculture, and implement the Treaty's provisions relating to not granting IPR protection on genetic material in the form received from gene banks protected by the Treaty.
- The digital libraries of traditional knowledge that are now being created, should be incorporated into the minimum search documentation lists of patent offices, to ensure that the data contained within them will be considered during the processing of patent applications.
- Consideration should be given to establishing a system whereby patent offices examining patent applications which identify the geographical source of genetic resources or traditional knowledge pass on that information either to the country concerned, or to WIPO to monitor the use and misuse of genetic resources more closely.
- Publishers and software producers should review their pricing policies to help reduce unauthorised copying and to facilitate access to their products in developing countries. Initiatives being undertaken by publishers to expand access to their products for developing countries should be expanded.
- Developing countries and donors should work together to ensure that national IP reform processes are integrated with related areas of development policy.
- Developed countries should implement procedures to facilitate effective access to their intellectual property systems by inventors from developing nations. (These might include, for example, fee differentials that favour poor or non-profit inventors, pro bono systems, arrangements for recovery of legal fees by prevailing parties in litigation, or inclusion of appropriate IP implementation costs in technical assistance programmes.)
- Developed countries and international institutions which provide assistance for the development of IPR regimes in developing countries should provide such assistance in concert with the development of appropriate competition policies and institutions.
- WIPO, EPO and developed countries should significantly expand their programmes of IP-related technical assistance.
- WIPO should act to integrate development objectives into its approach to the promotion of IP protection in developping countries.

Source: Commission on Intellectual Property Rights (2002)

6.4.5 Implications

IPR systems have been designed with a variety of aims. Historically the promotion of innovation has only been a major goal in the case of patents. With the advent of the knowledge-based economy, a number of issues are driving change in thinking about IPR. These include problems associated with:

- the complexity of IPR systems;
- technical innovations that fall outside conventional patenting mechanisms, e.g. software, services and network related innovations;
- disputes about protecting technical innovations by use of conventional mechanisms e.g. the ownership of human and other genetic information;
- with the rapid pace of change in technological knowledge;
- the increased ease of reproducing and distributing informational products by the use of new ICTs;
- increasing interest in using IP data as a source of commercial intelligence.

IPR protection is generally seen as conducive to innovation, though the strategies of companies with respect to patent acquisition and, latterly, use of copyright rules to limit the behaviour of other agents, requires careful appraisal in this light. Certainly, renewed efforts to establish common European patent are required, but the revisions to patent law that are mooted require extended consultation that consider the innovation impacts of change and stability explicitly. (For example, modifications of the rules for dynamic sectors - e.g. shorter lifetimes of patents - and extension of patents to cover business processes.) Similar consultations also to examine ways in which copyright and other rules may need to be adapted to stimulate - rather than impede - innovation. (The rapid development of copyright law to fit it with the activities enabled by new digital media urgently needs to examine innovation impacts of the developments in law and practice.) Improved advice and support should be provided to SMEs for their development and implementation of IP strategies (including negotiation with large business partners). IPR regulations and competition policy need to be jointly examined in the light of innovation trends in the knowledge-based economy.

Some attempts are being made to address these issue, e.g. the development of a Community patent, but there are many associated problems and they can be too limited in their scope, e.g. with the focus on copyright in the knowledge economy being limited to issues of piracy. What is clear is that this discussion has barely scratched the surface of the issues raised in connection with IPR and innovation. It can fairly safely be guessed that the coming years will see further problems being confronted, and the challenge is to develop frameworks which will allow these issues to be debated and acted upon in more effective ways.

6.5 Enterprise

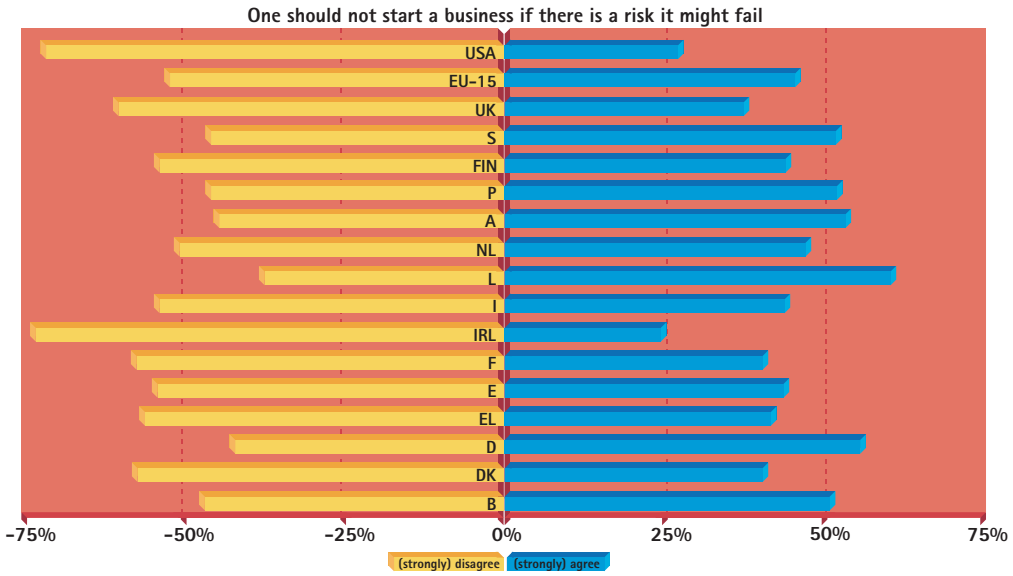
6.5.1 Overview

An enterprise is a form of organisation for economic activity, and a legal entity - a business enterprise or firm. But enterprise more generally is a concept that embraces an energy associated with economic activity - individuals and firms can be enterprising. DG Enterprise aims to nurture enterprise as a project, in this latter sense. In order to do this, its activities are focused on innovation, competitiveness and entrepreneurship and on promoting activities related to the health and vitality of enterprises, SMEs (Small and Medium-sized Enterprises) in particular.

An enterprising business will be engaged in entrepreneurial and intrapreneurial activity and will be striving to increase its competitiveness. Thus to be enterprising is close to being innovative. Innovation policy and enterprise policy are symbiotic. Innovation is an entrepreneurial activity, not a purely scientific or technological activity. It requires action on service delivery, marketing, design and organisational change; it is driven by imagination and opportunity, not just the discovery of new scientific knowledge or technical capability. But while Europe has many bright spots, it still lacks in dynamism. It has been argued that this is because "[d]espite efforts on the part of all the countries, the entrepreneurial spirit is generally weak across Europe as a whole". (Commission Staff Working Paper SEC(2000) 1825, p3)

This is one of many assertions that a good deal of Europe's economic tardiness as compared to the US, especially in SME and job creation, has to do with entrepreneurial attitudes. Strong evidence on this point is hard to come by, but a recent Flash Eurobarometer survey on "entrepreneurship" among the general public in the EU and the US (conducted in autumn 2000) provides some interesting leads. One of the key results concerns attitudes towards risk taking. - see Figure 6.5a. Europeans are more inclined to believe that one should not start a business if there is a risk it might fail (45% as against 27% in the USA). There seem to be few differences between Europeans and Americans as to willingness to give a second chance to people who have started their own business and then failed area less pronounced - most people are happy to do so. And the perceived difficulty of setting up a firm is also seen as roughly similar (though Europeans are liable to see it more difficult to get relevant information and negotiate administrative hurdles). But Europeans are much more cautious than Americans when it comes to the creation of a business. This may be an important factor inhibiting new business formation.

Figure 6.5a Attitudes to Entrepreneurial Risk, Europe and USA
Proportions agreeing and disagreeing with statement



Source: Flash Eurobarometer 107: Entrepreneurship Survey conducted on behalf of The European Commission, Directorate-General Enterprise by EOS Gallup Europe; available online at: http://europa.eu.int/comm/enterprise/enterprise_policy/survey/eurobarometer107_en.pdf

6.5.2 Drivers of Change

The call for greater entrepreneurship in Europe is nothing new. Has anything been added by the emergence of the knowledge-based economy? There are several ways in which this is the case.

First, consider the role of SMEs. A great deal of policy attention is directed towards SMEs, who are seen as major sources of job creation and entrepreneurial experimentation. Two-thirds of EU employment and more than half the value-added are accounted for by firms with less than 250 employees (the threshold for medium-sized enterprises: below 50 employees are small enterprises, below 10 microenterprises). As Figure 6.5b indicates, these smaller firms are particularly prevalent in services (other than transport, communications, and finance). Many smaller service firms are relatively uninnovative (cf, analyses of the Community Innovation Survey by Tether et al, 2001). This is the case for many smaller firms in distribution, personal services, and the like - though even here there is a good deal of incremental innovation and a number of extremely dynamic and venturesome companies. But some service sectors are highly innovative, even though they are heavily populated by SMEs. These include, in particular, business services - and especially the Knowledge Intensive Business Services (KIBS) that are an important element of the knowledge-based economy.

The development of such services, encouragement of their use - especially by sectors and types of firm hat have had little access or recourse to them in the past - should be stimulated.

Figure 6.5b Sectoral Distribution of Enterprises in the EU, 1997

Sectors of Activity	Enterprises		Employment		Turnover in E		Employment in SMEs
	Thousands	%	Million	%	Billion	%	%
Industry and Energy	2 048	10,9	30,78	27,5	5 047	27,4	54,6
Construction	2 504	13,3	10,1	6,9	942	5,1	88,8
Trade and HoReCa (Hotels, Restaurants and Cafés)	6 622	35,2	30,54	27,1	5 264	28,6	76,6
Transport and Communication	997	5,3	8,4	7,5	847	4,7	47,5
Financial Intermediation	320	1,7	4,68	4,2	4 380	23,8	26,8
Other business Activities	2 401	12,8	12,01	10,6	793	4,3	63,6
Other services	3 910	20,8	16,21	16,21	1 126	6,1	77,3
Total of all sectors	18 802	100	112,72	100	18 399	100	66

Source: European Commission Report (2001) **Creating an entrepreneurial Europe – The activities of the European Union for small and medium-sized enterprises (SMEs)** COM(2001) 98 final Brussels,

Second, new business models are emerging, from "virtual organisations" to integrated supply chains. Enterprises should be encouraged to explore new business models - both in terms of their internal organisation, and in relation to participation in networks and value chains of various kinds. While it is not the job of government to tell firms how to organise themselves, there is a cogent analysis that organisational innovation is lacking in Europe. It may even be as big a problem as attitudes to risk-taking (or perhaps the two compound each other) (Andreasen et al, 1995, presented a strong set of arguments about the need for organisational innovation). Policymakers can do a great deal by way of ensuring that awareness is fostered of the benefits - and dangers - of new ways of working and networking in the knowledge-based economy. Support for organisational innovation, and benchmarking activities are two of the possible measures here. New methods of encouraging the formation of firms such as virtual technology parks and internet based venture capital schemes should be expected to emerge as successors to the current generation of incubators; policies might aim to identify and accelerate this trend.

One issue related to organisational innovation is e-business, the use of the Internet for marketing, financial transactions and networking more generally. Broadband penetration and mobile networking can only accelerate the increasing use of such potentials. The importance to enterprise policy of e-commerce and its implications for business models is likely to be considerable, and to present unexpected possibilities. This suggests that Foresight and other techniques should be used to anticipate, prepare for and shape such possibilities.

More sophisticated and specialised ways of exploiting knowledge are emerging; enterprises are now frequently being created to process knowledge or to deliver knowledge-based services to other businesses rather than to manufacture products. Innovation is therefore not just an internal project activity but is one that transcends several companies. Companies will move into and out of networks and collaborations and will thereby cause a continuous dynamic reconfiguration of the 'industry' in which they do business. So new management skills will be needed to run these companies, where innovation will be the normal way of doing business rather than a perturbation.

6.5.3 Implications

Without enterprise, the goal of achieving a competitive knowledge-based economy is remote indeed. Designing policies that allow enterprise to flourish is a difficult craft, and it is important to further develop ways of drawing on the experience of entrepreneurs and KIBS who are engaged in enterprise support. It will be important also to examine the potential impact of contributions from other policy areas - tax, employment law, etc. - on these fields, as well as to highlight the need for regulatory reform to benefit enterprise as a project..

Enterprise is at the heart of successful innovation. Entrepreneurial attitudes - even if not precisely identical motivations - underpin much innovation in public sector organisations. Support for such enterprising attitudes in general should be fostered. This is liable to require new approaches in the educational and vocational training systems, and methods that link innovation management with entrepreneurship are appropriate.

Small and medium sized enterprises (SMEs) will continue to remain an important focus of innovative effort, and of policy interest. The two should be brought together: innovation support facilities can be built into systems that aim at supporting SMEs in general. Support for the development of networking and innovation "clubs" is another element here. Links with Higher Education Institutions and with business services that can assist SMEs' choice and implementation of innovations, and the further development and commercialisation of their own innovative ideas, should be fostered.

There is much need to continue to assist SMEs with adoption of innovations, especially those that will allow them to participate on a more equal footing in the knowledge-based economy, and in some cases achieve entry to new markets and more independence from large-firm-oriented networks.

Examples of support that might be available here include for instance, web design and maintenance services for small producers and retailers. (These might best be organised on a locality basis - there are liable to be significant economies of scale and reductions in learning times associated with pooling of resources across, and services of this kind to, SMEs.) Award systems can be good ways of promoting and diffusing knowledge of good practices, and an example here would be the introduction of awards for innovative SMEs (in "traditional" as well as "innovative" sectors), and for SME support services themselves. Information on the drivers of innovation performance – e.g. a "benchmarking " of emerging trends in the global environment as experienced in different sectors, supply chains, regional and countries, and the responses adopted to deal with these – can contribute to building new capabilities for innovation. Enterprises and economies can build foundations for ongoing innovation and learning by competing in global value chains, in which SMEs need support to achieve involvement appropriate to their level of technological competence.

6.6 Research

6.6.1 Overview

R&D and innovation are crucial drivers of growth and productivity. Technology push and market pull are important factors that determine the strategic direction of R&D and innovation (in both the private and public sectors); both should therefore be examined carefully and interpreted imaginatively, especially given that they are evolving rapidly. Research policy should be considered in this broad context.

General framework conditions strongly influence the extent to which the benefits of R&D and innovation are appropriated by firms, regions and national economies.

R&D is an investment that generates knowledge as well as prepares for the introduction and improvement of products and services; it does not just serve a functional business requirement or solve a specific public need, but can be exploited commercially in a variety of ways (e.g. licensing). This is becoming an increasingly important component of business strategy; there is scope to promote it more generally as a development strategy for public sector institutions and the networks in which they operate. Intellectual property regimes including patent protection are important to the appropriation of benefits from R&D and innovation in some industry sectors but are less important where secrecy, complementary assets and lead time are also exploited as business strategy (Arora et al 2002).

The creation of efficient markets in technology (and knowledge) also needs to be considered; the use of ICTs is important in this respect.

Manufacturing industries are globally dispersed but Europe has a high concentration of R&D expertise with international collaborations and needs to strengthen this position.

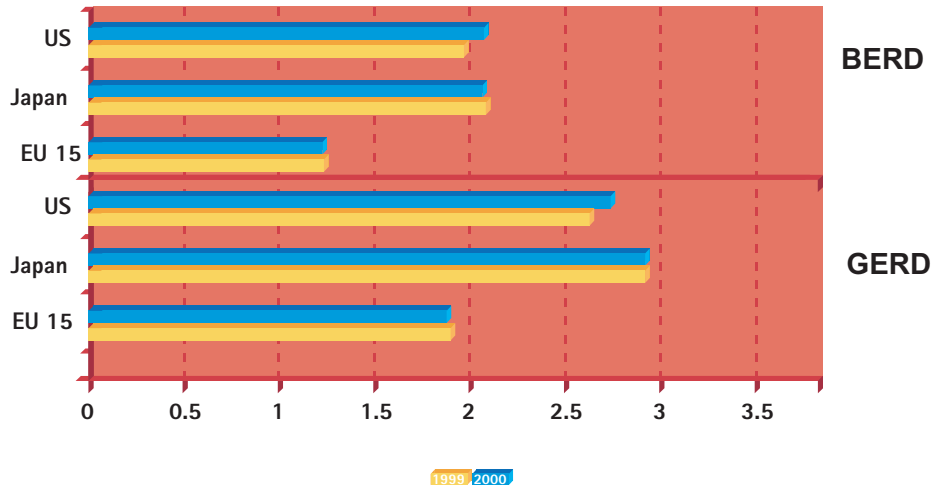
Multinational businesses will locate and sponsor R&D where it is most cost effective (but not just the least expensive) and where access is easy and secure; **Europe needs to ensure that it is at the frontiers of knowledge and it offers the highest value added cost effectively.**

In an advanced knowledge-based economy, research and other services are important sources of employment opportunity. Europe's strategic aims need economic activities to be based around the highest levels of the value chain. Both public and private RTD programmes should reflect this requirement.

It is recognised that the EU is lagging behind the US and Japan in terms of money spent on research and people employed in research. Figure 6.6 displays relevant data from the structural indicators, that confirm this: both business and total research expenditure lag in the EU. As we move into a knowledge-based society this is liable to be storing up problems for the future - or rather, failing to store up solutions to emerging problems and competitive challenges. There is need for knowledge generation through research and development, and for skilled persons to work in the new economy.

Europe must play an active role in RTD. This is in part because of a number of developments inherent to the RTD sector itself, mainly that: high level research is increasingly complex and interdisciplinary; and increasingly costly. High level research requests a constantly increasing "critical mass", and needs good connections with intermediaries that can relate it to commercialisation. Additionally, new research management tools may also be important in **increasing the productivity of research.**

Figure 6.6 Business Enterprises Expenditure on R&D (BERD) and overall Gross Domestic Expenditure on R&D as a percentage of GDP



Source: Annexe 2 to the Commission Staff Working Paper in Support of the Report from the Commission to the Spring European Council in Barcelona COM (2002)14 final, "The Lisbon Strategy - Making Change Happen" Brussels, 22.2.2002
(note; qualifications to data - especially time periods considered are provided in the original source)

6.6.2 Research policy and innovation policy

The "top-down" perspective on research illuminates links between changes that are possible in research policy, and points to related changes that might occur in the following policy areas: innovation, enterprise, employment, education, competition, trade, the protection of IPR, ICTs, financial services and risk capital, taxation. Both examples of top-down analysis provided above, in fact, start to identify such links with other policy areas. But each is developed from a single policy perspective. **The links between research and innovation policies seem to be among the strongest and most obvious of all interactions between various policy areas.**

However, it is important not to assume a linear, "technology push" relationship between the two. Not all research is directed towards the stimulation of innovation, and innovation is not the sole justification for research. However, much research is implicitly or explicitly intended to promote innovative ideas, and the need is to ensure that the multiple relations with actual and potential users of the new knowledge are effective ones. More widely defined the relationship between RTD and innovation may be changing, as is recognised by the arrival of discussions of 'strategic research' and 'mode 2 research'. In addition the "top down" perspective can work in a more generic, even more visionary, way. This allows us to pick up common issues, including some that are as yet only "weak signals" in individual policy areas.

One current concern centres on the rise of litigation in the USA in particular around such matters as IPR, health and safety, environment and employment law, and competition issues (to name but a few). The concern is that this is having huge impacts on what innovators can and cannot do, and on the costs that they confront. Key decisions are being made by legal personnel, with technical advice that at worse is one-sided and at best is barely able to consider the wider implications of judgements for innovation processes. The suspicion is that this is a problem that is currently most visible in a few fields but that will become salient to innovation policy on a much wider scale in years to come.

6.6.3 Institutional flexibility and innovation

Scientific and technological innovations are associated with complimentary institutional adjustments that facilitate the translation of innovations into products and devices. The first academic revolution started when universities began to regard themselves as agencies of research as opposed to purely teaching institutions.

More recently, there has been a second academic revolution, which involves a shift toward entrepreneurship and the nurturing of new business opportunities. This 'incubator' approach, whereby universities train and develop young firms, as well as young people and then send them out into the commercial world, is growing in popularity. Along with a shift towards entrepreneurship, there has been a move away from discipline-based research toward multidisciplinary research. This has in a few cases led to the creation of new hybrid disciplines such as 'bioinformatics' (Etzkowitz et al., 1998).

Research teams, laboratories and even companies and entire Member States find it increasingly difficult to be active and play a leading role in the many important areas of scientific and technological advance. The development of modern research in a global environment needs co-operation at different levels, co-ordination of national or European policies, networking teams and increasing the mobility of individuals and ideas. National efforts across Europe would be too fragmented to meet the challenge.
However, it has been recognised that to date there has not been anything that could be called a European research policy, as RTD remains contained in national boundaries. Efforts are now being made to rectify this with the focus on the European Research Area (ERA). The ERA is intended to optimise the European Union's collective capabilities by creating "a frontier-free area for research where scientific resources are used to create more jobs" (Research Commissioner Philippe Busquin). A series of initiatives aimed at making the ERA become a reality have been launched; they include the proposal for a new "framework programme for Research and Technological Development 2002-2006" which will be an important tool alongside national efforts and other European co-operative research activities. Integral to the strategy will be the creation of a network of "world-class centres of excellence" sharing their knowledge beyond national borders and linked by high-speed electronic networks.

6.6.4 Implications

Innovation has long been a fundamental objective of the Fifth EU Framework Programmes. The Fifth Framework Programmes established "innovation cells" in all of its thematic programmes, with the aim of fostering exploitation and transfer of technologies and useful knowledge generated in the course of the work. Additionally, a horizontal programme aimed at the "promotion of innovation and the encouragement of participation by SMEs". The new Framework Programme will also have innovation high on its agenda, and discussion of the European Research Area (ERA) features this. There is much interest in themes discussed elsewhere, such as the promotion of risk capital and of a single EU patent at affordable cost.

While the links between research and innovation policy seem obvious, **there are still questions posed by the development of the knowledge-based economy.** Is the understanding of RTD still appropriate given the different emphases on innovative activity involved in, for example, innovation in service activities and functions? Is sufficient attention being paid to the role of KIBS as sources as well as disseminators of knowledge? What challenges are faced by research policy to do with its governance (e.g. transparency, public accountability), and how far are these product or cause of the conflicts surrounding such innovations as genetically modified organisms? With the globalisation of economies, and often of research, how should EU RTD policy relate to activities in other regions?

6.7 Information and Communications Technologies (ICT) and e-government

6.7.1 Overview

The Information Society is among the central features of the knowledge-based economy. ICT is at the heart of a technological revolution, which has evolved at a remarkable pace and reached an unprecedented range of applications. Initially thus was often seen as a matter of computer and telecommunications hardware. It is now widely recognised that the embedding of microprocessors in equipment of all sorts is yielding new sorts of information processing and storage devices. It is also changing the functionality of many established devices and products of many kinds, not least by allowing them to communicate and interoperate. Additionally, the vital role of software has become visible, as well as that of "content" or "dataware" (such as websites, e-books, e-maps, videogames, and much more). And the convergence of computing and communications that is apparent in the Internet (and potentially in other new media such as mobile data communication and digital TV) has spawned new applications – in ecommerce and e-government, for example. Some of these create demands for new skills; and some give new impetus to social concerns about data protection, pornography, privacy and crime.

ICT and its applications have thus been one of the main foci of innovative effort, in ICT products and in the diffusion and the achievement of further innovation in other sectors and fields.

Thus, ICT innovation is more than the process of creation or diffusion of a single product. Rather, it involves many interlinked innovations, which are being developed at different rates, so as to offer diverse, sometimes competing, functionalities. The network capabilities of new IT raise particular issues for its diffusion, highlighting the role of standards, issues of content and intellectual property, and interaction among users. The rapid pace of change in IT products, services and applications means that many of these never seem to "mature". Generations of technology follow in a succession of products - and of implementation strategies (commentators have not only identified different generations of ICT hardware and software, but also different stages of organisational strategy, and even different phases of Information Society itself (cf. Miles, 2002). One of the factors helping to promote the rapid pace of change – in addition to market demand, concentration of R&D efforts, and the like, is the "recursive" nature of ICT.

It can be applied to the ways we handle knowledge - indeed to our undertaking of innovations. Innovation processes are being transformed and intensified by the application of IT to modelling and simulation, information search and knowledge sharing, and even invention itself. **ICT provides tools for fostering innovation and for the management of innovative organisations.** The new technologies can be used to facilitate R&D and other innovative activities dispersed over space, to provide tools for project management and intelligence about the strategies of other firms, the location of scarce expertise, or the characteristics of markets. Other major technology developments are crucially dependent on ICT. Computers and sensors, plus powerful software tools for data analysis, are used in all sorts of engineering and design activities, as well as in research. This underpins, for example, the importance of bioinformatics as an organising pole in the new biotechnology sectors.

The pervasiveness of ICT has made it an object of policy for decades, as the strategic importance of supply industries and of effective use of ICTs has been widely recognised. Policies have evolved from fostering national champions and supporting supply-side R&D, to more general "information society" or "information superhighway" policies, accompanied by efforts to support the emergence and consolidation of dynamic applications in ecommerce and e-government, for example. R&D policies, meanwhile, are looking ahead to future generations of ICT, as in notions of "ubiquitous computing" and "ambient intelligence".

As befits the importance of ICTs, and the centrality of information society developments to the knowledge-based economy, a number of the structural indicators do bear upon ICT issues. Figure 6.7a shows that the EU lags behind the US in Information Technology investment. The lower costs of equipment and services (see Figure 6.7b for data on relative costs of telecommunication services) mean that even where expenditures appear to be comparable, as in the case of telecommunications, the functionality obtained from this may vary considerably.

Figure 6.7c confirms the general impression that EU households tend to be less linked to the Internet than their US peers are. The latter will also often benefit from low telephone charges to access the Internet, pus more availability of broadband connections. (Interactive digital TV and mobile telephony capabilities are more developed in Europe than the OS, though mobile data communications services are very successful in Japan, however.) Figure 6.7d does not allow us to extend this comparison to business use, though the data suggest that most EU countries have more than 80% of their enterprises connected. Benchmarking studies commissioned for the UK's Department of Trade and Industry suggest that the bigger EU countries have fairly similar levels of Internet access than the US: though this does not tell us much about the frequency and strategy of use.

Figure 6.7a Expenditure on Information Technology (hardware, software, other services) and on Telecommunications Technology (telecommunications equipment and services) as a percentage of GDP

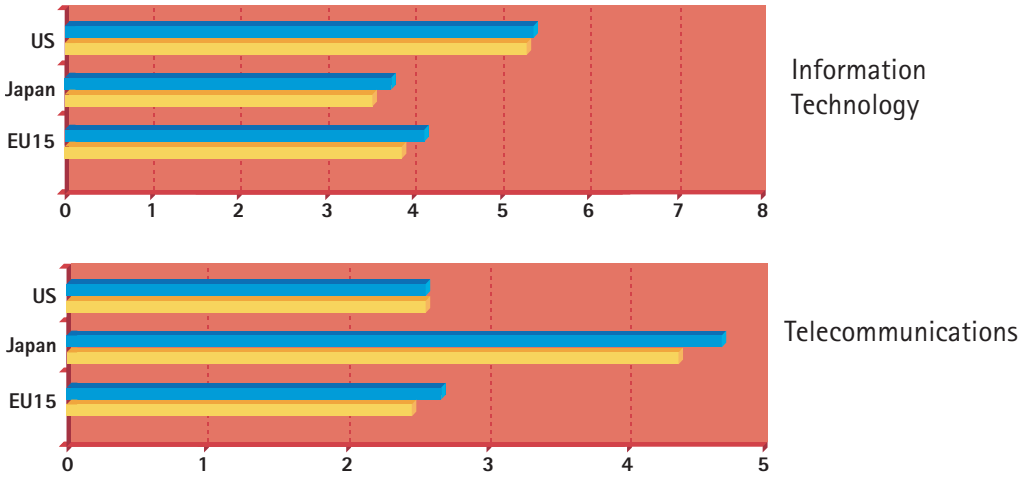
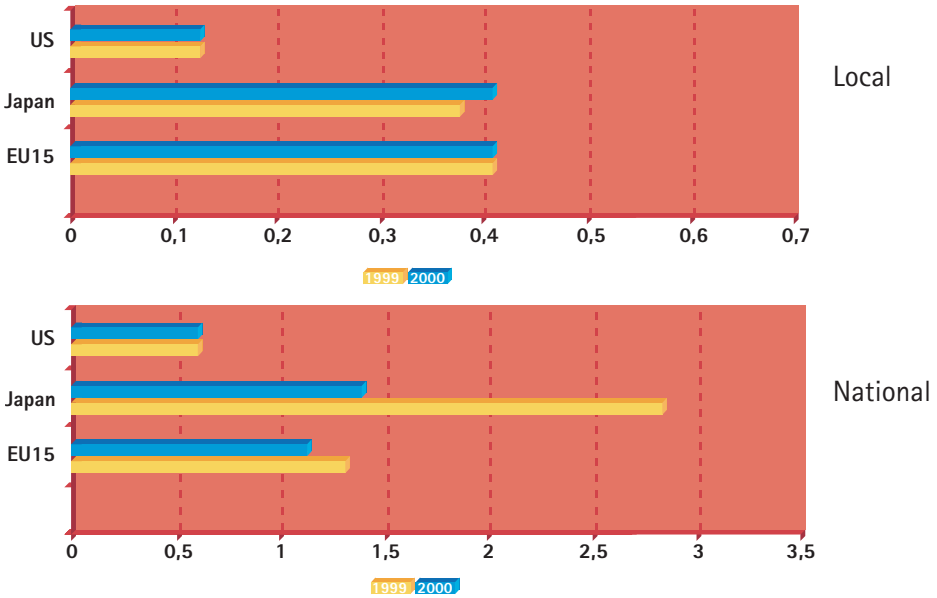


Figure 6.7b Price level and evolution in the telecommunications market (Euro)
Price in Euro (including VAT) of 10 minute call at 11 am on a weekday for local (3km)) and national (200km) calls



Source: Annexe 2 to the Commission Staff Working Paper in Support of the Report from the Commission to the Spring European Council in Barcelona COM (2002)14 final, "The Lisbon Strategy – Making Change Happen" Brussels, 22.2.2002 (note; qualifications to data - especially time periods considered are provided in the original source)

Figure 6.7c Percentage of households who have Internet access at home

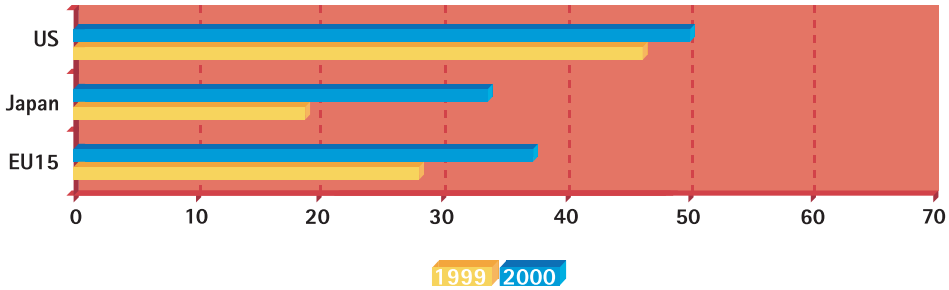
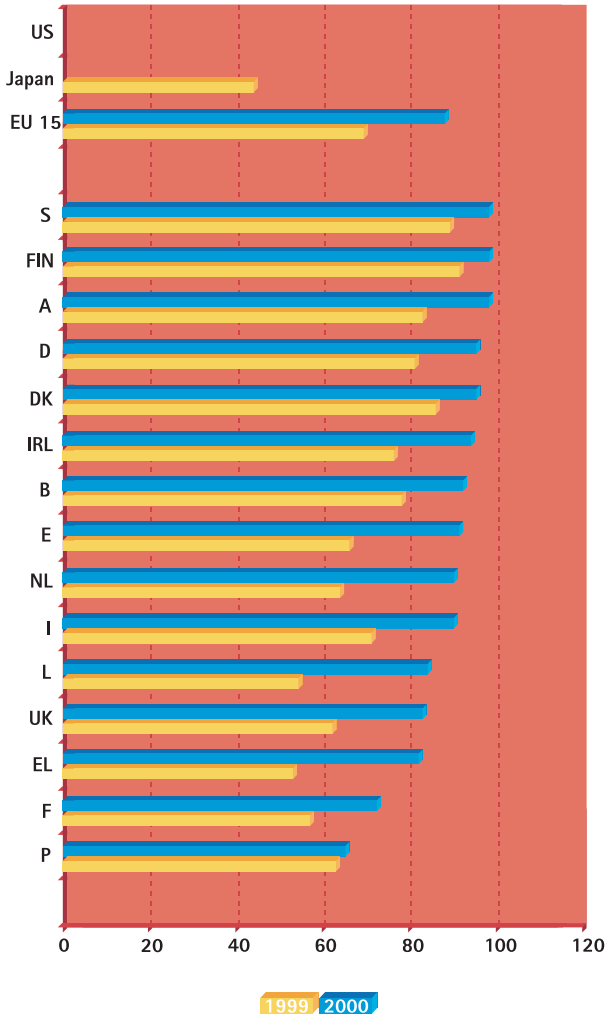


Figure 6.7d Percentage of enterprises who have Internet access



Source: Annexe 2 to the Commission Staff Working Paper in Support of the Report from the Commission to the Spring European Council in Barcelona COM (2002)14 final, "The Lisbon Strategy – Making Change Happen" Brussels, 22.2.2002 (note; qualifications to data - are provided in the original source; for instance the Japanese enterprise sector is of firms with more than 5 employees, and the EU households are those with telephone access rather than the whole population.)

6.7.2 Drivers of Change

The boundaries between innovation policies and ICT policies are very fluid ones, since ICT is itself the focus of and a facilitator of innovations. The pervasiveness of ICT means, too, that policies of practically all kinds have ICT elements, whether we are thinking of improving health or social services, making government more efficient and accountable, supporting the development of SMEs and of industrial competitiveness. This pervasiveness underlies many more specific drivers that could be identified as impinging upon the relations between these two areas of policy. A brief list of some of the main drivers we might identify here is:

- Naturally, **the ongoing development of ICT itself.** This is well-captured **in "Moore's Law"** concerning the power of microelectronic devices, and the similar "laws" that apply to magnetic discs, optical fibres, and practically every other component in ICT. This exceptionally rapid development means, among other things, **that innovators of all kinds are liable to be looking forward to the capabilities of components that will be on the market in future years.** It also implies that there is a **high level of obsolescence in equipment and devices; and that new standards are continually being forged and new applications pursued.** The role of government in the formation of standards has largely shifted to one of facilitation industry agreements and (sometimes) support through procurement; questions of standards are bound to remain important in industries where dominant players (e.g. Microsoft) use them to maintain their position.
- Unexpectedly high levels of market demand for many ICT applications – most notably in the recent past, mobile (including text messaging) and Internet communications and DVD systems. However, this growth in demand is not always sustained and there have been significant disappointments in some areas (e.g. WAP systems, home automation, and the like). One result of this has been considerable instability in stock markets and elsewhere as investors have flocked into and out of high-tech stocks: many start-ups have collapsed, several established firms are facing serious problems, and there is a lack of confidence about the ICT sector.
- In general there has been much less public resistance to ICT applications than was feared in the 1980s, when great alarm was raised about job loss, deskilling, invasion of privacy, etc. However, new generations of network technology are being brought into play. Public and private organisations alike continue to generate large volumes of information about everyday life through video surveillance, loyalty and ID cards, and other means. Policymakers have to balance demands concerning the application of fundamental principles (e.g. freedom of information and its uneasy companion, privacy protection), on the one hand, with practical requirements (commercial demands for better marketing information and government demands for better security) on the other.

■ **The emphasis on software, user interfaces, and "content" associated with the rise of ICTs is liable to shift the focus of innovation in important ways.** Elsewhere the issues of IPR as associated with the informational aspects of ICT, and the increased ease of copying and disseminating such products, have been discussed. Another implication is the possible growth in emphasis on social and human sciences alongside engineering and natural sciences. Multidisciplinarity may be becoming a critical factor in ICT policymaking and research management, and in innovation processes more generally.

■ Improved telecommunications networks – usually seen in terms of broadband systems capable of delivering high-quality interactivity to end-users – are important for the development of information society. Policy challenges are confronted in mobilising such networks, and stimulating their roll-out in peripheral regions and affordability to SMEs, in the context of policies of tele communications deregulation.

■ Similarly a "social infrastructure" is required for public and business confidence to be established in ecommerce and probably in other emerging applications of ICT (e.g. "ubiquitous computing" is liable to require ready access to all sorts of personal data through information networks). Broadly agreed rules concerning privacy and security of activities, accreditation, trust and liability arrangements, and the like need to be established. As with more technical standards, regulatory frameworks can be stepping-stones to market development and stimulation of innovation, or impediments to them.

■ Users are important in innovations in many ICT applications, often surprising the original corporate innovators with the uses to which they put the new technologies. User communities are also often important vectors of innovation and diffusion, and in some cases there are extremely active but widely dispersed communities engaged in furthering particular approaches to and applications of ICT. **It is quite common for innovations to require a "critical mass" of users before they really take off.** This is particularly the case for network technologies, as many ICT applications are. ICT itself offers ways for user communities to establish and maintain themselves, and to set up "gift economies" of support services (since the new media allow for the exchange of experience, software codes, templates, etc. among user groups). Policies relevant to such user communities may well need to be developed further, since they may contribute constructively (e.g. Linux), ambiguously (e.g. file-sharing systems), or destructively ("hacking") to the use of ICTs.

■ Experience of the general public with access to high volumes of up-to-date information, are liable to place increasing demands on government to supply similar facilities for an **informed citizenry** and participatory democracy, for business support and social services. It is likely, too, that alternative sources of information will emerge and potentially contest the officially sanctioned ones. This could be the case not only in government per se, where political parties and campaigning groups may seek to make their voices heard in new ways, but also in public services more widely. Alternative approaches to health, education, etc. are likely to become more evident (some of these with commercial orientations, some more driven by social or political goals - but all potentially innovative).

Given the borderless nature of the Internet, these challenges may come from anywhere, reflecting different cultural traditions and resources. There are questions of social exclusion repeatedly raised with respect to Information society, too, but these may be particularly acute where e-government is involved.

- Finally, there are continuing **concerns around the "productivity paradox"** and related problems. Why is it that so little impact of ICT investment is visible in European productivity statistics (and is the apparent impact in the US really sustainable)? **Are statistical changes necessary, or are different ways of evaluating and justifying** investments in ICT and ICT research required? **Or is it that the real deficits are in organisational learning processes, in management, and in effective implementation of the technology and its applications?**

6.7.3 Policy perspectives

European Union policy supporting the Information Society[IX] has responded to such drivers with a number of main lines of approach :

- **eEurope: Supporting Europe's entering the digital era** with the objective of promoting competition and job creation. The aim is to accelerate the development of the Information Society in Europe, so as to stimulate the creation of new services and economic activities
- **eContent:** promoting active content sectors, while combating illegal and harmful content on the Internet.
- **Promoting increased competition in telecommunication services in Europe, through:** revising the regulatory framework for liberalisation of communication services, monitoring its execution, and supporting liberalisation and the development of new services (including GATS dialogue). One major aim is to reduce prices for and enhance access to affordable, high- quality communications infrastructures and services.
- Strengthening research and technical development (RTD) potential in the area of Information Society technologies in Europe.
- Increasing public awareness of the impact of the Information Society (e.g. the PROMISE programme), increasing computer literacy at all levels of society, and facilitating the formation of the necessary skills to benefit from being members of and agents in the construction of the information society.
- Creating a clear and predictable legal framework for e-commerce, so that Internet users feel safe in their use of the new media.

6.7.4 Implications

ICT is seen as one of the main foci of innovative effort – far from reaching maturity, the technological revolution here is ongoing, with new capabilities appearing continually. New products, processes, services and systems are announced so frequently that some commentators are concerned that the pace of innovation is simply too high for many people to cope with.

We barely have time to learn about a set of technical options, the argument goes, before a whole new range of options comes along. We barely have time to learn how to use new technologies to best effect, before we are presented with a quite new set of capabilities. These complaints may be justified to some extent, and perhaps they go some way to explaining the "productivity paradox". But there is little indication that either businesses or consumers are being seriously deterred from exploring and adopting new ICT. The bursting of the "dot.com bubble", and subsequent stock market instability, has had far more of a negative effect on ICT investment. **The main problems in consumer markets seem to be associated with effective saturation of some markets** (e.g. for mobile phones – we are reaching the point where there is as many phones registered as there are adults in some countries, for example). **This simply drives suppliers on in the search for innovative features on which new markets can be built.**

ICT is also seen as providing tools for innovation and the management of innovative organisations. Erkki Liikanen, Member of the European Commission responsible for Enterprise and Information Society, has specified (on his home pages)[x] that the:

> *"...main priority is to foster an entrepreneurial and innovative Europe based on an inclusive information society... Information is becoming the main economic resource and the key to growth, competitiveness and the creation of better quality jobs. To reap the benefits of the e-economy we need to fulfil essential conditions, such as computer literacy at all levels of society, and access to affordable, quality communications infrastructures and services".*

The rapid pace of change in ICT, and its pervasive utility (include its applications back to innovation), means that it will continue to feature as a major element of innovation policy. The specific features of ICT mean that policies for the technologies of information society are likely to impinge upon innovation policies, and vice versa, in substantial ways. Policies fostering ICTs continue to be required as the technology itself develops, its uses become more pervasive and multifold, and problems of access and skill remain significant. In addition to continuing efforts to bridge skill gaps, it is important to continue to be vigilant against "digital divides". For example, measures may be required to ensure that SMEs are not excluded from e-markets by high entry costs, and that cheaper software and support services that are appropriate to SME business processes are available. Public bodies (local and regional agencies and HEIs as well as national governments should be encouraged to participate in the development and demonstration of innovation-oriented "knowledge management" and information systems (so as to establish standards, awareness of good practice, etc.). The scope for extended use of open source software should also be explored.

6.8 Financial Services and Risk Capital

6.8.1 Background

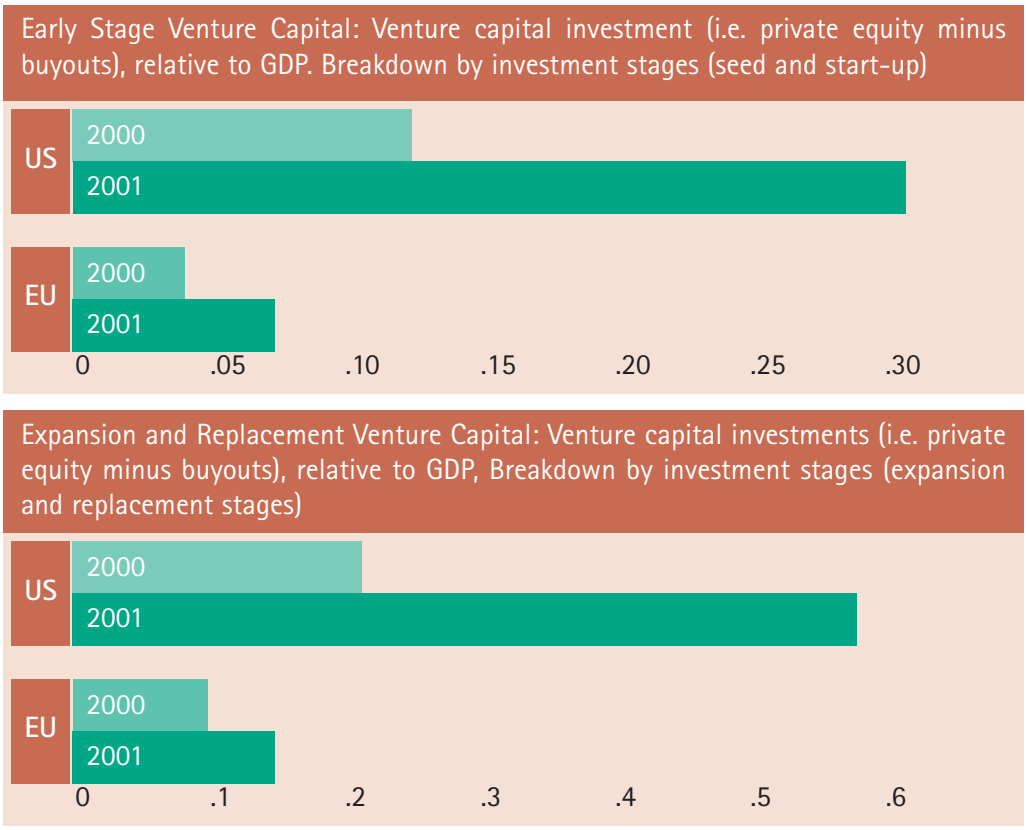
Innovation requires finance, and finance for innovation can come from a wide variety of sources[XI]. The financial services sector is a sophisticated and complex system in its own right. It has developed in very different ways in different parts of the world, which makes comparison a complicated affair. Block (2002) has provided a useful review of the links between financial systems and innovation. He argues that national financial systems influence economic performance through their effects on innovation, but that different types of financial system may favour innovation efforts in particular types of technology sector. His detailed results are complex, and are limited in that the performance data only concern manufacturing industries. But two features are outstanding:

- **First, financial systems need to be classified in a multidimensional way rather than in terms of simplistic stereotypes.** Some countries do fit relatively well into a simple dichotomy between bank-based systems (e.g. Germany) and stock market-based ones (e.g. the USA). But Japan has an important stock market, while usually being characterised as bank-based; Sweden has high accounting standards and market capitalisation alongside high levels of bank and product market concentration. Block's methodology shows the multidimensional nature of financial systems (though the statistical analysis that follows cannot really examine the systemic relations between these parameters).
- **Second, empirical analysis points to relationships between financial systems and performance.** Sectors characterised by "high technological opportunity and a focus on product innovation" (which are typically sectors based on radical new technologies) are likely to benefit from financial systems involving "large stock markets, competitive banking sectors, and good accounting standards[XII]. Sectors characterised by process innovation, on the other hand, are likely to benefit from financial systems oriented towards banks and featuring "concentrated ownership structures". (Block, 2002, p1) Thus the institutional framework of the financial system may be more conducive to some forms of innovation, and to innovation in some sectors, than others. Block points out that this can go beyond the provision of innovation finance, and involve issues of corporate governance, ownership, change in management structures, etc., but these important matters are beyond the scope of the present study.

Turning from such details about financial arrangements, it is obvious enough that the quantity of funding is an important issue. Sufficient available financing is, quite simply, a necessity for innovation. In general, the opportunities for funding support for innovation have generally been more limited in the EU than in the US. Two of the structural indicators presented to the Barcelona Summit in 2002 deal with innovation finance: early stage Venture Capital, and Venture Capital for expansion & replacement (see Figure 6.8.). While the precise figures are to be treated with caution – especially in the wake of the financial crises of the last years - the basic message is clear.

Both the volume of venture capital available in the US, and the share of such finance in GDP, are much higher than that in the EU. Further, Verlinden (2001) suggests that US venture capital is more innovation-related than Europe's. His data indicate that of a total of $12.7bn of venture capital investment in the USA in 1998, 74% was technology-related, whereas the EU total funding was less than half this value – and only 28% of it was technology-oriented (though this share was growing rapidly).

Figure 6.8 Venture Capital in EU and the US



Source: Annexe 2 to the Commission Staff Working Paper in Support of the Report from the Commission to the Spring European Council in Barcelona COM (2002)14 final, "The Lisbon Strategy – Making Change Happen" Brussels, 22.2.2002 (note; qualifications to data - especially time periods considered are provided in the original source)

A wide range of financial services is available to serve the different needs of individuals, businesses and other organisations (including the financial services industry and its own institutions). Among these are pensions, insurance, savings and investments plans, mortgages, loans, bonds, equity and microfinance (i.e. lending very small amounts - up to € 25 000 - often targeted to specific groups that would otherwise not get loans.)

Within each category there are many different products and services. There is a high level of competition within certain sectors of the industry.

The business areas of the financial services and risk capital industries are financially interdependent. They are governed by interest rates, inflation and currency fluctuations, as well as by industry practices and regulations. The industry is regulated from several perspectives and taxation policy is a closely related issue. Taxation rules in particular can stimulate product innovation through the provision of incentives. There have been significant process innovations in the industry (such as the introduction of telephone and Internet services, and that of equity markets dedicated to technology stocks or innovative companies). Such innovations dramatically change the geographical constraints that might otherwise reduce access to services. At the same time the structure of the industry is changing as a result of mergers, acquisitions and globalisation.

There are longstanding complaints about the short time horizons of some capital markets. Clearly, well-informed investors are clearly better able to direct funds to commercially attractive innovations. However, knowledge-based firms' main assets are 'intangible', as they lie in the skills of the employees, making market value very hard to assess and, in many cases, leading commercial banks to avoid investments in such firms due to their risky nature. The European Commission aims to remove obstacles and release the potential of SMEs to contribute to competitiveness, growth and employment, with innovation symbiotic to this objective. The problems of financing for innovation have long been recognised; accessibility of finance across Europe is monitored under the Financial Services Action Plan[XIII] and the Risk Capital Action Plan[XIV].

The Lisbon European Council provided an important impulse to the integration of EU financial markets and EU risk capital markets in particular. Paragraph 20 of the Presidency conclusions states that: "it is essential ... to push forward the integration of EU financial markets". Furthermore, it recognises that:

> "efficient risk capital markets play a major role in innovative high-growth SMEs and the creation of new and sustainable jobs".

Paragraph 21 requires that steps should be taken to complete the implementation of the Financial Services Action Plan (FSAP) before 2005 and of the RCAP before 2003.

6.8.2 Innovation finance : drivers of change and policy responses

Innovation finance includes finance for innovative enterprises and finance for other kinds of innovation. The timescales, risks, collateral, size of transaction and stage of finance (e.g. seed, start up or expansion) are important factors in matching the needs of an enterprise to the financial products that are available. Intermediary organisations, including accountants, advise clients and negotiate on their behalf. Despite the move of many accountancy firms into consultancy (perhaps now being reversed?) these are often not the same intermediary organisations as those advising and supporting other aspects of innovation.

The financing of enterprises is changing for a variety of reasons. Some classes of innovation demand particular sorts of finance - long-term support, large levels of support for equipment, support for marketing and intellectual property protection, and so on. The rapid pace of innovation means that providers of finance may have trouble understanding the new concepts being pioneered, let alone assessing their viability and the competition they may encounter. SMEs and networks of firms may be poorly linked to financial intermediaries. Changes in the supply and demand of finance associated with these and other developments can cause market gaps that need to be addressed.

While large companies may finance innovation internally, SMEs are more likely to seek external finance. A distinction is often made between supporting the growth of SMEs (enterprise finance) and supporting innovation. However this distinction is likely to become blurred. This is because R&D and innovation are increasingly being organised and financed through contracts (between firms in collaborative networks or supply chains) and by the creation of knowledge-intensive businesses. These and similar SMEs are regarded as 'innovative companies'.

> "The term 'innovative companies' refers to companies, particularly start-ups, which develop and bring to market goods and services that are either new, science-based, or contain other innovative elements. Such companies can most often be found in sectors like such as information technology, life sciences, medical equipment and other science-based industries among others."[xv]

Innovation finance is offered via such instruments as:

- loans,
- equity (risk capital) investments,
- venture capital,
- informal and micro finance (such as by business angels) and
- public sector schemes.

We briefly discuss some major points arising in respect of three of these instruments.

Loans

Loan finance is the most important source of external financing for most European enterprises. Loan finance differs between the Member States, depending on the closeness of the relationship between enterprises and banks, on the extent to which internal finance is used, and on the structure of the banking sector. The Observatory for SMEs has noted[XVI] that the financial structure of an enterprise seems to depend more on the financial system and financial practices of the country in which it operates than on the characteristics of the enterprise itself, such as size, sector, age and even profitability.

The different banking traditions in the Member States influence the instruments used in SME finance. If bank loans are difficult to get, the SMEs use other available forms of finance to cover their working capital and investment needs, including overdrafts and long payment periods. The conditions for bank loans differ between Member States, both in their term (long term or short term), and in the interest rate.

The problem of collateral is a general one, but has been alleviated in some countries by using public or private guarantee schemes. In general, SMEs use more debt than large companies, and its maturity is shorter. The problems in the candidate countries reflect those in the Member States, although the circumstances tend to exacerbate the problems.

However, loans are usually a minor part of any innovation finance package. **Banks are reluctant to invest in innovation projects. Many investment projects relate to intangible assets and the commercial success of an innovation project can be highly uncertain.** Entrepreneurs have to present a business plan to explain the technical feasibility of the project and its prospects in the marketplace. **Evaluating innovative projects is a major challenge for banks and other potential investors,** as they have to assess the merits of the project against the capabilities of European and global competitors. In addition, as the technical sophistication of innovation projects increases, assessing the business plans becomes more difficult. In addition intangible assets offer no or only very limited collateral for bank loans, and venture capital is often therefore the best solution for innovation finance. However, the award of venture capital can open doors for bank loans.

The gradual increase in the use of equity and alternative forms of financing will make the majority of enterprises (but not specifically innovative companies) **gradually less dependent on bank finance.** Consequently, the providers of risk capital will exert an increased influence on smaller enterprises, both in providing management support and in influencing decision-making.

Risk Capital

Risk capital includes equities and venture capital. The venture capital industry depends partially on the efficiency of equity markets since it needs to realise its investments from time to time. Innovative companies are dependent on the availability of suitable financing. The risks associated with innovation point towards the use of risk finance for innovation, at least at an early stage. Equity markets in Europe are evolving in a positive direction (e.g. dedicated markets for technology stocks and newly established companies).

The level and type of finance depends on the stage of development of the enterprise. Seed and start-up finance is the most important source in order to develop innovative businesses. The provision of early stage equity capital by formal venture capital investors in Europe increased significantly from € 444 million in 1996 to € 6,662 million in 2000. Around 4,700 companies in their early stage received investment capital. The provision of expansion capital increased from € 2,712 million in 1996 to € 12,986 million in 2000. But much remains to be done if the EU risk capital market is to be brought onto par with that of the United States (hence the deadline of 2003 to implement the Risk Capital Action Plan). Hybrid debt-equity and guarantee instruments can be fruitfully used in later stages of enterprise development. Innovative companies' finance can also be successfully supported by public-private partnerships. The Risk Capital Action Plan and its yearly follow-up reports tackle the fragmentation and gaps in venture capital finance, and barriers to the access of financial services.

On average, the European venture capital industry concentrates in on later-stage financing, although differences between Member States are considerable. Consequently, problems exist in several Member States for innovative start-ups. Debt finance is usually not available because the intangible assets such as intellectual property, which are most important for innovative companies, cannot be used as loan collateral. The different forms of public support for early-stage finance are trying to address the problem. However, due to budgetary constraints and limits to state aid, the schemes are more and more geared towards risk sharing in co-operation with the private sector. As the tendency is away from direct subsidies, risk-sharing instruments like loan guarantees, counter guarantees, and co-guarantees have become an important part of public support schemes for SME development.

A number of initiatives have been introduced to try and remedy the relatively inadequate supply of European venture capital (in comparison to the US). Such initiatives include amongst others, I-TEC and the ETF Start-up facility.

The European Investment Bank. tailors its activity to EU policies and acts in partnership with the banking community and international institutions. It has forged co-operative ties with the EU institutions and the European banking community, which enable it to ensure optimum interaction between its loans and EU budgetary aid. The European Investment Bank "Innovation 2000 Initiative" (i2i) identified the promotion of R&D as one of the areas where it should be more active.

Public sector schemes

Public sector schemes typically exist because there are gaps in the spectrum of products available to finance technology development or innovative companies. Gaps are usually found in the provision of small scale or seed capital finance and where perceived risks are an obstacle. Public sector schemes can be supported at a regional, national or European level. It is possible that there is insufficient continuity between the award of public sector support and applications for private sector innovation finance. In the latter much is left to the determination and perseverance of the entrepreneur and judgements about these intangible factors have been used to validate decisions. The success of an innovative company or an innovation project often depends highly on an enthusiastic champion. A conducive environment for innovation, such as a business incubator centre in a science park, can nurture these intangibles and allow potential investors an opportunity to evaluate them more carefully. In the absence of other collateral (or even when there is intellectual property involved) this can be important. Such centres can attract investors and intermediaries and as a result demonstrate by example in a particular locality that innovation finance is available.

Guarantee instruments stimulate lending and equity finance for innovative companies through assuming part of the risks. Besides investing its own and EIB funds, the European Investment Fund[XVII] invests Commission funds through the Start-up Scheme of the European Technology Facility and the SME Guarantee Facility, which target the existing early stage finance gap for innovative enterprises and the lack of collateral preventing banks from lending to these clients.

The European Commission launched the Gate2Growth Initiative in June 2000. It is the umbrella under which it is supporting the take-off of a number of projects that should become self-sustaining. These aim to facilitate access to private innovation finance and to provide tools for better knowledge protection and exploitation for innovative firms. The prime objective of the Gate2Growth Initiative (http://www.Gate2growth.com) is to support innovative entrepreneurs in Europe.

6.8.3 Implications

It has been recognised that EU firms tend to have greater difficulty in accessing adequate financing for innovation than their US equivalents. The problems of accessing finance can be particularly acute for knowledge-based firms whose main assets are intangible and reside in the skills of their employees, making market value hard to assess. In order to address these issues, a number of EU initiatives have been established. Central to this are the **Financial Services Action Plan**, which should be fully implemented by 2005, and the **Risk Capital Action Plan**, which should be fully implemented **by 2003**. The main instruments for offering innovation finance include: loans, the most important source of external financing for most European enterprises; risk capital; and public sector schemes, which typically exist because there are gaps in the spectrum of products available to finance innovation. With loans being only a minor part of the financing of innovation, the focus of initiatives has been on promoting the availability of risk capital, and on public sector schemes, which are not only financial but also designed to facilitate links between finance professionals and entrepreneurs.

There is continued need for the development of instruments providing finance for early-stage innovation and smaller firms: it is widely recognised that gaps in availability of small-scale venture capital require attention. Financial support for various activities (e.g. licensing, patent investigations, etc.) also needs to be fostered. Further development web-based financial services for SMEs is also recommended, together with appropriate awareness campaigns and support services. **The financial community should be helped to acquire better intelligence about emerging areas of technological opportunity, as well as about the general dynamics of innovation** (e.g. time required to reach profitability, complementary assets that may be required for commercialisation, typical barriers). Better tools and standards are needed for accounting for innovation-related intangible assets and intellectual capacity in firms. (Substantial input from business experts is required, to ensure that reporting regimes and procedures benefit those regulated, as well as imposing the lowest possible new burdens on them. In other words, the new data that are produced and the new procedures that are followed should be ones that benefit the firms concerned, as far as possible, as well as imposing fewest new costs on them. It may be able to follow the practices already explored by trend-setting firms here, for example.)

6.9 Education and Culture

6.9.1 Overview

Education is of course central to the knowledge-based economy. The importance of education to innovation is much wider than the supply of research scientists or production engineers and influences every person, or business or other organisations such as hospitals. Higher education plays a central role in the development of both human beings and modern societies as it enhances social, cultural and economic development, active citizenship and ethical values. Education can create a qualified workforce, management capability and flexibility, informed and demanding consumers or users of innovative applications – products processes or services. The importance of innovation to education, not least to schools and universities, is also significant. Education is a site for innovation, for adoption and demonstration of new technologies, for instance. Education related to innovation focuses around higher education and technical and management skills. It also influences attitudes to risk (financial and entrepreneurial risk, as discussed above) and patterns of employment and self-employment.

Responsibilities for the quality, level and direction of education especially higher education depend on attitudes, student and family incomes and employment prospects, and on standards and curriculum design in schools, colleges and universities. Governments can strongly influence all of these factors via changes in funding for study (grants, loans, tuition fees, graduate taxes), and in the quality and orientation of research and teaching (general and professional qualifications, budgets for research councils, the status and salaries of public sector employees such as teachers, nurses...) and hence influence the demand for certain courses. Much of this is, however, determined by national governments.

While the structural indicators do not provide us with direct US/EU comparisons, it is apparent from those cited in Figures 6.9a and b below that there is a huge range of variation within the EU in terms of investment in education and in lifelong learning. It is interesting that many of the same countries appear at the top of both lists, though the disparity in the UK's performance in life-long learning clearly demands closer inspection. Figure 6.9c indicates that there is wide variation across the EU in the production of graduates in science and technology, with several countries performing better than the US in this respect.

Figure 6.9a Spending on Human Resources: total public expenditure on education as a percentage of GDP

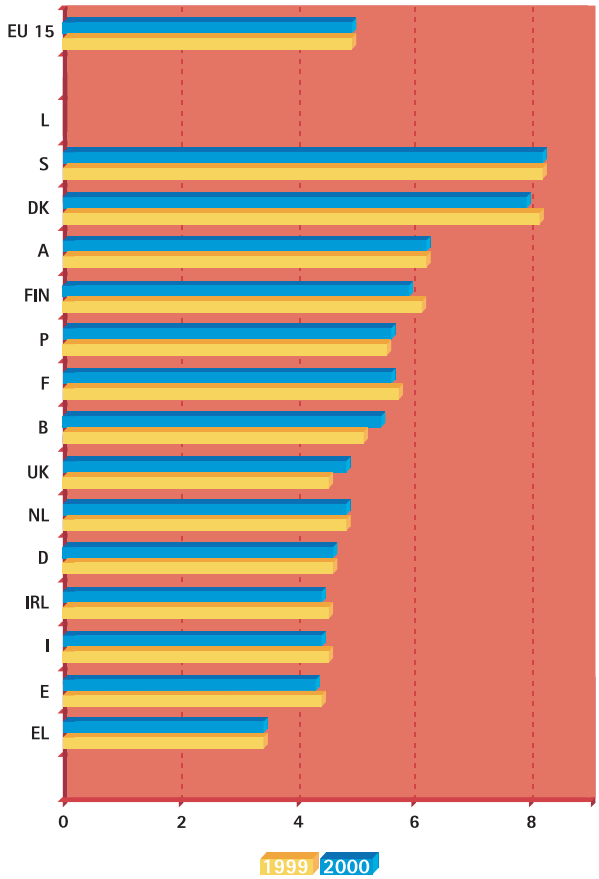
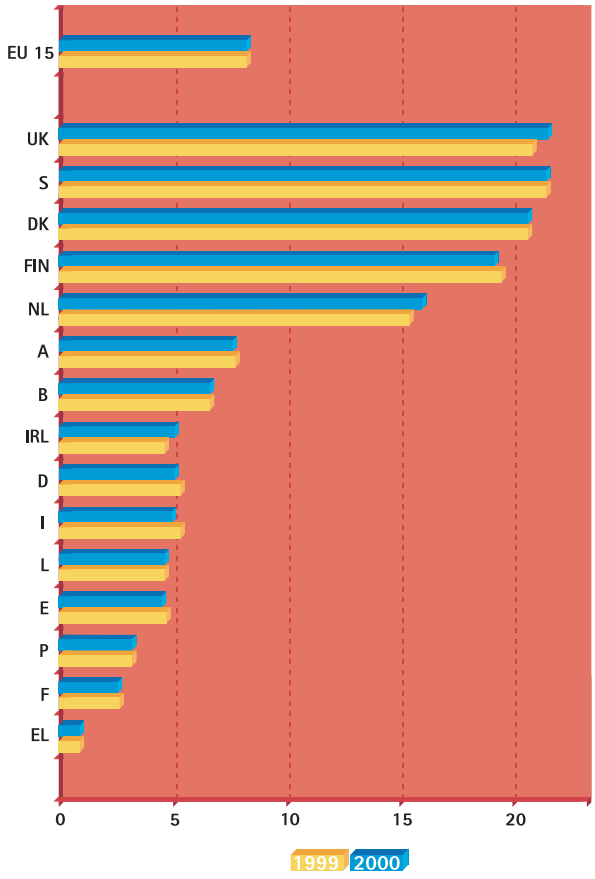
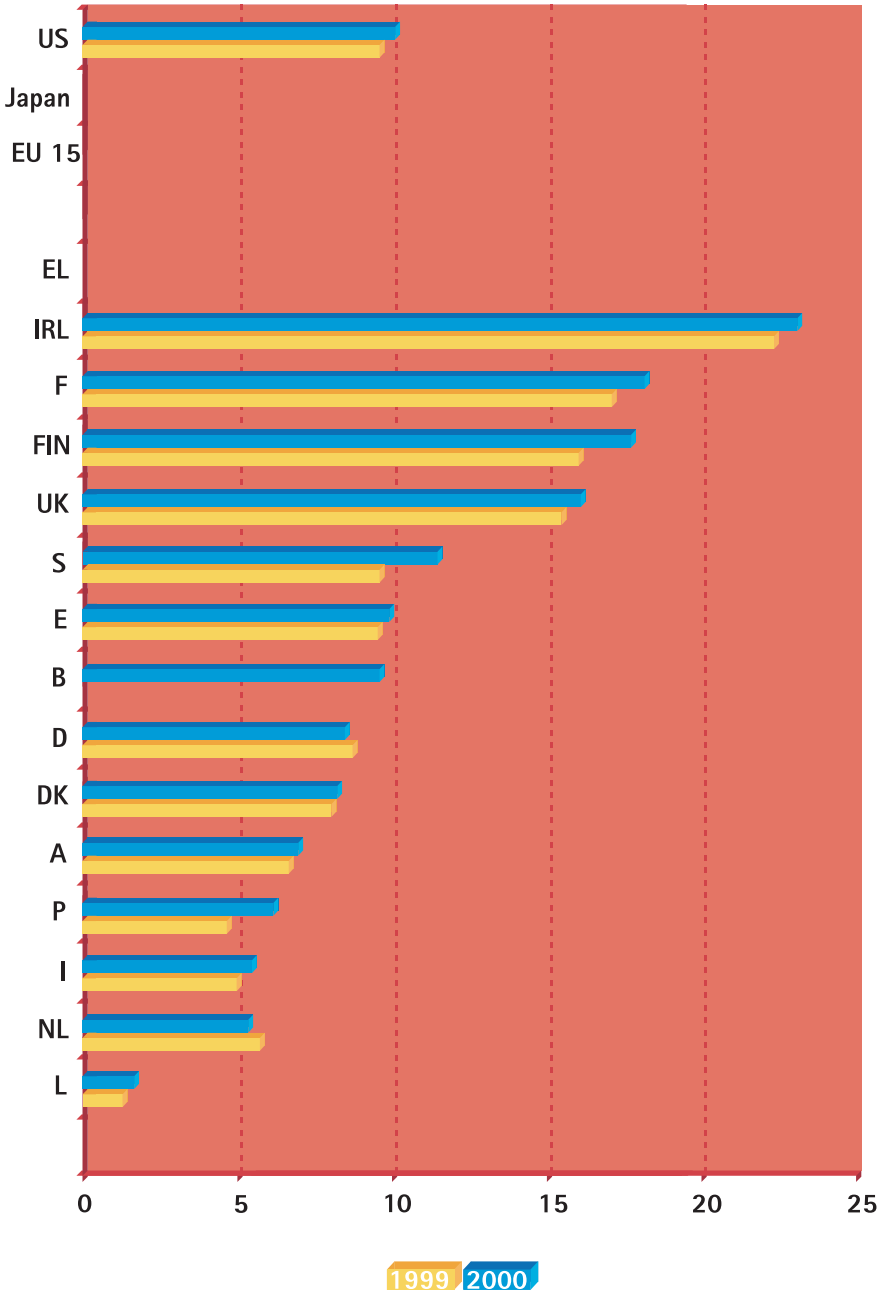


Figure 6.9b Data on Lifelong Learning: Percentage of population, aged 25-64, participating in education and training



Source: Annexe 2 to the Commission Staff Working Paper in Support of the Report from the Commission to the Spring European Council in Barcelona COM (2002)14 final, "The Lisbon Strategy – Making Change Happen" Brussels, 22.2.2002 (note; qualifications to data - especially time periods considered are provided in the original source)

Figure 6.9c Tertiary graduates in Science & Technology per 1000 population aged 20 to 29 years



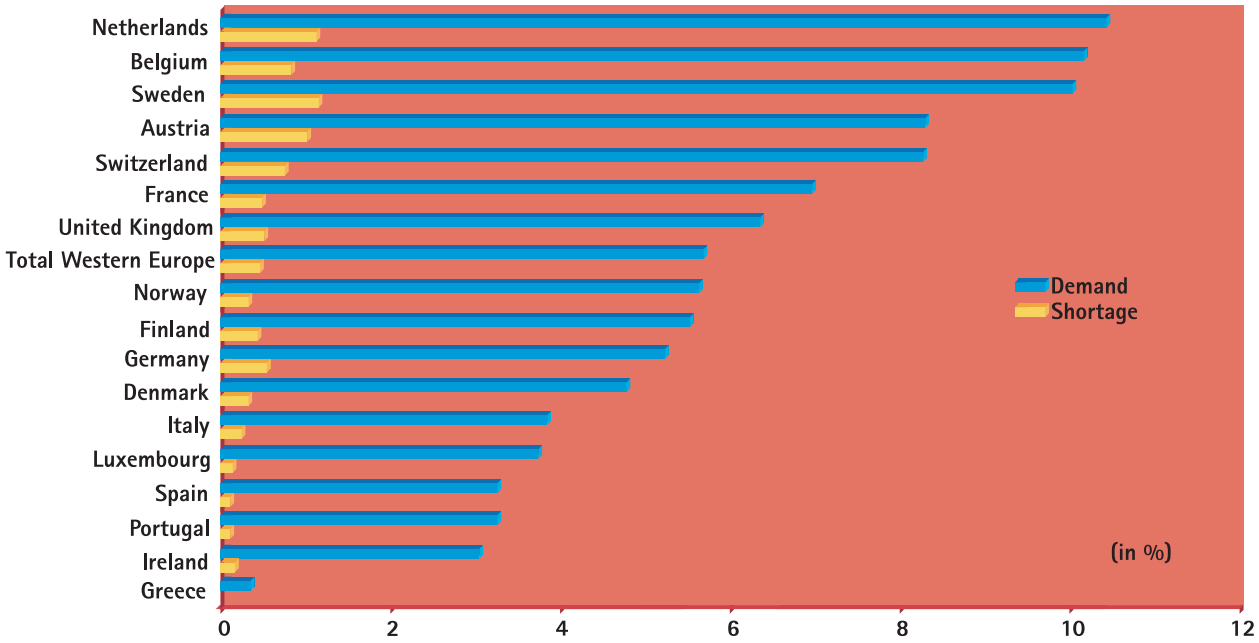
Source: Annexe 2 to the Commission Staff Working Paper in Support of the Report from the Commission to the Spring European Council in Barcelona COM (2002)14 final, "The Lisbon Strategy – Making Change Happen" Brussels, 22.2.2002 (note; qualifications to data - especially time periods considered are provided in the original source)

6.9.2 Drivers of Change

Innovation is stimulated by, and creates requirements for, a skilled workforce. The range of skills demanded by the trends to a service economy, and Information Society, and a knowledge-based economy in general, is vast. Skills are required to generate, implement, effectively use, and generate new uses for innovations (organisational as well as technological).

One vivid example of this is the matter of ICT-related skills. Estimates of shortages here are relatively easy to come by – though this fact should not lead us to assume that these are the only relevant skills – far from it. Figure 6.9d reproduces one set of estimates of the overall demand for ICT-related skills, and the levels of shortages that are reported.

Figure 6.9d Demand for, and shortage of, ICT Skills in Europe, 1999, as percent of total employment



Source: European Competitiveness Report 2001, Graph A.III.1.1

Already shortages are put at several million ICT professionals, and more still if skills connected with e-business are included. Demand is projected to grow, and skill shortages alongside this. **There are many reasons to be cautious in assigning precise values to skills shortages.** The perception of shortages is hard to disentangle from such matters as how much one is prepared to pay for them, whether older workers are being discriminated against, and whether technological solutions could be designed with one or other set of skill requirements built into them. The recent problems in "new economy" sectors have also suggested that a reduction in demand from these sectors is likely – though this is probably a short or medium term affair.

But the general picture would seem to be that shortages are most seriously felt in those countries where there is most ICT employment, and that they can run to ten percent or so of the numbers currently employed in these sectors. Policy responses may require – in addition to expansion of education for these skills – promoting outsourcing and relocation to areas where shortages are less severe, permitting immigration of suitably trained people, and helping business find its own solutions in terms of training and retraining facilities.

Moving away from ICT specifically, several member states report perceived problems in the supply (i.e. number) of suitably qualified scientists and technologists, especially at PhD level. This seems to be primarily a problem for national governments to address but it has some relevance to the creation of the European Research Area. This will have implications for the distribution of qualified workers – possibly leading to a higher concentration of resources around the most prestigious research-intensive employers, and hence a greater struggle in some regions to retain the best qualified staff for indigenous research or other activities. Innovation can be stimulated by an influx of new knowledge, whenever recruitment is arranged, whether this is from fresh graduates or experienced personnel.

Generating more human resources for research in science and technology in Europe also means that action is required over and above simply improving scientific careers. This is because Europe is observing a disaffection from scientific study, and a loss of interest among the young to pursue careers in scientific research in particular. A key question revolves around science teaching. It is at school that a basic knowledge and understanding of science is acquired and that a taste for scientific and technical subjects is developed. Some initiatives have been taken in Member States to make the public and in particular the young more familiar with science and its methods. Accordingly, the European Commisssion organises a competition each year for young scientists [COM (2000) 6]. This also highlights the need for teachers and trainers to consider using new innovative tools and teaching methods to attract and retain young people in areas of scientific and technical study. Also at the 'higher educational level', HEIs (Higher Education Institutes) should ensure that some of their research outputs are more directly aligned to their teaching programmes, as it is important to note that HEIs are important national research centres of excellence and not only teaching establishments.

The ability of individuals and communities to use Internet and other information technologies, discussed in relation to the ICT policy area above, is related to business efficiency and hence innovation. But it is valuable for a wide variety of other reasons, not least for access to information for problem solving and marketing information across a diverse range of small and large organisations. In addition it can create or stimulate new markets within and across communities or social groups where previously innovation might be slow to diffuse. The scope for innovation in e-learning technologies is itself significant and indicative of 'new' kinds of future innovations.

The eLearning Action Plan – 'Designing tomorrow's education', was adopted by the EC in May 2000. This is part of the wider eEurope Action Plan and especially focuses on infrastructure (i.e. Internet access for schools) and training issues. The intention is to involve education and training players, as well as the relevant social, industrial and economic players, in order to make lifelong learning the driving force between a cohesive and inclusive society, within a competitive economy. Language learning is increasingly being promoted in the educational curricula of Member States and modern languages are increasingly a growth niche in the educational multimedia market, which is attracting interest in the public and private sectors [COM (2001) 172].

6.9.3 European level considerations

At European level, education in general and higher education in particular are not subjects of a 'common European policy': competence for the content and the organisation of studies remains at national level. However, according to Art. 149 of the Treaty of Amsterdam, the Community 'shall contribute to the development of quality education by encouraging co-operation between Member States', through a wide range of actions, such as promoting the mobility of citizens, designing joint study programmes, establishing networks, exchanging information or teaching languages of the European Union. The Treaty also contains a commitment to promote life-long learning for all citizens of the Union. Therefore, the Community has a complementary role to play: to add a European dimension to education, to help to develop quality education and to encourage life-long learning. All the recent European summits (from Lisbon 2000 on) underlined the contribution of education in setting up the 'European knowledge society'.

There are several reasons for the EC to continue to promote cross-border mobility of science and engineering students within the EU. For instance, postdoctoral research fellows are encouraged to apply for a period (typically one or two years) of their postdoctoral training at a laboratory in another country. Here some of these fellowships are seen as crucial enablers of collaborative team projects between scientists based in different countries and are an example of innovative educational collaborations in scientific fields like molecular biology and neuroscience. In particular, such mobility is likely to have a long-term positive impact on cross-border **"knowledge flows"** – given that human beings are the main carriers of (tacit) knowledge.

This is not just through the relocation of people in new places; the creation and intensification of networks among and Qualified Scientists and Engineers (QSE) is also fostered in this way. This should enable rapid diffusion of information about new knowledge and innovations, and about where to locate new knowledge and expertise; thus it should ultimately impact on the innovative performance of EU countries. Other examples of closer relations between European QSEs are through co-operation via intergovernmental frameworks like ESF (European Science Foundation), EMBO (European Molecular Biology Laboratory) and HFSP (Human Frontier Science Program).

There is an increasing number of various private sector initiatives including corporate universities, business education, and commercial training and conferencing organisations. E-learning and lifelong learning are important issues for employers as well as individual students, and also for retired and early retired or 'portfolio career' persons (who might be a valuable resource in innovation either as a result of their technical expertise or their managerial experience).

Individual students and their families are strong determinants of the subjects studied, and career expectations are changing. Regional and national governments might like to emphasise and encourage education and training in certain geographical areas and sectors but acute problems are created from time to time and immigration from outside Europe might be used to relieve these situations.

Information generated across member states, such as human resources information used for benchmarking, can be valuable in order to raise standards, question the efficacy of policies, and in particular to compare the availability of resources for research and innovation. Such information might be of some interest to private sector employers but is of more interest to governments for policy advice; private sector employers might be more concerned with the competences and inter personal skills of potential recruits than with aggregate statistics. **Care should be taken in the interpretation of international benchmarking statistics and simple comparisons and suggestions that 'more' or 'more intensive' is better for innovation should be avoided;** the relationships are complex and non-linear, and imaginative strategies under adversity might be more successful.

Education at a European level is concerned via several schemes such as **Socrates** with the mobility of graduates and students, especially in science. Access to large-scale facilities or specialised equipment might be one aspect. Scientists and technologists are focused but the potential contribution of the arts and humanities to future innovation is gaining recognition. Culture and heritage are of increasing interest for these reasons, but also because diversity and openness are factors believed to contribute to innovation, and certainly to collaboration and teamwork. Education that maintains the benefits of European diversity for innovation is desirable although this might appear to conflict with schemes that promote mobility and which support the internationalisation and globalisation of business.

6.9.4 Social trends and culture

The ageing population and other trends are important to the demand for education (and leisure), and the demand for support services and hence training and retraining, as well as particular types of equipment and healthcare markets. It also has a bearing on pensions and personal and institutional investment strategies, especially in times of low interest rates for annuities; this might reinforce initiatives and campaigns for increased awareness and information about financial services, with consequences for equity markets and propensities towards entrepreneurial risk.

At the same time youth culture (including sport, music and computer games) is stimulating new kinds of 'industries' and especially the demand for creative industries, including media and advertising services. The importance of design to innovation (i.e. non-price factors) has long been recognised but is becoming more important whenever intangibles are emphasised.

There is an opportunity for curriculum reform and true multidisciplinary education but despite combinations of courses (including ancient history and science in one institution) to attract students towards science there is an inertia and conservatism within professions and professional institutions. In some cases rigid quality assurance can ossify innovation within the curriculum. However, even project-based learning and action learning can be supported over large geographical areas by e-technologies, so there are threats and challenges to poor quality or merely local education services that do not depend on student mobility. Governments might need to shift their emphasis away from how to afford and justify their national education system towards the development of education as a business.

6.9.5 Implications

Along with research policy, education policy helps underpin the frontiers of technological innovation. Supply of appropriate skills and talent can boost industrial innovation and competitiveness, both in high-tech sectors and in the economy more generally where there is a need to choose and utilise innovations initially produced elsewhere. Along with research policy, again, education policy can contribute to more than supporting enterprises and individual career aspirations. It can contribute to the solution of major social and economic problems – for example, in the fields of healthcare, crime prevention and security, the protection of cultural heritage and environmental sustainability, and so on. (see http://europa.eu.int/comm/research/press/2001/pr0510en.html)

Education is a field for the application of innovations in its own right, of course. New ICTs are especially relevant to the provision of life long learning, open and flexible systems that can be tailored to the needs of people in different locations, with different educational requirements and resources. There has been a long history of EU support for programmes that explore and demonstrate the possibilities for such systems, and these have aided the development and diffusion of innovation in many educational institutions. Yet there is still considerable scope for innovation, for learning from good practice elsewhere, for sharing resources, and the like. And education for innovation – for innovative managers, workers, and citizens – is widely regarded as in need of much more development. This is one area where a link has been recognised by policymakers, and there are many pronouncements to this effect. What needs to be established is how it is that the rhetoric has been reflected to such a limited extent in actual practice – and examination of how reform processes in this field may be used to achieve more headway.

Education and culture are sources of human capital and creativity, as well as nurturing institutions that can themselves be the source of innovations. HEIs need to be more entrepreneurial with respect to innovation in the knowledge-based economy. Policies can assist here for instance in terms of facilitating spin-offs and stimulating interactions and collaboration with industry. Of course, this has to be kept compatible with the maintenance of scholarly and ethical standards. But many disincentives are built into current institutions and regulations, and these should be replaced by systems that reward individual academics for such activities. Equally, people with entrepreneurial and intrapreneurial experience should be enabled to contribute more to HEI research and teaching.

In terms of human resources, it is important to develop individuals who combine solid disciplinary understanding with capacities to engage in multidisciplinary teamwork and to communicate across professional boundaries. **Business Schools and Management Colleges,** together with many other HEI courses, should be encouraged to provide high-quality training in innovation-related matters. They can be supported by such means as validation of courses, benchmarking good practice, and provision of suitable teaching material and of opportunities to learn from innovative firms and organisations.

6.10 Taxation

6.10.1Background

'Taxation' is an important structural factor in the European economy. But it is very much a matter for member states governments, with different tax regimes and levels of corporation tax in place in different countries. Although tax legislation is the preserve of member states, they are not completely free in the design of their tax policy and tax incentive instruments. They have, in particular, to comply with EU rules on state aid and on taxation. The EU has an important role in ensuring that the four freedoms of the internal market (free movement of person, goods and capital and the freedom to provide services) are not restricted. It also has a role to play in co-ordinating national activities, disseminating information about good practice, etc. Taxation of course raises revenue for the state, which it can apply to public administration redistribution, and the like. But fiscal measures can be used to steer private industry, by influencing the costs of specific lines of action. One key issue for debate is how tax policy can be used to promote innovation. In the EU, R&D has been the innovation activity most commonly supported under corporation tax rules.

6.10.2 Taxation policy on innovation

In an effort to increase levels of innovation, many countries have turned to fiscal incentives for R&D. The European Commission's survey (EC 1995) on state aid suggested that its members spent over $1 billion per annum on R&D tax incentives during the early 1990s. A valuable recent overview of the issues involved here is the study by Asesoría Industrial Zabala et al (2002) on Corporation Tax and Innovation, which we draw on in parts of the following discussion. This study points out that other types of tax measure, not just corporation tax, can be used to promote innovation, citing examples of the use of capital gains tax and taxes related to stock options and share ownership (among others) applied in this way in member states.

Tax incentives seem a natural policy tool for a market-oriented government wanting to increase innovation expenditures. The Asesoría Industrial Zabala et al (2002) study concluded that general programmes of fiscal incentives that promote a wide range of technological innovation activities tend to be the main approach adopted in countries with lower levels of innovation performance. Those countries with traditionally high innovation performance and large and well-developed technological infrastructures use both fiscal measures and financial incentives ton promote R&D. Northern European countries with high levels of private sector innovation activities tend to use financial means to prioritise particular sectors and/or technologies. Tax relief typically has the feature of stimulating innovation activities, without mandating the specific directions that innovation should take, which financial support measures will tend to do. This should allow businesses to determine the most rewarding lines to pursue. Of course, it is also possible to use taxes oriented to specific objectives (such as eco-taxes) to stimulate innovation in particular directions, so the case is not so clear cut

There are several problem areas that arise in practice, however:

- **Changing the volume of activity – or its designation and location?** Tax relief on a specific activity is liable to have less effect than might appear to be the case, simply because firms will tend to designate activities as falling into this category in order to gain relief. As long as adequate accounting conventions and reporting regimes are in place, this is not necessarily a bad thing – it may well be beneficial for firms to recognise, for example, that some of their software engineering activities actually do conform to the Frascati definition of R&D. There is reason to believe that official R&D statistics understate the amount of R&D undertaken in some firms and sectors. Also, does increased R&D expenditure lead to increases in the knowledge stock, or does it simply lead to higher wages for R&D scientists? Data concerning employment needs to be examined to see how far actual levels of effort are being increased. (In the Netherlands there are fiscal incentives for hiring research personnel.)
  A separate question is raised by Griffith (2000): do R&D tax credits increase the total amount of R&D - or is their main impact to relocate R&D between countries?

Since both effects are possible and may coexist, the question is really one of how far each effect occurs – a topic where research is needed, and where it will need to examine different firm types where impacts are liable to vary. With the greater integration of national markets, tax regulations in general are liable to have more impact on multinational corporations' decisions where to locate their production. R&D tax incentives may similarly have more influence on where R&D facilities are located.

■ **Fixation on R&D?** R&D is an activity that is fairly precisely defined and measured (even though as mentioned above, tax incentives are liable to lead to more activities being "discovered" to be R&D). But it is only a small part of the innovative effort being undertaken by firms. Other activities – such as training and development of human resource, acquisition of innovation-related consultancy and so on - are highly important in the knowledge-based economy. Tax incentives for R&D alone might push the evolution of innovative effort towards R&D at the expense of some other areas. The implications of this are poorly understood and require more analysis. Meanwhile, it is worth noting that a number of attempts to expand the scope of tax incentives have been undertaken. Spain has sought to apply a wider definition of innovation than R&D alone in its fiscal legislation. Particular incentives discussed by Asesoría Industrial Zabala et al (2002) include: those for acquisition of innovative technology (e.g. ICT in Spain), for design activities (Spain) for training (Italy), for quality control (Spain). Experience with these approaches should be studied with the aim of seeing whether they can be successfully employed more widely.

■ **Rewarding large firms?** Large companies have the capacity to study and plan for tax regulations; they are liable to seize available opportunities so that they benefit disproportionately from tax incentives. Some countries have provisions that favour R&D in SMEs. For example, the UK government announced R&D tax credits that were made available to SMEs from April 2000 so that this would encourage innovation by giving SMEs a strong incentive to increase their investment in R&D (HM Treasury, 2000). France provides support for spin-off companies, in another approach. But in general, a simplification of the regulations and procedures should be pursued, so as to make it more possible for SMEs to benefit. Additionally, forms of advice and support in understanding and working within tax frameworks could be targeted at SMEs.

Other possible areas that could impact on innovation could be over environmental taxes, especially with some desire to promote common environmentally friendly tax policies. It is likely that this could stimulate innovation in particular related areas. For example, all European countries believe design for sustainability is going to be a major issue in the future, both internally within their organisation and externally for all companies in the next five years. (Results from a recent survey of 600 European manufacturing companies conducted as part of a 'Design for Sustainability' study sponsored by the UK Design Council.).

6.10.3 The role of innovation in taxation policy

In the knowledge-based economy the critical element of R&D is human resources, therefore fiscal measures that focus on the costs of employment of skilled resources, rather than just turnover or profit based relief, should be paid particular attention.

More systematic analysis is required in order to identify appropriate practice and benefits of innovation in member states, to establish how it interacts with other policy instruments and taxation policy in particular. In the UK, for example, there is some initial movement towards analysing innovation within taxation policies, stimulated by the recent preparation of two consultation papers by HM Treasury *('Initiative/Consultation on The Green Challenge' – tax incentives for environmental improvements and 'Initiative on Supply of Science and Technology Graduates for Research').*

There is ongoing debate about the need and scope for new modes of taxation in a knowledge-based society. Some of the debate relates to such issues as tax reform to enhance sustainability (e.g. carbon taxes), some relates to the use of alternative revenue sources (e.g. fees for use of the radio spectrum). Other issues are posed by new business practices in the knowledge-based economy.

What are the prospects of multilateral agreement over taxation of e-commerce and its implications for innovation? For example, in the USA as e-commerce trading grows, states stand to lose a significant amount of revenue. In response, they are promoting a new 'simplified' state sales tax system and other changes to facilitate state collections of e-commerce taxes. Also an emerging consensus in USA is that a tax on Internet access (e.g. on the fee a customer pays an Internet Service Provider) is a tax on information. Thus some states who imposed this now moving away from it, fearing that it might constrain Internet use by those least able to pay (Institute for Policy Innovation, 2001). However, a powerful case in favour of reassessing the basis of taxation in a knowledge-based economy has also been made from some European quarters, in particular. Here it is pointed out that the shift toward immaterial consumption and intangible assets, together with the challenges that e-commerce creates for taxation of material goods, means that new approaches are required. The Internet remains relatively unregulated in taxation terms, so there is an opportunity here for a "bit tax" or tax on information exchange. (Cf. Soete and Kemp, 1996). The specific proposal would probably impede Internet activities (and create a market in high-value data compression systems), and raise horrendous questions as to application across media (digital TV? conventional radio? books??) and the bit tax proposal has not been received favourably by the EU. But the challenges raised by its proponents are ones that will need to be confronted.

Removing obstacles and reducing the regulatory and tax burdens on small businesses could have a substantial, positive impact on small businesses to facilitate job creation in many innovative industries and services that require skilled people.

Taking up a theme from the financial services policy areas, it is widely acknowledged that *venture capital* is highly risky, as venture capital successes are far fewer than failures. However, when projects are successful, they provide extraordinary returns to investors. Thus, the *tax provisions in relation to a risky, growing companies are most relevant.* These tax provisions are not just related to the taxes paid at the time when a company starts up. They also apply at the time when a person cashes in his gains by selling shares to new investors or incurs losses from unsuccessful ventures (CILP, 2001). EU member states should continue to pursue efforts to create a legal, fiscal and financial environment favourable to the creation and development of start-ups. The interface between companies and financial markets requires attention since financial constraints, including lack of appropriate sources of finance, continue to figure among the most cited obstacles to innovation *(EC Enterprise DG, 2000).*

6.10.4 Implications

While tax removes resources that could be applied to innovation, tax rules can be developed so as to promote innovative efforts and particular directions of innovation. The relationship between taxation and innovation policy encompasses a range of other issues, such as employment, financial risks, environment and regulatory reform. For example, a substantial effort to introduce environmentally-oriented taxes would be bound to shape the direction of technological innovation in profound ways. This again highlights the need for greater co-ordination between all policy areas. There has been considerable interest in the development of environmentally-oriented taxes; this should be seen as opportunity to spur innovation. Accordingly, relevant criteria should be brought into design of such taxes.

Tax incentives for innovative effort are recommended. These should include but going beyond R&D, and thus methods of systematically appraising non-R&D inputs to innovation (and possibly innovation performance) should be developed. Attention should be paid not just to rewarding the level of activity, but also to encouraging continuous improvement of such effort. (In the first instance this will need to be assessed in terms of inputs, but ideally output-oriented approaches will be devised). There is also, again, need for international co-ordination – and for analysis of the effects that taxation policy has on the location of R&D and innovative effort. . And in other policy analyses, to examine how all forms of innovative effort – not just R&D – are influenced by taxation policies – and how these policies might best foster these efforts and the achievement of the most effective results from them.

6.11 Regional Policy

6.11.1 Background

European regions vary considerably, and countries vary considerably in terms of the diversity of their regions. Figure 6.11 draws on structural indicator data to present evidence concerning the variation within countries of so-called NUTS level 2 regions. (Eurostat recommends caution in using any specific indicator of this sort. The precise statistics are influenced heavily by the varying number of cases within countries and the historic definition of regions embodied in the classification. However, the basic message concerning the **diversity of Europe's regions** is one that emerges from just about all conceivable indicators.)

EU regional policy aims to "ensure that all regions and their citizens can take full advantage of the single market and economic and monetary union"[XVIII]. In the past the focus of regional policy tended to be on ensuring a high standard of basic infrastructure. Recently, much greater emphasis has been placed on capacity building and the promotion of innovation.

6.11.2 Regional policy and innovation

Innovation is being built into regional policy to an increasing extent. Reforms to the **Structural Funds** for 2000-06 have increased the possibilities for financing measures linked to innovation. For example, the **European Regional Development Fund (ERDF)** can now contribute to,

> "financing the transfer of technology, including in particular the collection and dissemination of information, common organisation between enterprises and research establishments and financing the implementation of innovation in enterprises" [and supporting RTD] "with a view to promoting the introduction of new technologies and innovation and the strengthening of research and technological development capacities contributing to regional development" (CEC, 2000, p.134).

While the scope of the European Structural Fund includes,

> "promoting innovation and adaptability in work organisation, developing entrepreneurship and conditions facilitating job creation and enhancing skills and boosting human potential in research, science and technology" (ibid.).

The intention is to promote innovative approaches in three strategic areas:

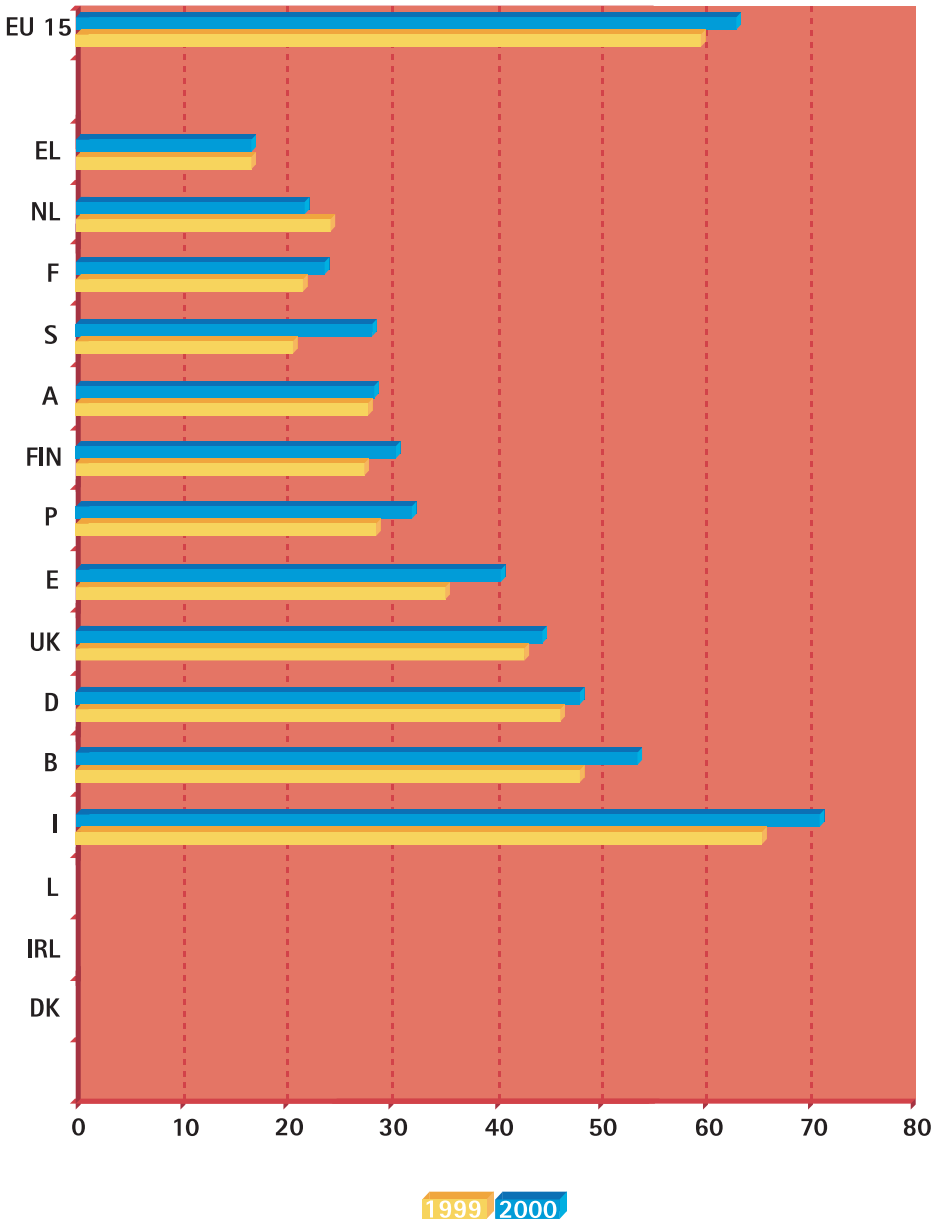
- **Regional economies based on knowledge and technological innovation: helping less favoured regions to raise their technological level.** It is seen as essential that efforts are made to try and establish co-operation between the public sector and bodies responsible for RTDI and business, so that efficient regional innovation systems can be created.

"It is a matter of establishing an environmental and a regional institutional framework which will promote, by reinforcing human capital, the creation, dissemination and integration of
knowledge within the productive fabric as a principle source of innovation and competitive advantage" (CEC, 2001, p.7).

- **e-EuropeRegio: the information society at the service of regional development.** This recognises the risk that the swift development of information and communication technologies could enhance current regional disparities, and possibly create new ones, due to inequalities in access. In the context of the e-Europe initiative, the aim is to ensure that the less-favoured regions are in a good position to take advantage of the opportunities offered by the information society.
- **Regional identity and sustainable development: promoting regional cohesion and competitiveness through an integrated approach to economic, environmental, cultural and social activities.** This recognises the importance of local assets in developing a sustainable and competitive economy.

The links between innovation policy and regional policy have been recognised. **Regional Innovation and Technology Transfer Strategies** (RITTS), funded through the Innovation and SMEs programme, and **Regional Innovation Strategies** (RIS), funded through the ERDF, have been jointly managed by Enterprise DG and Regional Policy DG. Because of the different sources of funding RITTS projects can be located throughout the EU and EEA while the RIS projects are confined to those regions entitled to ERDF assistance. The Regional Policy DG has invited all current RIS and eligible RITTS regions to submit proposals for ERDF assistance (as mentioned above this now has a strong innovation focus), in a RITTS/RIS+ initiative[xix]. A review of the RITTS projects, saw the programme as achieving a positive impact in four areas:

Figure 6.11 An Indicator of Regional Cohesion? The Coefficient of variation of unemployment across regions (NUTS 2 level) within countries



Source: Annexe 2 to the Commission Staff Working Paper in Support of the Report from the Commission to the Spring European Council in Barcelona COM (2002)14 final, "The Lisbon Strategy – Making Change Happen" Brussels, 22.2.2002 (note; qualifications to data - especially time periods considered are provided in the original source)

- "It encouraged a much needed move towards strategic thinking for innovation-orientated regional development.
- It offered mechanisms and incentives to create regional dialogue in geographically, institutionally or culturally fragmented regions.
- It promoted the development of a concept of innovation broader than linear technology transfer, and it helped to raise this higher on the agenda.
- It assisted many regions to clarify the components of their innovation support infrastructures, and to develop actions to rationalise them and augment their visibility." (Enterprise DG, 2001, p.63).

A further policy initiative that has both regional and innovation components has been the **Community network of Innovation Relay Centres** (IRC) that is part of the Innovation/SMEs programme. The Relay Centres have "become a leading European network for the promotion of technology partnerships and transfer between SMEs". The centres are technology advisory centres staffed by business and technology specialists. They are regionally based and hence there is no standard 'centre' as they are designed to fit the needs of the region. In total there are 68 centres in 30 countries[xx].

6.11.3 Drivers for changes in regional policy

Thinking about the importance of regions in relation to innovation and the economy has evolved over the last decade, raising the profile of the issue. Over the past two decades, the focus of innovation policy has shifted from a 'linear model' to one based on a systems perspective, in which the science base is seen as only one among many important components of a 'national innovation system'. Recently, academics and policy makers have begun to refine the **idea of national innovation systems**, considering the **utility of 'regional innovation systems' as both a theoretical concept and a policy objective** (Cooke and Uranga et al, 1997 and 1998). Whilst the regional innovation systems perspective is clearly a development of the innovation systems literature, it can also be considered part of the 'new-regionalism'. In a line of argument reminiscent of some of the points made about the knowledge-based economy, this 'new-regionalism' posits that the nation state is too small to deal with global capitalism yet too large to respond to rapid changes at the local level. Hence, the nation state has been forced to devolve powers upwards to supra-national bodies and downwards to sub-national bodies (Mittleman, 1996; Keating, 1998).

The - perhaps counterintuitive - conclusion of this line of analysis is that, in a globalising economy, regions should be the prime focus for economic policy. Hence, regional policy and innovation policy should be mutually beneficial. This has been recognised in thinking about the establishment of **industry 'clusters'**, which, with the example of Silicon Valley in mind, posits the idea that the clustering of particular firms in particular industries, can be beneficial. It is also an important aspect in **encouraging improved links between universities and their local region**. Recently, efforts have been made to rethink tools designed for improving national innovative performance, such as Foresight, to make them relevant in the regional context (e.g. FOREN, 2001).

However, there is the possibility that innovation policy and regional policy may not be as mutually beneficially as they appear. In relation to innovation, the objective of regional policy is to ensure that all regions have the capacity to be innovative and to take advantage of the opportunities of the knowledge-based economy.

Meanwhile, with the goal for innovation policy of ensuring that the EU is more innovative, and ultimately more competitive, **it could be argued that it would more beneficial to focus investment in regions that are already innovative.**

A further issue concerns industrial clusters, for in attempting to generate clusters in particular regions it may be the case that firms are drawn away from other regions. It is not realistic to expect every industrial cluster in every region – or even that all regions have a firm hold on the industrial clusters that at present seem to top everyone's priorities list (ICT, new media, biotechnology, new materials, etc.). Another potential problem concerns the different needs of companies. Regional innovation strategies tend to emphasise priorities for the majority of enterprises, or for the strongest and weakest aspects of the region. Some enterprises may need different kinds of support, such as better connectivity across Europe rather than associations within the region. Both of these aspects need to recognised.

6.11.4 Implications

Innovation has become increasingly central to regional policy, though there is considerable unevenness in how far this has been translated into effective action – or even effective analysis – across Europe's regions. Regions have become more prominent in innovation policy thinking, too, as it is apparent that many of the most dynamic industrial clusters have a strong regional dimension to them. This is one of the policy areas, then, where there has been more attention to the links with innovation policy. There has been considerable recognition of the regional embeddedness of many innovative clusters and systems. The study also suggests (in the case study work as much as the literature review) that it is equally important to recognise that it is most often cities and metropolitan areas that are the crucibles of innovative activity. These entities require specific attention in regional innovation policy, even though in some cases there will be bitter competition between cities to be the regional champion (while in other cases cities may be more able to co-operate).

Regional innovation strategies should be helped to build more on regional distinctiveness (rather than simply identifying the same set of priorities (ICT, biotechnology, new materials...). It is important to recognise the significance of innovation and new technology for "traditional" sectoral activities (e.g. tourism). Opportunities for linking sectoral strengths (for example, combining strengths in medical care and tourism, or in energy and environment) should be examined, and strategies to capitalise on them fostered.

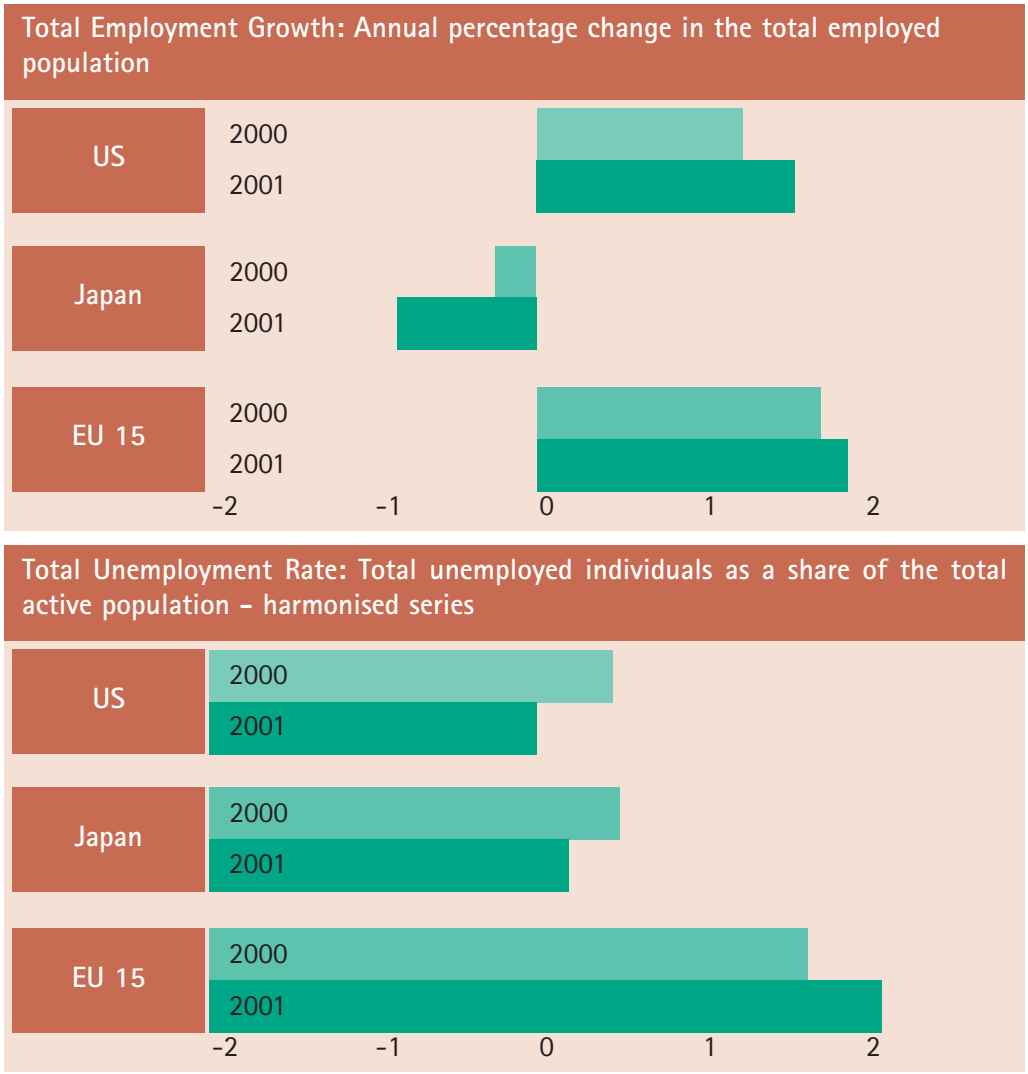
There remains considerable work to be done in understanding the relations between regional development and the fostering of national and European innovation systems. It appears that there may well be tensions between achieving the most rapid growth of high-tech industries, for example, and the reduction of regional inequalities (in diffusion of innovations as well as in income levels and quality of life). This is one area where there has been much effort to document and assess the success of regional strategies, so there should be a reasonable data base from which to develop analysis of such issues.

6.12 Employment

6.12.1 Overview

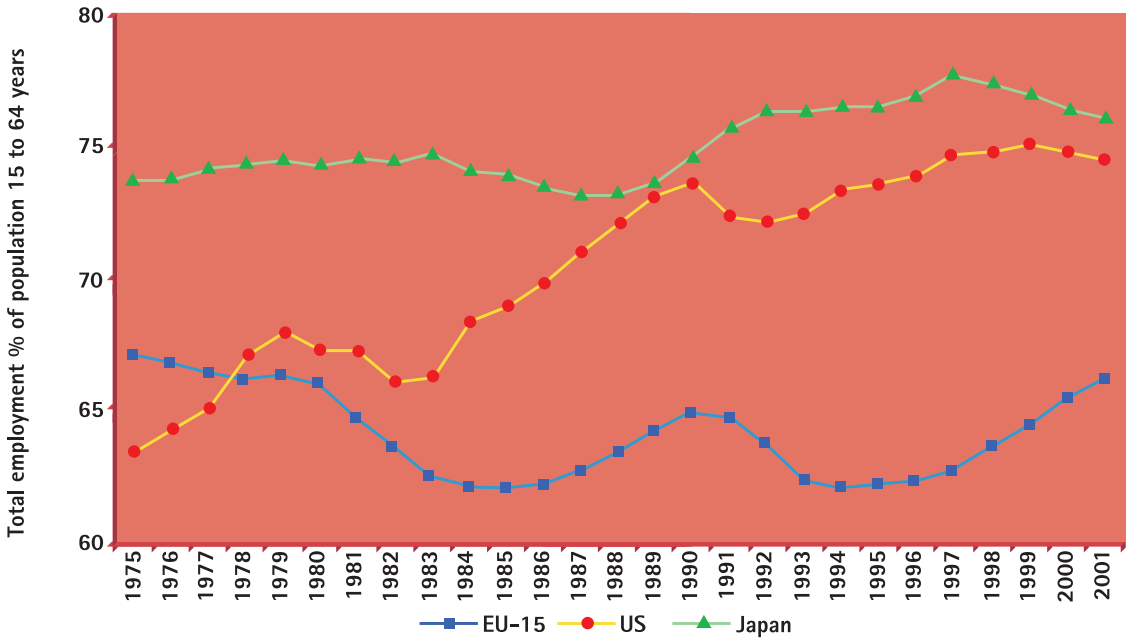
Full employment, and decent employment, is a policy goal for the EU. It has long been noted that the US economy has been particularly good at generating new jobs, and that this is a major factor in overall US growth performance. Overall, through the 1980s and 1990s the US outperformed the EU in GDP, employment and labour productivity growth - see Figure 6.12a which presents relevant structural indicator data. However, the structural indicators presented to the Barcelona summit indicate that in recent years the EU as performed exceptionally well in terms of job creation (see Figure 6.12b). But unemployment levels remain unacceptably high in Europe (where the divergence from US data seems higher for females than males).

Figure 6.12a Employment and Unemployment Statistics



Source: Annexe 2 to the Commission Staff Working Paper in Support of the Report from the Commission to the Spring European Council in Barcelona COM (2002)14 final, "The Lisbon Strategy – Making Change Happen" Brussels, 22.2.2002 (note; qualifications to data - especially time periods considered -are provided in the original source)

Figure 6.12b Trends in Employment in Three Regions



Source: Graph 1.2 of European Competitiveness Report 2001, Luxembourg.

Technological change and organisational innovation impact upon the number, nature, and location of jobs. There is at present something of a consensus that **fears of technological change leading to mass unemployment and deskilling of work are unfounded: if anything, innovation to date has tended to promote the opposite directions of change.** (Though there always some exceptions, where particular jobs or skills have been displaced – and there are continuing concerns about workforce polarisation and the possible thinning of middle-level jobs and associated paths of career mobility.) Skills and skill shortages are liable to shape, and to facilitate or impede, innovation. So are broader capabilities to manage and master change. The mobility of labour is an important way of transferring skill and knowledge across firms, sectors, regions and countries – and, of course, may be a source of 'brain gain' as well as 'brain drains'.

In February 2000 a new strategy to promote employment and skills for the knowledge-based economy was announced by Employment Commissioner Anna Diamantopoulou:

> "...to build an inclusive knowledge based economy ... is the only route to create jobs and growth in Europe in the coming years. If we can combine competitiveness and cohesion in the new knowledge economy, Europe will act as a model to the world...."

The Commission paper highlights a number of opportunities and challenges presented by the knowledge economy. Among the points addressed are:

- Prospects for major job creation in ICT producer and ICT-intensive industries. (This relates to other common elements of strategy, e.g. the emphasis on SMEs as agents of job creation. There is a 'Growth and Employment Initiative - measures in financial assistance for innovative and job creating SMEs'. This puts the emphasis on the need to help SMEs with growth, and hence job creating, potential. The report on the initiative highlights again the fact that "such companies are often unable to raise finance because of risks associated with their particular stage of development". To help foster job creating SMEs three schemes exist: the ETF start-up Facility, as mentioned earlier; the Joint European Venture (JEV), a scheme designed to help SMEs establish transnational joint ventures within the EU; and the SME guarantee facility.)
- Prospects for a major expansion of telework (utilising innovations, of course, but also arguably promoting organisational flexibility and innovativeness). Telework is seen as being impeded by regulations (tax, employment, etc.) as well as by lack of awareness and organisational rigidity. (See below.)
- The next generation of the workforce will come from "the net generation", who can be reached through educational institutions. They will face less stable and certain jobs, dependent on high skills and adaptability. There are major issues for training and promoting entrepreneurial attitudes.
- One class of problems involves slow Internet penetration (compared to the US), lower levels of use amongst users, and the risks of social exclusion in access to relevant technologies and services. Awareness of programmes, public access programmes, support for disabled people, are among the instruments suggested.
- Another set of problems involves lack of some key skills (in terms both of inter national comparisons, and skill shortages reported by industry). Again issues of training, and also of mobility, rank high.

There is also optimism that new technologies such as biotechnology will create new industries that will be optimally located in Europe in order to provide jobs. A further topic is the scope for "empowered" employees to be important assets for organisational innovation and modernisation. The other side of this coin is the fact that most of the firm's assets are attributes of its workforce, and in order to protect intellectual assets it may need to regulate their activities and subsequent employment.

'Entrepreneurship' defined in a broad way, to cover the start-up and running of new enterprises, the development of existing enterprises, and the encouragement of new initiatives within large firms, can also be seen to support measures that help generate new sources of employment. This can include self-employment and can lead to the creation of networks among enterprises and between enterprises and local authorities. Therefore if the European Union wants to deal successfully with the employment challenge, all possible sources of jobs and new technologies and innovations must be exploited effectively. Also Member States need to investigate measures to fully exploit these sources of job creation at local level, in the social economy and in new activities linked to needs not yet satisfied by the market.

6.12.2 Drivers of Change and Policy Perspectives

A recent DG Enterprise study[xxi] has examined the link between innovation and employment in SMEs. Both product and process innovation in SMEs were found to create new employment. (However, other factors such as leadership, energy, and entrepreneurial spirit often outweigh the employment-boosting impact of innovation.) The impact of innovation on skill levels appears to be smaller than previously believed. Job creation for highly skilled labour tends to increase as innovative enterprises become larger. If true, the emphasis on upgrading skills in SMEs needs to be balanced by the consideration of other important factors. These include organisational innovation (this usually involves the restructuring of either internal or external working relationships - as a result of change in workers' responsibilities, or the purchase of external goods and services, for example). Within the SME sector 'organisational innovation' is likely to be a significant factor contributing to increases in productivity and may therefore also effect employment.

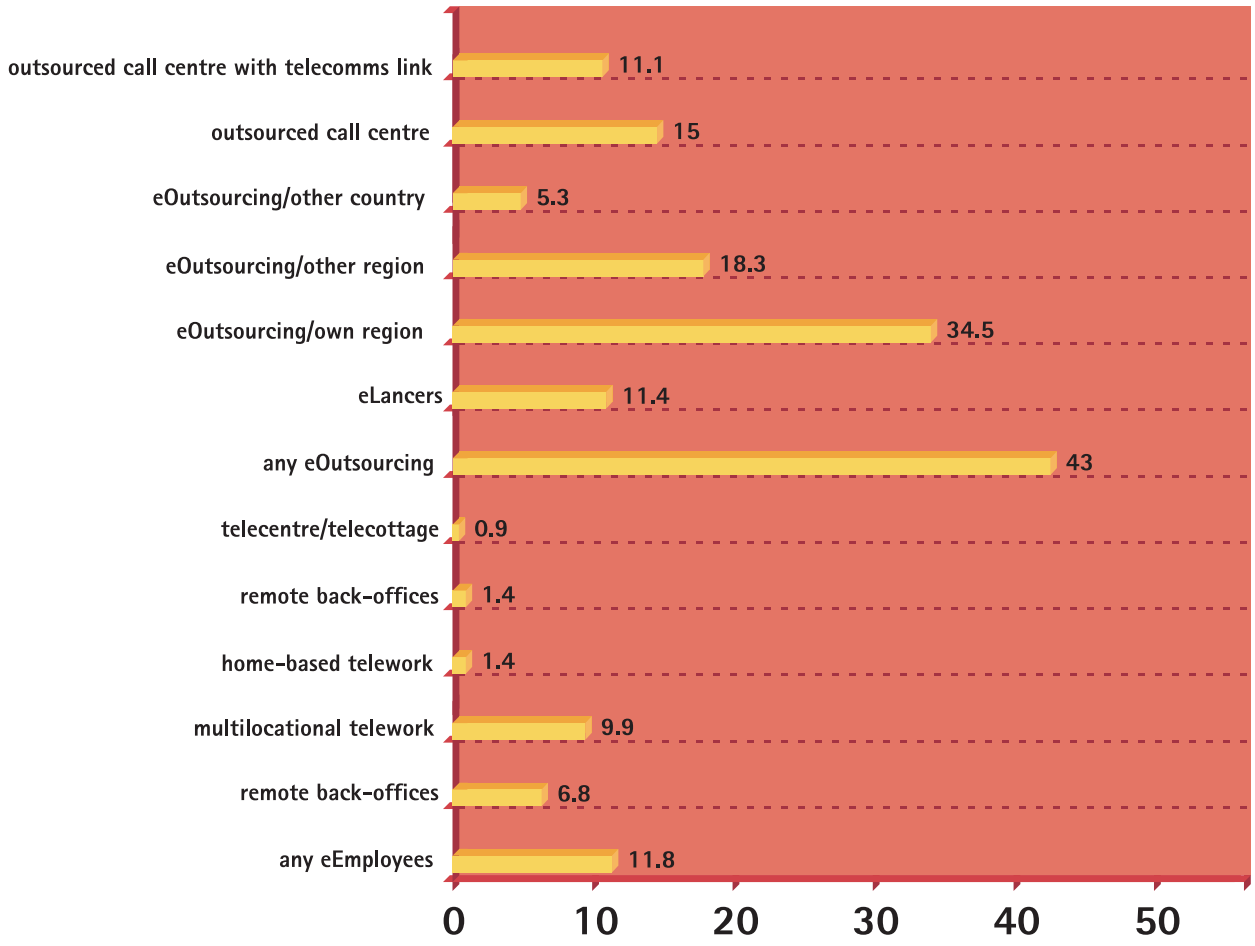
One of the most frequently debated topics concerning employment in the Knowledge-Based Economy involves new forms of work associated with the application of new ICT – what is now known as eWork. Figure 6.12c presents results from a recent survey by the EMERGENCE project, (cf. Huws and O'Regan (2001). This examines the involvement of enterprises of 50 or more employees with different forms of eWork. These results are striking:

- Almost half of the firms (49%) did undertake some sort of eWork. This is a "thriving European market". It tends to bring the jobs to people, rather than vice versa – which has implications for transport demand, sustainability, and regional policy.
- Home-based teleworking, the sort of eWork that achieves most attention in the media, is actually relatively rare. Mobile teleworking (where employees work from several, or numerous locations) is much more common.
- However, more common still are various forms of eOutsourcing. It is far more often the case that the new arrangements will govern the use of external labour than that they will be used to manage internal staff.
- Trade within Europe outweighs that with the rest of the world (though the latter is significant).

The study also concluded that:

- The major driver for eWork was requirements for technical expertise.
- Regional incentives such as subsidies or tax breaks have a limited role on choice of location to source from. The same is true for strong labour market regulation or trade unions. In contrast, cost and quality issues are prominent. (We would add that also important are access to relevant skills, and other network links – the study suggested that "proximity to other parts of the organisation" was important, for instance).
- Policy issues arise around co-ordination of national policies for employment, labour markets and social protection. Other issues concern individuals access to training and learning opportunities, and their career prospects.

Figure 6.12c eWork in Europe, 2000
(percent of enterprises undertaking)



Source: Huws and O'Regan (2001) Figure 4.1.

Management education and attitudes towards business strategy and management performance and how the latter in particular is measured and perceived can create conflict and tension. Managers make complex decisions and intuitively balance risks between strategies for market share, innovation, employment growth, reductions in operating costs etc. These will depend partially on economic conditions and intensity of competition in an industry as well as the stage of business growth and the business cycle. Thus how innovation creates and destroys jobs is complex but corporate responsibilities for employment and how management performance is measured and rewarded may not be explicitly articulated or in balance.

Organisational innovations such as those derived from business reengineering or company restructuring may depend on making available to employees inducements and compensations (for early retirement etc) and these can utilise the resources invested in pensions schemes.

Efforts are often made, especially by larger companies, to redeploy or to create new jobs in a local community, and to help individuals find new career opportunities. But there may still be more scope to devise better schemes and mechanisms that exploit the strong motivations and high levels of energy in restructuring exercises and such initiatives might be better focused on innovation in its various guises.

Some senior positions have contractual obligations and equity options, that ameliorate some of the disadvantages of temporary work whilst emphasising rewards for performance, creativity or other aspects of innovation. In small high tech companies such arrangements may be vital for maintaining or attracting intellectual assets. In larger companies there are serious concerns about corporate governance and controls over the abuse of such incentive schemes. These factors influence the culture of organisations and hence impinge on innovation efforts.

The relationships between employment factors and innovation include within-firm issues such as the direct effects and perceived effects of innovation on jobs, the attractiveness of jobs (job design and job definition), the quality of working life, patterns of work and leisure; and extra-firm issues that play a role in determining what firms do. The driving forces behind industrial and consumer demand, stimulating and stimulated by advances in the design, costs and prices of goods and services, and hence innovation, cause firms to evolve in such a way that some jobs are satisfying and in demand whilst others are much less so.

In a knowledge-based society there is an increasing search by the better educated and more successful categories of employee for employment that is fulfilling and this will shape the organisations in which they work and the extent to which other necessary work is outsourced.

The EC adopted a communication Towards a European Research Area (COM [2000] 6 final) in January 2000, that deals with the adequacy of human resources for the future needs of European research. Here greater mobility of researchers was one the key elements. To improve the mobility of researchers some obstacles have to be removed. These obstacles include: legal and administrative obstacles to transnational mobility; social, cultural and practical obstacles to transnational mobility; obstacles to a European dimension in research careers; and obstacles to intersectoral mobility. There is also a danger of a shortage of young researchers in the future, as a scientific career is not perceived as attractive for some young people these days.

The proportion of **female entrepreneurs** is another important factor and an indicator on this is incorporated in the Enterprise Scoreboard. By increasing this proportion the benefits are not just equitable organisations and role models in business leadership but also tapping or utilising more effectively a higher absolute level of human resources. These benefits relate closely to the indicators showing propensity towards self-employment and barriers to entrepreneurship and incrementally modify attitudes towards risk. The activities of business incubators (which constitute yet another indicator) can be modified in order to stimulate changes in both these areas.

Finally, it is important to cater for low skilled as well as high skilled workers. There is some evidence that the USA's output growth is associated with growth of low skilled rather than knowledge workers. This may say more about the US labour market and economic inequality, and its influence on innovation systems, than on necessary paths for growth in general. But a more general point is that "high-tech" clusters do require support services of all kinds - construction, transport, retail and catering - not just knowledge-intensive services. Infrastructural restrictions here may limit development of such clusters, and growth will not only create high-skill employment. This is reassuring in one way - since there are liable to be many members of the labour market remaining who will find such employment most suitable for at least some of their working lives. But policy intervention may be required to ensure that such people are not priced out of the housing and other markets.

6.12.3 Implications

The relations between employment and labour market policies, and those seeking to foster technological and organisational innovation, remain to be explored in any great depth. One exception is a recent study on labour law conducted as part of SITRA's examination of the Finnish system of innovation. Here, Koskinen and Mikkola (2001) pay particular attention to the need to understand changing patterns of work and employment, such as the growing importance of non-traditional forms of work (e.g. self-employment and contract work) and of knowledge workers. Problems associated with Intellectual Property and employment contracts loom large. They also point to the problems that small firms and self-employed people can face in interacting with larger networks.

ICTs are being used as part of organisational strategies aimed at facilitating major changes in working practices – toward flexible patterns of work, in general. This will have an impact on the **"work-life balance"**, as well as on requirements for transport and building, and for other industries and services. Changes in working life, in other words, are not just the product of innovation. They also set the context for innovations, as new ways of life are developed to take advantage of more flexible or shorter working hours, for example, or to cope with requirements to travel more or to take more work home. Since trends in working life are very complicated ones, and there is indeed some polarisation in features such as working hours and income levels, this context is very heterogeneous.

As more people work (for at least some of their lives) in SMEs and self employment, there is increasing autonomy of career direction. Required levels of education and training and experience are therefore more volatile and subject to market forces instead of strategic planning. Innovation to support life-long learning is thus a widely accepted requisite for a dynamic knowledge-based economy.

Personal preferences and loyalties mean that **people are relatively immobile** (both within Europe and globally). **This is part of the reason why knowledge-based clusters cannot easily be relocated.** It lends some regions greater strength than they might possess in a more fluid world, though other regions may find it difficult to recruit needed capabilities. It may be one reason for the development of KIBS. (Their staff provide an alternative source of human-embodied knowledge, as compared to labour mobility – which raises questions about how they are treated in terms of employment policy, training and labour law, and so on.) How and where are skill shortages felt? Alongside the standard indicators, more qualitative information (e.g. trends in individuals' expectations regarding job satisfaction, career development, and higher education) may be required to understand the knowledge-based society and in particular the complexity of the relationship between innovation and employment. For example, what underpins the apparent discrepancies between the experience of older workers and those of managers finding it difficult to recruit staff – is this a matter of age discrimination, or of the obsolescence of skills?

In conclusion, some main recommendations are as follows. It is important to examine the changing nature of work, especially insofar as it affects the growing class of **"knowledge workers"** who are major sources of innovation. Increased mobility of such workers can raise questions of contractual restrictions on their use of Intellectual property and their employment in particular firms and sectors. There remains a need to develop pension, income tax, and related systems further, so as to make it easier for staff to be mobile in terms of geographical location, employment, and self-employment. However, mobility should not be seen as a panacea: there are personal and perhaps community costs that may mean that there could be "too much mobility" in some circumstances. There needs to be a great deal more evidence about how mobility contributes to innovation and knowledge development, as compared to other ways of achieving this, in different circumstances.

More generally, methods of providing support for the development of systems and procedures that reward employees for seeking innovative solutions rather than "playing it safe" should be developed. While this is largely a matter for private initiative, public policy has a role to play in promoting awareness, good practice, and exchange of experience here. Demonstration of the rewards that innovative activities and "thinking outside the box" can yield is important. High-quality material concerning innovation and entrepreneurship should also e developed for use in expanded programmes of lifelong learning.

6.13 Environment

6.13.1 Background

The environmental impacts of economic activities (distribution and consumption as well as production) continue to attract increasing attention.

This is growing as concerns about climate change and threats to biodiversity have grown alongside longstanding worries about resource depletion, ill health, and the quality of life. Figure 6.13 presents some of the structural indicator data on environmental issues (other indicators concern transport modes and waste disposal, for instance).

Innovation is seen as crucial to the goals of environmental policy. There is an accepted need to move towards more sustainable economy and it is increasingly recognised that the achievement of environmental sustainability will require major changes in the goods and services that are produced and in the ways that they are produced, distributed and used. As such, it is necessary that considerations regarding innovation be central to environmental policy.

Figure 6.13a Aggregated emissions of Kyoto basket of 6 greenhouse gases, expressed in CO2 equivalents (1990=100)
Gases: CO2, CH4, N2O, HFCs, PFCs and SF6

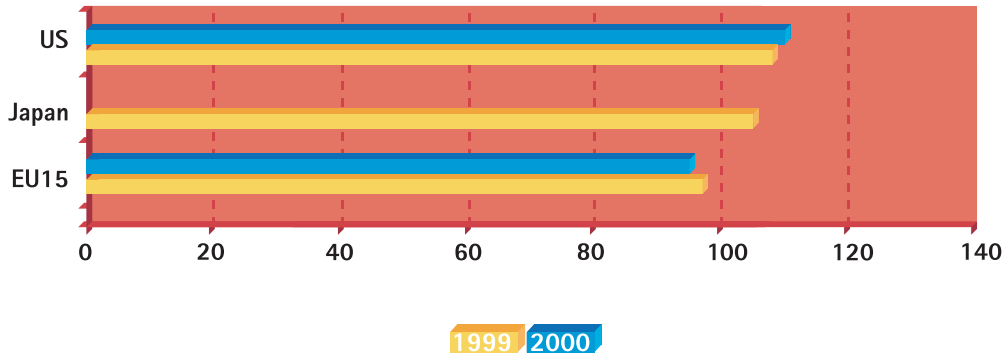
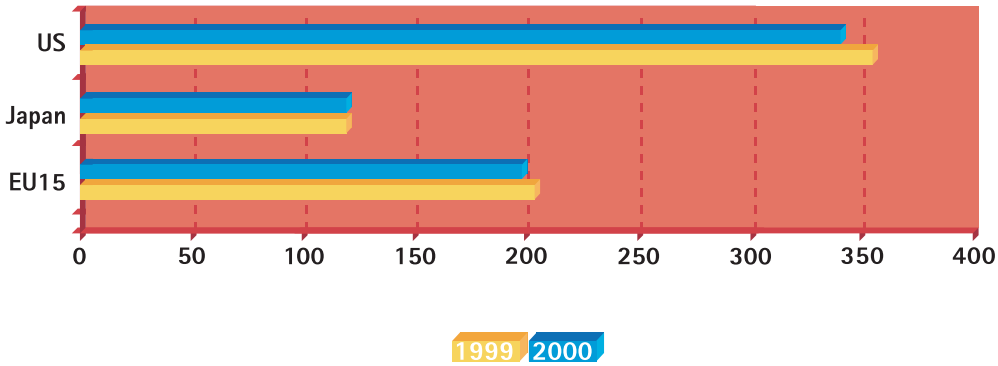


Figure 6.13b Energy Intensity of the Economy: Gross inland consumption of energy divided by GDP – Kgoe (kilogram of oil equivalent)/1000 EUR



Source: Annexe 2 to the Commission Staff Working Paper in Support of the Report from the Commission to the Spring European Council in Barcelona COM (2002)14 final, "The Lisbon Strategy – Making Change Happen" Brussels, 22.2.2002 (note; qualifications to data - especially time periods considered are provided in the original source)

6.13.2 Effects of environmental policy on innovation

Links between environment policy and innovation have long been recognised. However, they have not necessarily been seen as positive. During the 1980s, when deregulation became a dominant part of the prevailing political philosophy, it was argued that environmental regulation imposed excessive costs on industry and would stifle innovation. The OECD identified a number of reasons behind this view, including:

- That due to the cost regulation places on industry there are less resources to divert to R&D;
- That as R&D resources have to be directed to help the firm comply with regulations, less can be devoted to achieving profitable innovation;
- That uncertainty with regards to issues such as timing and modes of implementation add to the risk factor of innovation; and
- That regulations can lead to a modification in the market structure as small to medium size firms will find it harder to innovate in order to comply with regulations, new firms may be prevented from entering a particular area, and new firms tend to be subject to stricter controls than the established ones (OECD, 1985, p.29-33)

However, this view has been largely superseded by the idea that environmental controls can stimulate innovation. This can happen both directly, as firms search for innovative ways of complying with regulations, or indirectly, where other innovations result from the compliance process. In addition a firm's longer-term innovative performance may improve as constraints provided by environmental controls may result in improved R&D services through staff training, recruitment or reorganisation (OECD, 1985, p.34). This idea that environmental controls can be a spur to innovation has been embraced by the Commission which recognises that, "high environmental standards are an engine for innovation and business opportunities" (COM(2001)31 final).

With the recognition that innovation is an important factor of environmental policy there is a need to better understand how particular environmental policies incorporate thinking about innovation.

6.13.3 The role of innovation in environmental policy

The primary concern of environmental policy has been to ensure environmental quality, not to stimulate innovation. Hence, any innovation that has resulted from environmental controls has generally been an unintended by product. Environmental controls were designed as more of a "post-innovation check on undesired side effects rather than as a tool for directing technology towards socially desirable ends"(Irwin and Vergragt, 1989, p.58).

However, it is being increasingly recognised that, if moves towards a more sustainable economy are to be successful, then thoughts of stimulating innovation need to be more central to environmental policy design.

Of course, this raises questions regarding the most appropriate policy instruments for helping to stimulate innovation but it also raises more fundamental questions about the process of how environmental policy can play a role in directing firms' innovative behaviour.

6.13.4 The main policy instruments

Environmental standards
Environmental standards e.g. emission levels have often been based on best available technologies and these do little to encourage the development of new technologies, although they are likely to stimulate the diffusion of available technologies.

Standards that are technology forcing – that is, they require the development of new technologies – are a better way of encouraging innovation. There are however, drawbacks to such standards. Given that the standards are set so that new technologies are needed to comply with them the potential costs are relatively unknown and could place an excessive burden on industry. Hence for such standards to work there needs to be a degree of flexibility and in forcing compliance and this in turn can undermine the innovation incentive.

Economic measures
Economic measures come in a number of forms, from the incentive of grants and subsidies that can be offered for reducing emissions or for adopting more environmentally friendly technologies, to the disincentive provided by taxes on pollution levels. Alternatively they could encompass tradable emissions permits which allow firms to pollute up to a certain level, with emissions above that level deemed illegal. These permits are tradable between firms – so one firm that can meet lower emission targets can sell on permits to other firms for whom the high costs of abatement make purchasing further permits the cheaper option.

It is often argued that economic measures are more effective at inducing innovation than setting standards. This is largely based on the idea that while with standards there is no incentive to continue to improve once the legal standard has been met, with economic measures there are always gains to be made from environmental improvement. **This is however oversimplifying the situation.** For example the level at which a tax is set is clearly important. The overall costs (abatement costs and tax payments) can be high and if the tax level is set too high then the costs may prove prohibitive to innovation. This worry can often lead to the regulator setting a low level for the tax[xxii], reducing any incentive to innovate.

Voluntary agreements
Voluntary agreements refer to agreements that commit firms to improved environmental performance but are not enforced by law. Generally, voluntary agreements have arisen under the threat or anticipation of government actions.

In these cases the adoption of voluntary agreements can be seen as a way for industry to try and shape the regulatory framework, rather than waiting for governments to impose controls. However, there is hope that voluntary agreements can help to stimulate greater environmental responsibility in firms and improve the relationship between regulators and industry.

Given that the agreements are negotiated by industry they provide greater freedom in how firms can achieve compliance, reducing the regulatory burden. **In terms of innovation this means that firms are unlikely to call for changes that require radical innovations and it is likely that voluntary agreements will only stimulate incremental innovation and technology diffusion.**

Others

Most discussion of environmental controls focus on the control of polluting firms. However, a different approach, and one that figures in Commission policy, is to try and stimulate markets for environmentally friendly goods by improving information about these products through schemes such as eco-labelling. This may help stimulate technological diffusion and possibly a limited amount of incremental innovation where markets become better established but is unlikely to lead to major innovation efforts.

Information campaigns also have a role to play in raising awareness, particularly amongst SMEs, of regulatory requirements and the possible options for achieving compliance.

One thing that is clear is that there is no magic solution to the problem of environmental improvement and it is increasingly recognised that a combination of measures may prove most effective. In addition, the way in which environmental controls can impact on innovation is also being reconsidered.

6.13.5 Rethinking the link between environmental controls and innovation

Studies of the effects of environmental controls have undermined the idea that regulations necessarily impede innovation. But they have also shown that the idea that firms will automatically innovate in response to regulations is over simplified. **Regulation is only one of many stimuli for innovation and in many cases environmentally beneficial technologies may be adopted for reasons of costs or improved product quality, rather than with the explicit goal of environmental improvement.** The stimuli of pressure from consumer organisations, pressure groups, employees etc. can also be an important factor. A further issue that needs to be considered is the information problem of regulations. In setting controls governments can be reliant on industry information - leading to what is referred to as **"regulatory capture"**. This problem has led some to argue that perhaps the threat of regulations is a more effective stimulus to innovation than the regulations themselves.

In this multi-stimuli environment, the starting point for policy needs to be "the capabilities, interests, interdependencies and interactions of social actors around an environmental problem instead of the environmental problem itself" (Kemp, 2000, p. 46). Such analysis of the social environment in which controls will operate should enable them to be designed so as to have a better chance of directing technical change towards a more sustainable trajectory. This implies a much more proactive, and inclusive, approach to policy making. It demands improved processes for anticipating problems, the creation of networks for learning and interaction and wider discussions with relevant actors.

6.13.6 Implications

This short discussion highlights the complex links between environmental policy and innovation. This is not a one-way link with environmental policy having a role to play in stimulating innovation. Equally, in the moves towards a sustainable economy, innovation policy needs to take greater account of environmental needs. It is important to increase recognition that environmental threats may be translated into technology strengths and market opportunities (e.g. alternative approaches to energy generation, remediation technologies). Research can be oriented to environmental objectives; incentive systems may be designed so as to reward the design, adoption and effective use of innovations that have demonstrable environmental benefits.

Environmental issues are bound to continue to grow in importance, and to receive continuing research effort in their own right. Such research should routinely include consideration of the scope for applications of innovation in support of environmental objectives. Other RTD programmes conversely, should routinely include consideration of ways of enhancing sustainability, in their design, functioning, and reporting. There are considerable synergies to be achieved if these areas can be brought closely together - another example is in the sphere of Business Impact Assessment, where it is possible to include criteria specifically concerning positive and negative effects of regulations on environmental innovation. Environmental regulations themselves should be routinely reviewed so that, for example, performance-based regulation (encouraging flexibility in finding solutions to environmental problems) and process regulation (encouraging better understanding of critical points of impact and innovations to reduce damage here) can be considered as alternatives to mandatory technology-freezing rules. Information and awareness campaigns are important for alerting SMEs and less dynamic sectors to the scope for environmentally-oriented innovations.

Finally, we should stress that environmental policy is in many respects a horizontal theme, like innovation policy. All sorts of policy areas can – and should – have environmental objectives built into them. Indeed, it might be useful to see how far the various points made in the present report would need to be modified were the terminology "environmentally sensitive innovation" to be used throughout! More immediately, it is apparent that the relationships between these two policy areas raise questions connected with the other policy areas (for instance, taxation and regulatory reform). This again highlights the need for greater co-ordination between all policy areas.

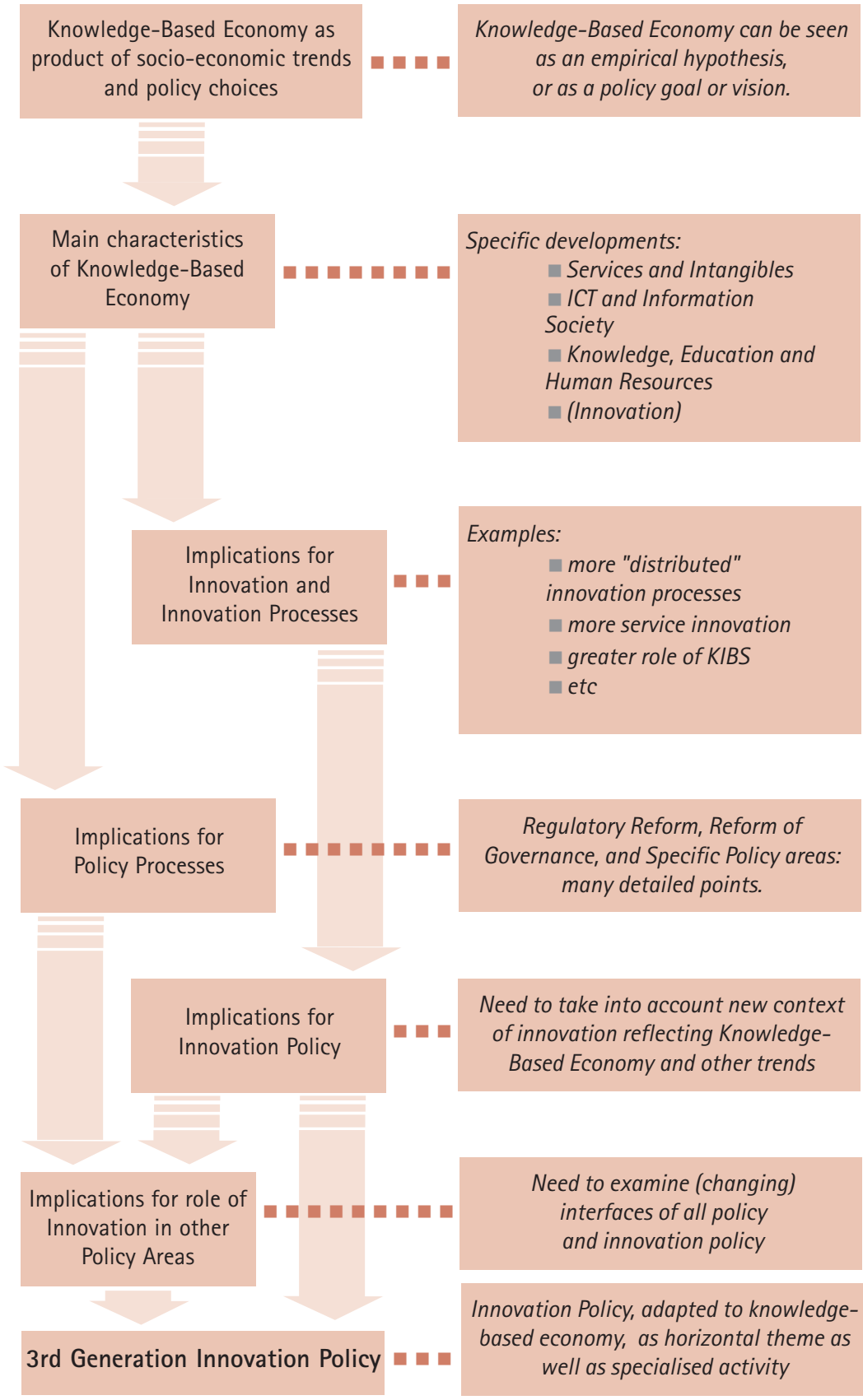
6.14 End Note

This chapter has reviewed a set of policy areas. To different extents, and in different ways, we find that al of the policy areas are related to innovation. Furthermore, **the ways in which they are related to innovation are changing** - both as innovation itself changes in the knowledge-based economy, and as regulatory reform and other processes are changing the policy areas. With only a few exceptions, there is very little documentation about these changing relationships. This is remarkable, given the influence they are liable to exert upon innovation policy and its effectiveness. It is important to develop much more extensive knowledge of these issues.

7_Major Issues and Conclusions

7.1 Introduction

Chapter 6 reviewed a series of policy areas. It examined the ways in which these impinge upon, and are affected by, innovation and innovation policy. It concluded that there is a common tendency for these interrelations to be undergoing more or less profound change. Some of this change reflects ongoing changes in the nature of innovation and regulatory reform processes. Much of it is intimately bound up with the trends that are seen as characteristic of the knowledge–based economy.


Knowledge-Based Economy as product of socio-economic trends and policy choices
Knowledge-Based Economy can be seen as an empirical hypothesis, or as a policy goal or vision.
Main characteristics of Knowledge-Based Economy
Specific developments:
Services and Intangibles
ICT and Information Society
Knowledge, Education and Human Resources
(Innovation)
Implications for Innovation and Innovation Processes
Examples:
more "distributed" innovation processes
more service innovation
greater role of KIBS
etc
Implications for Policy Processes
Regulatory Reform, Reform of Governance, and Specific Policy areas: many detailed points.
Implications for Innovation Policy
Need to take into account new context of innovation reflecting Knowledge-Based Economy and other trends
Implications for role of Innovation in other Policy Areas
Need to examine (changing) interfaces of all policy and innovation policy
3rd Generation Innovation Policy
Innovation Policy, adapted to knowledge-based economy, as horizontal theme as well as specialised activity

The report has developed the argument that a third generation innovation policy is required. A major task now is spelling out more of the contours for such a policy, having made the case for the need for it. Such a policy cannot emerge by fiat, however. It is much more likely to be effective if it is the product of an evolutionary process, in which a wide range of agents help shape it, experiment and learn from efforts to implement it, develop it in the light of their own practical experience. This report concludes by specifying some of the ways in which such a policy design process may be advanced, and pointing to some of the broad contours of policy to which the present study points.

7.2 Creating Third Generation Policy

The most important feature of the third generation innovation policy is that, building on the understanding of innovation systems developed in second generation policy, it needs to recognise the relevance of innovation in and for effectively all policy areas. It needs to build in procedures for identifying this relevance – and the ways in which it is changing with the evolution of the knowledge-based economy – and mechanisms for acting upon it. The aim is to maximise the chances that regulatory reform will support innovation objectives, rather than running the risk of impeding or undermining them. This in turns requires that several considerations are reconciled:

- "Top down" analyses such as those in chapters 5 and 6 can point to major issues that deserve attention. But they cannot substitute for the detailed understanding that can derive from "bottom up" dialogues between those encharged with the design of policies in specific areas and those familiar with innovation and innovation policy.
- It is important, too, to draw on the experience and practical knowledge developed by those of the "receiving end" of regulatory policies – and those actively engaged in generating innovations. Entrepreneurs and researchers have important contributions to make to policy design and assessment.
- **Innovation objectives need to be incorporated into all policy areas and regulatory reform processes.** But this runs the risk of dilution of these objectives, in that they may become just one more set of items to be checked off on a list of organisational formalities. It is necessary to avoid this dilution, while finding ways of preventing innovation policy being compartmentalised away from other policy areas with which innovation is intimately related.
- One element of the resolution of this tension is **ensuring that innovation policy concerns continue to have a central focus. A body responsible for developing ongoing analyses of innovation processes, systems and policies, and for monitoring the flows of innovation-relevant information and adoption of innovation-relevant policies into all policy areas is required.** This body must have real clout, reporting to the highest executive levels, and net working across all policy agencies.

- There are bound to be challenges in communicating across innovation and regulatory policy areas, and in making the case for new linkages across the responsible agencies. Efforts will be required to establish the sorts of evidence and argument required for actors to make the case persuasively to their peers in other agencies - and to their own senior officials. The issues will need to be framed in ways that are appropriate to the organisational cultures concerned. This is needed for mutual understandings to be reached about the nature of innovation processes and policies, about the types of problems which are being dealt with by the regulatory system, and about the ways in which these inter act.
- The interfaces between departmental responsibilities will need to be effectively managed – while communications between departments will need to be open and flexible, and preferably informal and interpersonal (rather than formal and procedural).
- Regulatory reform and governance processes are following their own time tables. This means that opportunities to integrate innovation perspectives into these processes may emerge on a sporadic, but partly predictable basis. However, preparations that would enable interventions to be made at appropriate times should begin immediately. The changes will not be instantaneous, and call for knowledge-based analysis and action.

These considerations will have to be confronted in different ways in different circumstances. What is important is that a serious effort is made to confront them, to find ways of resolving the tensions that are apparent, so as to make progress. Almost as important, it is essential to learn, and diffuse learning, from this effort, so that solutions to problems developed in particular cases can be shared more widely. Solutions cannot simply be transplanted from one place to another, given the many contingencies that arise in different circumstances. But elements of solutions may be combined and customised to fit specific circumstances, and the ways in which they were achieved may offer more general lessons. Furthermore, it is likely that some of the concrete issues that arise at the interface of innovation and other policy areas will be ones common across different circumstances, so analyses can be expedited and the need for such analysis made more compellingly.

What then is needed for such an effort? A number of suggestions arise from this study – and more will probably be forthcoming as some or all of these are acted upon. The possibilities that we see immediately are:

- At the level of the EU itself, and within member states (and some of the more autonomous regions), an agency should be given the task of examining, and co-ordinating action on, the interfaces between innovation and other policy areas. While these agencies will need to prioritise specific areas to examine first, they should have the mandate to examine all policy areas' interfaces with innovation and innovation policy. Such an agency needs to be given sufficient resource to make substantial progress with this task in short order, and it requires high-level political backing - a champion at a high executive level, and reporting to high-level committees.

The EU can play an important role in networking such agencies together and helping them co-ordinated their activities. There may be scope for combining forces with bodies co-ordinating regulatory reform processes.

- As mentioned, each agency will need to prioritise its efforts. But it should convene a committee of policymakers from all directorates or ministries. This can be used in several ways. First, as a means of articulating and conveying the messages about third generation innovation policy to all policy areas - and feeding back information about the rationales and instruments for regulatory reform that are being instituted in different policy areas. Second, this should institute a first overview of the critical issues in the various policy interfaces, and in particular examining those issues that involve multiple areas (e.g. environment, taxation, and employment as well as innovation). Third, it can feed intelligence about ongoing and planned processes of regulatory reform into the innovation policy discussion, and into decisions about what areas require most immediate attention
- Much of the detailed work that will inform the design of third generation innovation policy will be based upon the work of smaller groups, usually bilateral groups between innovation policy and other policy specialists, examining specific areas where reform is being considered or implemented. As noted earlier, there may be advantages in bringing outside experts – researchers or industrial representatives, for example – into these discussions, though this will not always be practically viable. These groups will need to expend time to develop common understandings, since their members will typically come from quite different knowledge backgrounds, and will need to take time to achieve a shared language, to appreciate each other's frameworks and language. By developing a joint view as to how specific innovation and innovation policy issues are related to specific regulatory and regulatory reform issues, the group should be able to determine how best innovation objectives can be built into regulatory processes in the immediate instance, and on an enduring basis.
- The experience generated by such activities needs to be documented and key understandings, results and lessons shared more widely. Thus a set of procedures should be instituted to "capture" such material, and make it available to the other parties mentioned above. Regular sessions in which the experiences of different groups can be contrasted should be instituted. This will provide opportunities for a kind of benchmarking of progress and strategies within and across countries and policy areas.
- The approaches listed above should enable the articulation of more detailed principles for the third generation innovation policy – for example, explicating the classes of issues that arise in the context of different policy areas. (E.g. where there are specific conflicts between different policy goals such as flexibility, equity, transparency, simplicity.) In addition, it will be helpful to draw on experiences that have arisen "spontaneously" in member states, within the Commission, and in other countries (such as the USA and Canada). A series of studies of the interfaces between innovation and regulatory reform in different policy areas could be undertaken more or less immediately.

- The creation of a third generation innovation policy should be a political objective. The steps described above should be accompanied by a regular review of progress in this direction, and this should be the opportunity for widespread debate on the critical principles and issues arising.

In the UK some government departments are beginning to publish joint white papers addressing innovation policy concerns, adopting the sort of policy networking that is advocated here. For example, the Department of Trade & Industry and the Department of Education & Employment have published a joint white paper on how to "close the skills gap". Also in the UK, one example of a regional technology network addressing a skills shortage is the Yorkshire and Humberside Regional Network's plan to develop innovative capacity that could be instilled into the region's permanent infrastructure. The plan involved developing an educational training initiative, that enabled the Electronics Yorkshire Centre of Excellence to train 300 unemployed people in the first year of its programme (EC Innovation & Technology Transfer, IRE Network News, September 2001).[xxiii]

7.3 Some Contours of Third Generation Policy

Though it is not possible to design the third generation policy without engaging in the sorts of process described above, the analysis of the knowledge-based economy undertaken in this study has pointed to a number of issues that will need to be addressed by such policy. Fortunately, an extensive analysis of innovation in the knowledge-based economy (Cowan and van de Paal, 2000) has already identified a large number of strategic issues for policy, so it is not necessary to reiterate this here.

The thrust of the present report has been to explore how regulations affect innovation, in the context of change in innovation processes and of regulatory reforms. In general, regulatory policies may influence the **resources** (funds, skills, etc.) available for innovation and they may make certain **directions** of innovative effort (e.g. patentable innovations, sustainable industrial processes) more or less attractive. Regulatory reform should be undertaken with these considerations in mind, so that it does not impeded innovation in the knowledge-based economy. The goals of simplification of regulations, increased transparency, and reduced costs of compliance are of course highly relevant. Alongside them, there is the need for more flexible regulations. These are needed to cope with the rapid pace of change in the knowledge-based economy, that affects everything from the sorts of collaboration we are witnessing in the innovation process, to the social and environmental issues (e.g. privacy, congestion) raised by new products, processes and systems. These also should not tie innovative efforts to particular types of solution to the problems that these efforts are required to address. Flexibility may be harder to achieve in practice than it is to proclaim as a goal, because of the needs for consistency, equity, transparency, and the like in regulations. But the general principle can and should be explored and developed as far as possible in specific circumstances.

Regulatory structures may often need to be adapted to the new context of innovation in the knowledge-based economy. For example, in relation to the rise of **Services and Intangibles**, there is a need to take into account several factors. One is the importance of services innovation, with its distinctive organisation as compared to classical industry R&D, which means that research and taxation policies may need to take this into account if their goal is to stimulate innovation in all sectors (let alone in the less productive service branches!). Another is the rise of KIBS as important generators of innovation and agents for distribution of innovation-related resources through the whole economy. These firms partly complement and partly compete with the traditional public knowledge infrastructure of public education and laboratories, raising questions about how best to build upon their distinctive contributions while securing the public good elements of knowledge production.

In relation to **Information and Communications Technology and Information Society** developments, we have stressed the role of the new technologies as an infrastructure for innovation, and therefore as an important element in innovation policy. This infrastructure will require more than just hardware and software if it is to be used widely and effectively, and support services of various kinds are required to fulfil its innovation potential. The phases of Information Society that are on the horizon are likely to pose even greater challenges in terms of factors such as privacy and civil liberties, competition policy, and intellectual policy, too, and it is important to recognise that this is still a rapidly evolving source of change. (There is some tendency to see genomics as the fulcrum of innovative activity – and perhaps of public unease about innovation and science itself – in the near future. But ICTs will continue their dynamic development, continue to be major sources of employment and growth, and continue to pose social and political challenges.)

In relation to **Knowledge, learning and human resources**, many of the key challenges are liable to be associated with the **appropriability of knowledge**. Both intellectual property instruments and the use of contracts and employment law as tools for knowledge management are liable to become more important as firms recognise the importance of these assets. The use of such techniques is not guaranteed to increase levels of innovation across the whole economy - indeed it is likely to have very uneven impacts. Consultations such as those recently held on software patenting[xxiv](and debates on business process patenting) may be required for other approaches to the governance of intellectual property. It is important to examine the tensions between innovative activities and instruments that are not primarily designed to deal with new knowledge and techniques.

Bringing together the specific conclusions and recommendations developed from the study of various policy areas, the following main points emerge.

Regulatory and institutional reform should be seen as an opportunity for efficient policy design processes to be introduced, especially where it is appropriate for efficiency and effectiveness to work across policy interfaces. Existing approaches to Business Impact Assessment need to be further developed so as to allow all reform processes to be designed and assessed (ex ante, wherever possible) with innovation criteria to the fore. (They should also allow for the impacts of reform on innovation in non-business organisations.) Systems for regular intelligence gathering, improved understanding, and benchmarking of contributions of reform to innovation should be installed. The major regulatory factors impacting innovation across all policy areas, and the relationship between different factors within and across areas, should be identified.

Governance is also importance for innovation, and the reform of European governance presents challenges and opportunities in this respect. Informed public opinion about broad classes of innovation must be nurtured. One element in achieving this will be the improvement of systems of communication about RTD and innovation programmes - their design, rationale, evaluation, etc. - with public, greater public involvement in decision-making as to priorities, etc. Furthermore, potential areas of social or ethical concern identified and addressed. Trust in regulatory agencies must be earned (and seen to be earned), not assumed. Thus openness and participation are important, and multiple methods to achieve these ends will need to be instituted.

Competition policy's aim of fostering greater market competition should in general benefit innovation. However, discussion in the literature indicates that there are complicated links between competition and innovation, especially in highly innovative and rapidly changing sectors. In particular, technological and other innovation-related collaborations may be impeded by laws that are quite legitimately intended to restrict oligopolistic behaviour and collusion. This complicated picture requires flexible design of policies around clearly stated principles that give high priority to innovation. Regulatory agencies and other implementers and interpreters of policy (e.g. the judiciary) need to be better informed about the innovation considerations associated with decisions concerning collaborations, monopolies and mergers. These issues are also closely entangled with matters of Intellectual Property, too, and this needs to be brought into the equation.

Education and Culture. These are sources of human capital and creativity, as well as nurturing institutions that can themselves be the source of innovations. Higher Education Institutions (HEIs) can be more entrepreneurial with respect to innovation, and policies can assist here for instance in terms of facilitating spin-offs and stimulating interactions and collaboration with industry. Of course, this has to be kept compatible with the maintenance of scholarly and ethical standards. But many disincentives are built into current institutions and regulations, and these should be replaced by systems that reward individual academics for such activities. Equally, people with entrepreneurial and intrapreneurial experience should be enabled to contribute more to HEI research and teaching. In terms of human resources, it is important to developing individuals who combine solid disciplinary understanding with capacities to engage in multidisciplinary teamwork and to communicate across professional boundaries.

Business Schools and Management Colleges, together with many other HEI courses, should be encouraged to provide high-quality training in innovation-related matters, and supported by such means as validation of courses and provision of suitable teaching material.

Employment. The changing nature of work, and the impacts of labour law, need to be examined in relation to influences on innovation. This is especially true insofar as the changes affect the growing class of "knowledge workers" who are major sources of innovation. Increased mobility of such workers can raise questions of contractual restrictions on their use of Intellectual property and their employment in particular firms and sectors. There remains a need to develop pension, income tax, and related systems further, so as to make it easier for staff to be mobile in terms of geographical location, employment, and self-employment. More generally, methods of providing support for the development of systems and procedures that reward employees for seeking innovative solutions rather than "playing it safe" should be developed. While this is largely a matter for private initiative, public policy has a role to play in promoting awareness, good practice, and exchange of experience here. The rewards that innovative activities and "thinking outside the box" can yield should be demonstrated. High-quality material concerning innovation and entrepreneurship should also e developed for use in expanded programmes of lifelong learning.

Enterprise. Enterprise is at the heart of successful innovation. Entrepreneurial attitudes - even if not precisely identical motivations - underpin much innovation in public sector organisations. Support for such enterprising attitudes in general should be fostered. Small and medium sized enterprises (SMEs) will continue to remain an important focus of innovative effort, and of policy interest. The two should be brought together: innovation support facilities can be built into systems that aim at supporting SMEs in general. Support for the development of networking and innovation "clubs" is another element here. Links with HEIs and with business services that can assist SMEs' choice and implementation of innovations, and the further development and commercialisation of their own innovative ideas, should be fostered. There is much need to continue to assist SMEs with adoption of innovations, especially those that will allow them to participate on a more equal footing in the knowledge-based economy, and in some cases achieve entry to new markets and more independence from large-firm-oriented networks. Examples of support that might be available here include for instance, web design and maintenance services for small producers and retailers. (These might best be organised on a locality basis - there are liable to be significant economies of scale and reductions in learning times associated with pooling of resources across, and services of this kind to, SMEs.) Award systems can be good ways of promoting and diffusing knowledge of good practices, and an example here would be the introduction of awards for innovative SMEs (in "traditional" as well as "innovative" sectors), and for SME support services themselves. Information on the drivers of innovation performance – e.g. a "benchmarking " of emerging trends in the global environment as experienced in different sectors, supply chains, regional and countries, and the responses adopted to deal with these – can contribute to building new capabilities for innovation.

Enterprises and economies can build foundations for ongoing innovation and learning by competing in global value chains, in which SMEs need support to achieve involvement appropriate to their level of technological competence.

Environment. Environmental issues are bound to continue to grow in importance, and to receive continuing research effort in their own right. Such research should routinely include consideration of the scope for applications of innovation in support of environmental objectives. Other RTD programmes conversely, should routinely include consideration of ways of enhancing sustainability, in their design, functioning, and reporting. There are considerable synergies to be achieved if these areas can be brought closely together - another example is in the sphere of Business Impact Assessment, where it is possible to include criteria specifically concerning positive and negative effects of regulations on environmental innovation. Environmental regulations themselves should be regularly reviewed so as to examine alternative regulatory instruments. For example, performance-based regulation (encouraging flexibility in finding solutions to environmental problems) and process regulation (encouraging better understanding of critical points of impact and innovations to reduce damage here) can be considered as alternatives to mandatory technology-freezing rules. Information and awareness campaigns are important for alerting SMEs and less dynamic sectors to the scope for environmentally-oriented innovations. It is important to increase recognition that environmental threats may be translated into technology strengths and market opportunities (e.g. alternative approaches to energy generation, remediation technologies)

Financial Services and Risk Capital. There is continued need for the development of instruments providing finance for early-stage innovation and smaller firms, with apparent gaps in availability of small-scale venture capital requiring attention. Financial support for various activities (e.g. licensing, patent investigations, etc.) also needs to be fostered. Further development web-based financial services for SMEs is also recommended, together with appropriate awareness campaigns and support services. The financial community should be helped to acquire better intelligence about emerging areas of technological opportunity, as well as about the general dynamics of innovation (e.g. time required to reach profitability, complementary assets that may be required for commercialisation, typical barriers). Better tools and standards are needed for accounting for innovation-related intangible assets and intellectual capacity in firms. (Strong business participation in such a process is required, to ensure that reporting regimes and procedures benefit those regulated, as well as imposing the lowest possible new burdens on them.).

Information and Communication Technologies. Policies fostering ICTs continue to be required as the technology itself develops, its uses become more pervasive and manifold, and problems of access and skill remain significant. In addition to continuing efforts to bridge skill gaps, it is important to continue to be vigilant against "digital divides". For example, measures may be required to ensure that SMEs are not excluded from e-markets by high entry costs, and that cheaper software and support services that are appropriate to SME business processes are available.

Public bodies (local and regional agencies and HEIs as well as national governments should be encouraged to participate in the development and demonstration of innovation-oriented "knowledge management" and information systems (so as to establish standards, awareness of good practice, etc.). The scope for extended use of open source software should be explored. ICT can be an enabling tool for many of the developments suggested for other policy areas, and this potential should be exploited.

Intellectual Property Rights IPR protection is generally seen as conducive to innovation, though the strategies of companies with respect to patent acquisition and, latterly, use of copyright rules to limit the behaviour of other agents, requires careful appraisal in this light. Certainly, renewed efforts to establish common European patent are required, but the revisions to patent law that are mooted require extended consultation that consider the innovation impacts of change and stability explicitly. (For example, modifications of the rules for dynamic sectors - e.g. shorter lifetimes of patents - and extension of patents to cover business processes.) Similar consultations also to examine ways in which copyright and other rules may need to be adapted to stimulate - rather than impede - innovation. (The rapid development of copyright law to fit it with the activities enabled by new digital media urgently needs to examine innovation impacts of the developments in law and practice.) Improved advice and support should be provided to SMEs for their development and implementation of IP strategies (including negotiation with large business partners). IPR regulations and competition policy need to be jointly examined in the light of innovation trends in the knowledge-based economy.

Regional Policy. There has been considerable recognition of the regional embeddedness of much innovative activity, with clusters and systems often (not always) having a strong regional basis. The study suggests (in the case study work as much as the literature review) that it is equally important to recognise that it is most often cities and metropolitan areas that are the crucibles of innovative activity. These entities require specific attention in regional innovation policy, even though in some cases there will be bitter competition between cities to be the regional champion (while in other cases cities may be more able to co-operate). Regional innovation strategies should be helped to build more on regional distinctiveness (rather than simply identifying the same set of priorities (ICT, biotechnology, new materials...). It is important to recognise the significance of innovation and new technology for "traditional" sectoral activities (e.g. tourism). Opportunities for linking sectoral strengths (for example, combining strengths in medical care and tourism, or in energy and environment) should be fostered.

Taxation Policy. While tax removes resources that could be applied to innovation, tax rules (selective or otherwise) can be developed so as to promote innovative efforts and particular directions of innovation. On the first point, tax incentives for innovative effort are recommended. These should include but going beyond R&D, and thus methods of systematically appraising non-R&D inputs to innovation (and possibly innovation performance) should be developed. Attention should be paid not just to rewarding the level of activity, but also to encouraging continuous improvement of such effort. (In the first instance this will need to be assessed in terms of inputs, but ideally output-oriented approaches will be devised).

There has been considerable interest in the development of environmentally-oriented taxes; this should be seen as opportunity to spur innovation. Accordingly, relevant criteria should be brought into design of such taxes.

Trade Policy. Liberalisation of trade should promote the diffusion of knowledge and innovations, though trade between countries need not spread benefits equally. Since trade disputes easily escalate into serious political tensions, international efforts are required to establish mutual understanding and shared norms concerning the systematically incorporation of innovation concerns (including governance issues such as those connected with public acceptance of specific innovations) into trade negotiations and procedures. The EU must play a leading role in these processes, since there are substantial differences between European and US experience of these matters. Trade liberalisation in knowledge-based services needs co-ordination of rules and other practices (for example those governing professional practice and qualifications) across different countries

Across all these diverse policy areas - and presumably across other areas that we have not studied here, such as consumer and transport policy - there are many common points. The need to confront mismatches between the emerging realities of innovation, and the traditional ways in which innovation has been taken into account in these policy areas (if at all) is growing. The overall recommendation of this study is that procedures for enhancing dialogue and mutual learning should be introduced to render all policies innovation friendly. This approach will support the successful implementation of the policies in the different areas, and contribute to the development of third generation innovation policy. Such third generation policy should be a strategic goal..

References

Academia Europaea, Responses from the Academia Europaea to the Communication from the European Commission, January 2000 at http://albert.hep.ph.ic.ac.uk/~bttrwrth/ae-response.html

Andersen, B, Howells, J, Hull, R, Miles, I, and Roberts, J (eds.) (2000) **Knowledge and Innovation in the New Service Economy** Aldershot, Elgar

Andreasen, L E, B Coriat, F den Hertog and R Kaplinsky (eds.) (1995) **Europe's next Step: Organisational Innovation, Competition and Employment** Ilford, Frank Cass

Arora, A, Fosfuri, A, & Gambardella, A (2002) **Markets for Technology: the economics of innovation and corporate strategy** MIT Press, Cambridge Ma, 2002, ISBN 0-262-01190-5

Asesoría Industrial Zabala S.A, European Economic Development Services Ltd, Michel Goyhenetche Consultants and Mcon Consulting (2002) **Corporation Tax and Innovation** DG Enterprise EUR Report 17035, available from ftp://ftp.cordis.lu/pub/innovation-policy/studies/studies_corporation_tax_innovation_en.pdf

Baker, P (2002) "The internationalization of European services: What can data on international services transactions tell us?" in Miozzo and Miles op cit.

Berkhout, A J (2000) **New Science in a New Society, cyclic interaction between knowledge and innovation** T U Delft, December 2000

Block, T, **Financial systems, innovation and economic performance**, MERIT & Infonomics Research Memorandum Series 2002-011

Centre for Innovation Law and Policy CILP (2001), 'Taxation and venture capital', (From website: http://www.innovationlaw.org/pages/taxandventure.htm).

Commission on Intellectual Property Rights, 2002, **Integrating Intellectual Property Rights and Development Policy**, London: Department for International Development; Available at: : http://www.iprcommission.org

Commission Staff Working Paper (2000) **Report on the Implementation of the Action Plan to Promote Entrepreneurship and Competitiveness Terms of Reference** SEC(2000) 1825 Brussels, European Commission

Cooke, P, Uranga, M G et al (1997) "Regional innovation systems: institutional and organisational dimensions", **Research Policy**, 26, 685-699

Cooke, P, Uranga, M G et al (1998) "Regional systems of innovation: an evolutionary perspective", **Environment and Planning A**, 30(9), 1563-1584

Coombs, R and Georghiou, L (2002)A New Industrial Ecology, **Science** April 2002
Cowan R, and G van de Paal (2000), **Innovation in a knowledge-based economy**, A Merit

Study Commissioned by the European Commission Enterprise Directorate General, Publication no. EUR 17023, June 2000

Driver, R, and Wren-Lewis, S (1999) 'Innovation and exports: Investigating new trade theory using panel cointegration', Royal Economic Society Annual Conference 1999, University of Nottingham, UK.

Economic Policy Committee (2002), Working group on Research and Development, **'Report on Research and Development'**, EPC/ECFIN/01/777-EN Final, Brussels, 10 January 2002

Encaoua, D, and Hollander, A (2001), **Competition Policy and Innovation** forthcoming in Oxford Review of Economic Policy Volume 18, issue 1 2002 available at www.core.ucl.ac.be/GabsHonor/ papers/EncaouaHollander.pdf

Enterprise DG (2000), 'Innovation in a knowledge-based economy', *Innovation and Technology Transfer (Special Edition)*, Nov. 2000.

Enterprise DG (2001) **Building an Innovative Economy in Europe**, European Commission

Enterprise DG (2002), "Business Impact Assessment Pilot Project - Final Report: Lessons Learned and The Way Forward", Enterprise Working Paper of March 2002, available from http://europa.eu.int/comm/enterprise/regulation/bia/ppbia_en.htm

European Commission (1995), 'Fourth Survey on State Aid in the European Union in the Manufacturing and Certain Other Sectors', in Griffith, R. (2000).

European Commission (1995), **Green Paper on Innovation**, COM (95) 688, December 1995

European Commission (1997), **Green Paper on the Community patent and patent system** in Europe, COM (97) 314 final 24 June 1997

European Commission (2000a) Communication from the commission **"Research and technological development activities of the European Union"**, Annual Report http://europa.eu.int

European Commission (2000b) **11th Annual Report on the Structural Funds (1999)**, COM (2000) 698 final

European Commission (2000c) **"Towards a European Research Area"**, Communication from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions, COM(2000)6 http://www.europarl.eu.int/

European Commission (2001a): Competitiveness Report 2001, Commission staff working paper, SEC (2001) 1705 - available at: http://europa.eu.int/comm/enterprise/enterprise_policy/competitiveness/doc/competitiveness_report_2001/

European Commission (2001b) **Environment 2010: Our future. Our Choice" – the sixth Environment Action Plan**, *Proposal for a decision of the European Parliament and of the Council*, COM(2001)31 final

European Commission (2001c) **The Regions and the New Economy**, COM (2001) 60-005

European Commission (2001d): **Structural Indicators**, Communication from the Commission,

European Commission (2002) **Innovation Policy in Europe 2001 – European Trend Chart on Innovation**, Luxembourg, EUR 17044, ISBN 92-894-1787-0

Fagerberg, J (1999) **Specialization and Growth: World Manufacturing Productivity 1973– 1990**, MERIT Working Paper, TSER report, available at http://meritbbs.unimaas.nl/tser/tser.html

FOREN (2001) **A Practical Guide to Regional Foresight**, European Communities, EUR 20128 EN

Gibbons, M. C Limes, H. Novotny, S. Schwartzman, P. Scott and M. Trow (1994), **The New Production of Knowledge – The Dynamics of Science and Research in Contemporary Societies** Sage, London.

Governance - The Governance Web Site: http://europa.eu.int/comm/governance/index_en.htm

Griffith, R. (2000), 'How important is business R&D for economic growth and should the government subsidise it?', Institute of Fiscal Studies briefing notes (published online at: http://www.ifs.org.uk)

Huws, U and S O'Regan, 2001 **eWork in Europe: the EMERGENCE 18-Country Employer Survey** Brighton, Institute for Employment Studies,

Informal Seminar of Industry and Research Ministers, "Fostering Innovation: the European Research and Innovation Area", S'Agaró-Girona, 1-2 February 2002,

IPI Ideas (June 6, 2001), 'Navigating the Internet Tax Debate', (From the Institute for Policy Innovation website: www.ipi.org).

Irwin A. and Vergragt P. (1989) "Re-thinking the relationship between environmental regulation and industrial innovation: the social negotiation of technical change", Technology Analysis & Strategic Management, Vol.1 No.1, pp57-70

Keating M (1998) **The new regionalism in Western Europe**, Edward Elgar, London
Koskinen S, Mikkola H (2001) **The new work and labour law** Helsinki : Sitra ISSN 1457-571X; 13) ISBN 951-563-400-8 (available online at www.sitra.fi

Lamy, P (2001) "What should and could be the contribution of public policies to create an environment that stimulates innovation, competitiveness and growth?", European Business Summit Workshop, Brussels, 10 June

Lamy, P (2002) "Facing the challenge of globalisation: regional integration or multilateral rules?", Speech - Buenos Aires, 1 March

Lundvall, B.A. and S. Borras, (1997), **The Globalising Learning Economy: Implications for Innovation Policy**, report prepared for the TSER programme, European Commission, Brussels available online at: http://www.cordis.lu/tser/src/globec.htm

Määttä K (2001) **Regulatory reform and innovations : Whether to trust the invisible hand or use the visible one?** Helsinki : Sitra. ISBN: 951-563-395-8 (available online at www.sitra.fi)

Miles I (2002) "Rethinking Organisation in the Information Society" in M Rader and G Schienstock (eds) **Work, Organisation and Social Exclusion in the Information Society** Frankfurt: Campus Frankfurt/M

Miozzo M and I Miles (eds.) 2002 **Internationalization, Technology and Services** Aldershot, Edward Elgar

Mittleman J H (1996) "Rethinking the 'new-regionalism' in the context of globalisation", Global Governance, 2, 189-213

OECD (1985) **Environmental Policy and Technical Change**, OECD, Paris

OECD (1992) **Technology and the Economy – the Key Relationships**, TEP Programme, OECD, Paris

OECD (1997), **The OECD Report on Regulatory Reform: Synthesis**, Paris 1997

OECD, 1998, **Co-Operative Approaches To Regulation**, PUMA Occasional Papers No. 18

OECD (2000) **Innovation and the Environment**, OECD, Paris (particularly Fukasaku Y. "Innovation and Environmental Sustainability: a background", chapter 2; and Kemp R. "Technology and Environmental Policy: innovation effects on past policies and suggestions for improvements", chapter 3)

OECD (2000), **Reducing The Risk Of Policy Failure: Challenges For Regulatory Compliance**, Paris 2000 (OECD PUMA group, available at

www.oecd.org/puma/regrefs/pubs/compliance.pdf)

OECD Trade Directorate Website (accessed 22/03/02): http://www1.oecd.org/ech/act/ecom.htm

Owen, G. (2002) 'The age of the enterprise ', Financial Times 2nd January 2002.

G Petrash and W Bukowitz (1997) "Visualizing, Measuring and Managing Knowledge" **Research Technology Management** July-August

Presidency Conclusions, Lisbon European Council, 23 and 24 March 2000. European Council website: http://ue.eu.int

Regional policy - http://europa.eu.int/comm/regional_policy/index_en.htm

Soete, L and K Kamp (1996) The 'bit tax': the case for further research, **Science and Public Policy** Volume 23, Number 6 December 1996,

Sprenger R I (2001), **Inter-firm networks and regional networks, opportunities for employment and environmental protection**, ADAPT National Support Structure, October 2001

Tether, B et al (2001) CRIC/IDSE/ISE **Analysis of CIS Data on Innovation in the Service Sector: Final Report**, report to European Commission DG12, CRIC, University of Manchester

Trade DG Website: "Towards better recognition of intellectual property rights" http://europa.eu.int/comm/trade/index_en.htm

Trade DG Website: "Trade and EU enlargement: Towards more trade in an enlarged union": http://europa.eu.int/comm/trade/index_en.htm

Trade DG website: http://europa.eu.int/comm/trade/speeches articles/spla99_en.htm

Tuomi, I. (2001) 'From Periphery to Center: Emerging Research Topics on Knowledge Society', TEKES (Finland) Technology Review 116/2001, p. 46.

UK Design Council (March 2001), 'Design for sustainability' report findings, (From website: http://www.design-council.org.uk/).

UK HM Treasury & Department of Trade and Industry (June 2001), **Enterprise and Productivity: The Government's Strategy for the next Parliament – Productivity in the UK: Enterprise and the Productivity Challenge**, UK June 2001, http://www.hm-treasury.gov.uk

UK HM Treasury (March 2000), 'Further Help for Small Business', available at: **http://www.hm-treasury.gov.uk/budget2000/revce1.html**.

UNICE, **Stimulating Creativity and Innovation in Europe –The UNICE Benchmarking Report** 2000, www.unice.org

Verlinden, M (2001) **EU Financing Innovation** presented at Industry Space Days, Noordwijk, 9 May 2001 (DG Enterprise, Innovation Policy Unit) available at: http://www.estec.esa.nl/conferences/isd2001/24.pdf

ANNEXE 1 MEMBERS OF THE HIGH LEVEL WORKING GROUP

Name	Role	Organisation	Country
Bruno Amable	Research Director	Cepremap-CNRS	France
A.J. Berkhout	Vice-President Research	Delft University of Technology	Netherlands
Raoul Kneucker	Head of Division, 'Scientific Research and International Affairs'	Federal Ministry of Education, Science and Culture	Austria
John Barber	International Innovation Policy	Department of Trade and Industry	United Kingdom
Donald Hillebrand	Research and technology division	Daimler Chrysler	Germany
Reinhold Enqvist	Managing Director	Nordic Industrial Fund	Nordic countries
Juan Mulett	Managing Director	COTEC Foundation	Spain
Riccardo Viale	Director	Fondazione Rosselli	Italy

SUBSTITUTES:

John Barber was replaced by Martin Ridge, from the International Innovation Policy unit of DTI at the first meeting.

Riccardo Viale was replaced by Davide Diamantini, also from Fondazione Rosselli, at the second and third meetings.

MEETINGS OF THE HIGH LEVEL WORKING GROUP WERE HELD:

- in Versailles, on 20 July 2001
- in Brussels, on 12 October 2001
- in Tuusula (Helsinki), on 10-11 January 2002
- in Castelldefels (Barcelona), on 11-12 April 2002

ANNEXE 2 MEMBERS OF THE STUDY TEAM

CO-ORDINATOR

Louis Lengrand, Managing partner, Louis Lengrand & Associés, Versailles, France

CORE TEAM

Prof. Ian Miles, Prest, University of Manchester, United Kingdom
Jeff Butler, Prest, University of Manchester, United Kingdom
Alain Quévreux, Chef du service Europe, ANRT, Paris, France
Isabelle Chatrie, Associée, Louis Lengrand & Associés, Paris, France

ANNEXE 3 CASE STUDY REPORTS

The three case studies are appended in the next pages in their original 'stand-alone' format

[i] See http://www.cordis.lu/innovation-smes/scoreboard/

[ii] See http://trendchart.cordis.lu/

[iii] This is available from http://europa.eu.int/comm/enterprise/regulation/bia/ppbia_en.htm.

[iv] For the review and associated consultation, see http://www.hm-treasury.gov.uk/Consultations_and_Legislation/Review_of_the_Supply_of_Scientists_and_Engineers/consult_rsse_index.cfm

[V] The following paragraphs are adapted from the project website (from which several papers can be downloaded), see http://www1.oecd.org/puma/regref/altern.htm and the regulatory reform site in general.

[vi] See also COM(2001)726.

[vii] See the Governance Web Site: http://europa.eu.int/comm/governance/index_en.htm for debates on governance initiated by institutional and non-governmental actors, debates on the Future of Europe and the Commission's portal on interactive policy-making.

[viii] See http://europa.eu.int/scadplus/leg/en/lvb/l26055.htm

[ix] See http://europa.eu.int/information_society/programmes/text_en.htm

[x] See http://europa.eu.int/comm/commissioners/liikanen/index_en.htm

[xi] It may be useful to read this discussion in conjunction with that on taxation policy below.

[xii] In the light of recent events, however, readers should note that the USA was here believed to represent a case of good accounting standards.

[xiii] See http://europa.eu.int/comm/internal_market/en/finances/actionplan/

[xiv] Communication from the Commission to the Council and the European Parliament, Progress Report on the Risk Capital Action Plan, COM (2000) 658 final

[xv] Commission Staff Working Paper, Enterprises' access to finance, ENTR DTSC 2001/172/B4 Finance

[xvi] See in particular page 155 of The European Observatory for SMEs - Sixth Annual Report, , 2000, prepared for DG Enterprise by KPMG Consulting and EIM Small Business Research and Consultancy, the European Observatory for SMEs, Luxembourg, Eur-Op Catalogue n° CT-22-99-200-**-C. An Executive Summary of this report is available online at www.kobinet.org.tr/kosgebabm/ english/lib/eu/eurob6en.pdf

[xvii] See http://www.eif.eu.int/

[xviii] See http://europa.eu.int/comm/regional_policy/index_en.htm

[xix] See http://www.innovating-regions.org/the_network/network_1_1.html

[xx] See http://www.cordis.lu/irc/

[xxi] Sonja Sheikh, [Austrian Institute for Small Business Research (IfGH)], 2001, Innovative SMEs and Employment Creation, 2001, Catalogue Number: NB-NA-17037-EN-C; available at: http://www.cordis.lu/innovation-policy/studies/gen_study6.htm#download

[xxii] Kemp (2000) argues that where effluent charges have been used this has generally been the case.

[xxiii] IRE Network News is available at http://www.cordis.lu/itt/itt-en/01-5/ire04.htm, while the centre of excellence itself can be reaches at http://www.electronicsyorkshire.org.uk/.

[xxiv] See http://europa.eu.int/comm/internal_market/en/indprop/comp/studyintro.htm

Innovation policy and the regulatory framework

Making innovation an integral part of the broader structural agenda

POLICY OVERVIEWS - ISSUE N°1 - OCTOBER 2001
TAXATION AND INNOVATION POLICY

CONTENTS:

1. ABOUT TAXATION AND INNOVATION POLICY

'Taxation' is an important structural factor in the European economy and one key issue for debate is how tax policy can be used to promote innovation? In the EU, Member states are largely responsible for taxation, with the European commission ensuring that the four freedoms of the internal market (free movement of person, goods and capital and the freedom to provide services) are not restricted.

Effects of taxation policy on innovation

In an effort to increase their levels of innovation, many countries have turned to fiscal incentives for R&D. The European commission's survey (E.C. 1995) on state aid suggested that its members spent over $1 billion per annum on R&D tax incentives during the early 1990s. Tax incentives seem a natural policy tool for a market-oriented government wanting to increase R&D expenditures. However Griffith (2000) poses the question that although R&D tax credits have become a popular policy tool in many countries, do they increase the total amount of R&D or is their main impact to relocate R&D between countries? Also does increased R&D expenditure lead to increases in the knowledge stock, or does it simply lead to higher wages for R&D scientists?

With the ever-stronger integration of national markets, the impact of tax regulations, including R&D tax incentives, on multinational corporations' decisions where to locate their production and R&D facilities has grown. Some countries have provisions that favour R&D in SMEs. For example, the UK government announced R&D tax credits that were made available to SMEs from April 2000 so that this would encourage innovation by giving SMEs a strong incentive to increase their investment in R&D (HM Treasury, 2000).

Other possible areas that could impact on innovation could be over environmental taxes, especially with some desire to promote common environmentally friendly tax policies. It is likely that this could stimulate innovation in particular related areas. For example, a recent survey of 600 European manufacturing companies (conducted as part of a 'Design for sustainability' research study sponsored by the UK Design Council) concluded that all European countries believe design for sustainability is going to be a major issue in the

future, both internally within their organisation and externally for all companies in the next five years.

The role of innovation in taxation policy

Although tax legislation is the preserve of Member states, the States are not completely free in the design of their tax policy and tax incentive instruments. They have, in particular, to comply with EU rules on state aid and on taxation. This indicates that national and regional (direct/ indirect) taxation measures should be complementary. In the knowledge driven economy the critical element of R&D is human resources, therefore fiscal measures that focus on the costs of employment of skilled resources, rather than just turnover or profit based relief, should be paid particular attention. More systematic analysis is required in order to identify appropriate practice and benefits of innovation in member states to establish how it interacts with other policy instruments and taxation policy in particular.

It needs to be stressed that the relationship between taxation and innovation policy areas encompasses a range of other issues such as employment, financial risks, environment and regulatory reform, highlighting the need for greater co-ordination between all policy areas. There seems to be a need to make both the opportunities and risks of new technologies as transparent as possible in a broad dialogue with science, business and the general public, taking account of the potential economic and social costs of 'non-innovation'.

Key issues and questions

Ongoing debate about the scope and even need for new modes of taxation in a knowledge driven society.

What are the prospects of multilateral agreement over taxation of e-commerce and its implications for innovation? For example, in the USA as e-commerce trading grows, states stand to lose a significant amount of revenue. In response, they are promoting a new 'simplified' state sales tax system and other changes to facilitate state collections of e-commerce taxes. Also an emerging consensus in USA is that a tax on Internet access (this is a tax on the fee a customer pays an Internet service provider such as America Online) is a tax on information, with some states who imposed this now moving away from it as this might constrain Internet use by those least able to pay (Institute for Policy Innovation, 2001).

Removing obstacles and reducing the regulatory and tax burdens on small businesses could have a substantial, positive impact on small businesses to facilitate job creation in many innovative industries and services that require skilled people.

It is widely acknowledged that venture capital is highly risky, as venture capital successes are far fewer than failures. However, when projects are successful, they provide extraordinary returns to investors. Thus, the tax provisions in relation to a risky, growing companies are most relevant. These tax provisions are not just related to the taxes paid at the time when a company starts up. They also apply at the time when a person cashes in his gains by selling shares to new investors or incurs losses from unsuccessful ventures (CILP, 2001). EU member states should continue to pursue efforts to create a legal, fiscal and financial environment favourable to the creation and development of start-ups.

The interface between companies and financial markets requires attention since financial constraints, including lack of appropriate sources of finance, continue to figure among the most cited obstacles to innovation (EC Enterprise DG, 2000).

However, the potential ways in which the better co-ordination of policies described above can help to encourage innovation can only be successful if the practical aspects of policymaking and implementation are appropriately organised. The following example of the use of taxation policy to promote innovation in the United Kingdom involving co-ordination with other policy areas and the practical lessons that can be drawn from it are useful in illustrating this point.

2. THE UK EXPERIENCE

The UK Government is working to create a favourable business climate for businesses to innovate in the UK. Small and medium-sized companies (SMEs) wishing to undertake R&D can face particular difficulties in this regard. R&D is often a long-term investment. Smaller companies are the least well able to sustain this necessary investment over long periods of time, and do not necessarily have access to funding. The SME R&D tax credit was developed by the Department of Trade and Industry and HM Treasury to help overcome these barriers to encourage R&D, since R&D can help create:

- new and more competitive products, services and processes;
- new markets;
- high-quality employment opportunities for skilled people.

The SME R&D tax credits allow for enhanced tax relief for certain R&D spending in two ways:

- an increase in the tax relief SMEs can claim for their qualifying R&D expenditure from the usual R&D Allowance (see below) of 100% to 150%;
- or a payable R&D tax credit for companies not in profit - a cash payment of £24 for every £100 spent on qualifying R&D.

In response to concerns that innovative businesses in the UK sometimes find it difficult to recruit the skilled researchers they need, the Government asked Sir Gareth Roberts in June 2001 to lead an independent review of the supply of scientists and engineers in the UK. As well as examining the numbers of scientists and engineers in the UK and the jobs they do, he is looking at the skills needed by businesses for their R&D activity, and at the skills gained by science and engineering graduates and postgraduate students, particularly PhD students. The Robert's Review links closely with the R&D Tax Credit for SMEs as innovative businesses will need to be able to recruit more researchers with appropriate qualifications in order to be able to increase their R&D activity in response to the tax credit.

Timeline

- The UK Chancellor announced proposals for anew R&D tax credit in the 1999 Budget, for implementation in the 2000 Budget.
- The new scheme for R&D tax credits for small and medium-sized companies (SMEs) was introduced in the Finance Act 2000.
- From 1 April 2000, spending on R&D by SMEs could qualify for R&D tax credits.
- In support of this, the Secretary of State for the Department of Trade and Industry issued new guidelines on the meaning of R&D for tax purposes on 28 July 2000.
- The Robert's Review of the Supply of Scientists and Engineers began in June 2001 and will report in February 2002.

New Guidelines on the meaning of R&D for tax purposes, including a new statutory definition of R&D, were issued to coincide with the introduction of R&D tax credits. The new definition and guidelines clarify what constitutes R&D for tax purposes and give businesses added certainty in their tax affairs.

Wider links and relationships

The UK Government is preparing a number of wider economic reforms to help to create a truly entrepreneurial and innovative culture open to all where talented people in all the UK's regions and communities have the chance to start and succeed in business.

- major reforms to the **competition regime** including full independence for better resourced competition authorities, a new duty to promote competition across the economy, reform of the complex monopoly regime, and a proposal of criminal penalties for those involved in cartels;
- reforms to **insolvency laws** to abolish the Crown's preferential right to recover unpaid taxes ahead of other creditors, and to ensure the use of collective procedures instead of administrative receivership;
- changes to the **taxation of share options**, enhancing **Enterprise Management Incentives** to help high-growth firms attract high-quality employees, doubling the size of firms that can qualify;

Key reforms and actions at the EU level include:

- the EU R&D and innovation initiative, an in-depth study to highlight the barriers to R&D and innovation, and examples of best practice to raise performance, for the Barcelona Spring Council 2002;
- action to tackle the EU's poor patenting performance by reaching agreement by 2001 on an affordable and easy to obtain Community patent;
- implementation of the Risk Capital Action Plan to tackle market failures in the supply of venture capital to support innovation;
- the creation of new guidelines for venture capital state aids, allowing governments to develop initiatives such as the UK's Regional Venture Capital Fund; and
- reforming the EU's own spending on R&D to focus on fewer research areas to enable the EU to build a critical research mass in key technologies.

3. ISSUES FOR POLICY MAKERS – EMPIRICAL FINDINGS ON NEW CHALLENGES FOR STRUCTURAL POLICIES

Spillover and social return are seen as the mostly desired outcome from private R&D in, order to support sustainable wealth creation in the knowledge based society. As such, they provide a sound foundation to public policy and public intervention.

The goal to strengthen the level and return of R&D and innovation in SMEs raises structural challenges in the medium and long term. Based on the UK Case study, a need to bridge macroeconomic policy and a "global hands-off approach" of microeconomic policy can be emphasised.

Reducing taxes on intellectual business assets, such as the 150% refundable SME R&D tax credit implemented in the UK is one option. This instrument was designed to tackle the problem of declining R&D. However, the appropriate level of tax cuts was not addressed in the decision making process: it is an important feature of any policy that not everything can be totally understood until the new instrument is launched. Hence, on going monitoring and feedback loops are of paramount importance.

This particular case study teaches that innovation is about working out reliable solutions based on the accurate assessment of benefits and burdens affecting stakeholder behaviours. In that respect, early feedback from this scheme raises expectation for good results.

NO EVIDENCE WAS MADE OF THE REASONS WHY TO DECIDE TO WORK IN A DIFFERENT WAY? HOW CAN TASKS BE FORMULATED TO ASSIST AND DEVELOP BETTER-ADAPTED FRAMEWORK CONDITIONS? AS A LESSON LEARNT, GOOD PRACTICE CAN BE THOUGHT OF AS A SHARED VISION, A CAREFUL IMPLEMENTATION, AN ENFORCEMENT POLICY AND A SUPPORT FROM THE EUROPEAN COMMISSION TO DISCUSS HOW NEW SCHEMES FORM A COHERENT AGGREGATE AT EU LEVEL.

A. Better vision – Empirical evidence – Degree of beliefs and resistance –

1) **Creating a shared** vision based on pre-established diverging understandings of evidence. A reinforced culture of consultation and dialogue should be systematically put in place
2) Adequate level of competition together with the right level of liberalisation drives innovation. Liberalisation may not be sufficient as the single driving force. Policy makers have to strike **the right balance between the need to ensure competitive pressure and the adjustment of regulation**

B. Better implementation – Concrete measures

3) The way in which support schemes are implemented in practice must be carefully considered in order to **avoid creating new distortions** that could be larger than the initial gap.
4) The focus on **corporate tax credit** was given a preference while no discussion were started on **tax cut for knowledge intensive labour**. In many cases, departments can make blind or wobbly proposals to support innovation when in fact they stick to their internal boundaries or to their proprietary knowledge and beliefs.
5) How can differences in taxation between countries interfere with competition among teams within the same global company? How does it affect the outsourcing policy of firms? Many **crucial issues at firm level are not dealt with** when shaping a new instrument because the accurate information is not available to policy makers, mainly because this **information is not rooted nationally.**

C. Better enforcement – Indicators and judgement

6) Co-ordination is about **concurrent process engineering** of business and policy models for networked enterprises at European level
7) Co-regulation is about **bridging different ministries**/departments or DGs. Links were demonstrated between research and innovation, finance and innovation, skills and innovation, tax revenue and innovation
8) How can the **level of pro-activity**, as a mix of formal and informal links, be measured as an output and increased? Statistical data are of little use to explain quick moves and to discuss **target based instruments**.

D. EC support – Initiative taker and market maker for reform options

It becomes much more difficult to act on innovation policy because it is demand-driven whereas public policy used to be supply-driven and top-down (and may still be). European Commission can **help progress on reforms** by putting in place instruments to

prepare a more effective analysis by policy makers :

9) Revising the **blue-sky** thinking based on large consultation
10) Reporting on the use of regulations and instruments i.e. giving a detailed description of the links between the implementation world and the policy makers expectations domain.
11) Linking with annual report on structural reform edited by DG ECFIN and discussing the indicators for monitoring
12) Linking with the White paper on European governance

Extracts from the White paper on European governance
The consultation process

The Commission will:
- Adopt before the end of 2001 minimum standards for consultation and publish them in a code of conduct.
- Develop more extensive partnership arrangements from 2002 onwards in certain sectors.

The Economic and Social Committee should play a more proactive role in examining policy, for example through the preparation of exploratory reports.

Member States should examine how to improve their consultative processes in the context of EU policy

The Council and European Parliament should review their relationship with civil society and, building on the minimum standards for consultations, contribute to a general reference framework for consultation by 2004.

4. FURTHER RESOURCES

- European Commission (1995), 'Fourth Survey on State Aid in the European Union in the Manufacturing and Certain Other Sectors', op.cit. Griffith, R. (2000).

- Griffith, R. (2000), 'How important is business R&D for economic growth and should the government subsidise it?', Institute of Fisca Studies briefing notes (published online at: www.ifs.org.uk)

- UK HM Treasury (March 2000), 'Further Help for Small Business', (From website: www.hm-treasury. gov.uk/budget2000/revce1.html).

- UK Design Council (March 2001), 'Design for sustainability' report findings, (From website: www.design-council.org.uk/).

- IPI Ideas (June 6, 2001), 'Navigating the Internet Tax Debate', (From the Institute for Policy Innovation website: www.ipi.org).

- Centre for Innovation Law and Policy (CILP, 2001), 'Taxation and venture capital', (From website:www.innovationlaw.org/pages/taxandventure.htm).

- European Commission Enterprise DG (2000), 'Innovation in a knowledge-driven economy', Innovation and Technology Transfer (Special Edition), Nov. 2000.

About the study

The study being carried out for DG Enterprise of the European Commission is entitled, 'Innovation policy and the regulatory framework. Making innovation an integral part of the broader structural agenda'. The context for the study is DG Enterprise's work to promote a regulatory environment that is conducive to innovation so as to advance the strategy, set out at the Lisbon European Council, to make the European Union the most competitive and dynamic knowledge-based economy in the world by 2010.

The study deals centrally with the interface of these two areas:
- What implications do the move into a creative knowledge-based society, and its associated changes in innovation processes, have for other policy areas?
- To what extent and how should other policy areas be utilised in order to advance innovation policy in Europe?

The study will focus on 14 regulatory and community policies: Competition, Regulatory reform, Financial services and risk-capital plans, Trade, Protection of IPR, Taxation, Employment, R&D, Regional policy (with especial focus on structural funds), Policies fostering ICT, Education and Culture, Environment, Enterprise, Governance.

A high level working group has been established, in order to widen the scope of the project's analysis and ensure the input of views from the perspective of the different policy areas that make up the Community regulatory framework.

Innovation policy and the regulatory framework

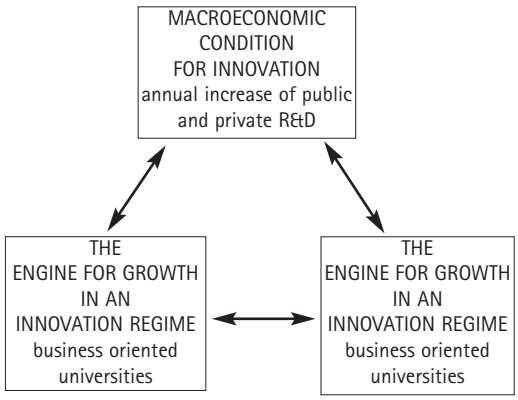
Making innovation an integral part of the broader structural agenda

POLICY OVERVIEWS - ISSUE N°2 - JANUARY 2002 MACROECONOMIC CONDITION, GROWTH AND EMPLOYMENT IN THE INNOVATION SYSTEM IN FINLAND

CONTENTS:

HOW TO TAKE ADVANTAGE OF THE FINNISH EXPERIENCE

Several books have been written to describe the popular and trendy Finnish system of innovation and its evolution. The purpose of this case study is neither to add a new contribution nor to discuss the validity of the Finnish model. The aim is to take advantage of the Finnish experience to propose a set of pointers, which deserve attention in order to "make innovation a part of the structural agenda". In a way, successful achievements in Finland appear to be somewhat unexpected to the Finns themselves and the outcome may have come out of a set of local circumstances and talented people. However, lessons learnt should be used by every national government in Europe. They could form the basis for a shared vision and collective learning at European level.



I – MACROECONOMIC CONDITION FOR INNOVATION : EXPANDING R&D

POINTER 1

Long term development of research and continuity of public sector commitment

"Invest in research" and always "focus on research facts" are two key messages deri-

ved from the Finnish case study. The structural debate has always been focussed on stronger and faster increase in public and private investment in R&D.

As a matter of fact, since the 50s, investment in research has increased continuously year after year. A shared vision of the necessity to change in order to survive the economic depression of the late 80s has been seen as a key factor to remove barriers and to make people feel that things had to be changed radically. The rationale is the need to continuously improve the quality, relevance and impact of research. It is recognised as a strategic resource and asset by ministries.

A law was passed in 2000: it makes compulsory to increase the deflated volume for university research funding.

■ Indicators

Indicators. The following two indicators clearly show that Finland is currently becoming a knowledge-driven economy:

- Finland, the volume of R&D has doubled every ten years. Over the last 15 years the ratio R&D/GDP has grown up from 1.8% to 3.3%, i.e. +0.1% a year.
- Researchers now represent 1% of the total labour force

Budget constraint: When the virtuous circle is at work, i.e. successful research calls for further research, the issue for the budget law is to keep up with private R&D funding. A ratio of 70% funding by the private sector versus 30% for the public sector must be maintained. This investment in public R&D is necessary to maintain the right level of collaborative R&D between multinational firms and national R&D infrastructure.

Public funding is used to strengthen the links within the knowledge base, collaborations are strongly supported. Only a few cases of very academic or promising research are funded as such. Quality of collaboration and interactions can be measured by assessing the risk-sharing process.

POINTER 2
A range of adequate institutions is required to shape the knowledge competition

Trade-offs: the ability to take controversial decision through a shared strategic vision is a key factor for competitiveness in the Finnish example.

A constant policy in the long term, the courage to maintain the level of research investment in the crisis period in the early 90s when everything else was cut, the decision made in 1996 to increase public research funding by 25% over 3 years, are many facets of a multi-partner consensus for R&D support. This hands-off top-down approach (an approach which is government lead in a soft non interventionist manner) created an environment conducive to innovation letting businesses decide how to create economic welfare by selecting the more appropriate research.

Nowadays, the national innovation system is mainly driven by a cluster of 7 institutions : Science and technology policy council, ministry of trade and industry, ministry of education, Parliament, Academy of Finland (funds for university and academic research), Technology research centre (Tekes), Sitra. In all bodies, stakeholders and industry have members on the Board.

■ History

In the 60s

- Science Policy Council (founded in 1963)
- Innovative exploration, feasibility study and testing (Sitra – founded in 1967)

- University research (Academy of Finland, renewed in 1969)
- Ministry of trade and industry

In the 80s

- In the 80s, Finns realised that they were not competitive enough in the Western market.
- Generic technology research (Tekes-Technology research Centre founded in 1983)
- Science and Technology Council created in 1986 by converting the 1963 Science Policy Council

In the 90s

- National system of innovation is introduced by the Science and Technology Policy Council as a framework for future development measures. This concept implies that everything is operating internationally and that two sets of interactions must be emphasised: user needs and knowledge transfers.

POINTER 3

Informal networking of policy makers is an essential part of the innovation policy. Broadening the scope of innovation policy can only be achieved by building up new informal networks

The Science and Technology Policy Council of Finland is a strategy building body: this consensus approach avoids different ministries' counteractions. Innovation policy integration is prepared by a limited number of persons. Each person participates in several bodies. Informal but dense networking and intense exchange of information is achieved through these participations. "Natural co-ordination is achieved when as many people as possible know what you do and what you need. All stakeholders must be involved from the beginning to be able to reach a consensus by smooth settlement of dispute".

Academy of Finland supporting university research, Tekes supporting generic technology, Sitra exploring new areas and new incentives, complement each other.

This modern way of working by personal contacts and frequent interactions is time consuming. Broadening the co-ordination takes time because you need to build up informal networks before an open exchange of information based on short messages and clear target setting can take place.

As an example, STPC meets 2 to 4 times a year. One meeting is a longer seminar for in-depth discussion; 2 subcommittees meet once a month during the academic period. Altogether 20 meetings a year are taking place to co-ordinate policies and settle disputes.

POINTER 4

Law and regulation must set reasonable standards and have incentives to enhance innovation.

The goals must be long-term oriented and strategic targets must be clearly set. Limit law-originated rules and conditions. Do not interfere when you cannot understand and do not implement a too detailed approach when you cannot anticipate all possible situations. Let the players do it.

Unions are seen as strong but also tuned to the needs of society. However, the will to keep the spectrum of wages very narrow brings about less flexibility for competitiveness. The trade-off is that it helps overcome a recession or downturn: Unions want a policy tuned for bad times; industry wants to reinforce economic growth and wealth creation whenever feasible.

II - BUSINESS ORIENTED UNIVERSITIES, THE ENGINE FOR GROWTH IN THE INNOVATION REGIME

How does research affect growth in Finland? After the deep crisis Finland faced in the late 80s, the R&D-based recovery is uneven. Five universities can be identified as national growth centres: Helsinki, Turkku, Tampere, Oulu, Jyväskyla. The Oulu university paved the way. It was Finland's first regional university established to serve Northern Finland about forty years ago. Jyväskyla has been the fastest growing over the recent years after a declining period. Together with 5 other universities, they form the bulk of Finland economic success.

Innovation policy debate goes back to the 1980s when the country recognised that it needed to be more competitive in the global market. Nokia conversion from tyres and TV sets for the USSR to an ITC company competing for world-wide market has been key to the renewal of Finland. Strong investment in US was accompanied by strong revival of the Finnish system in order to remain an attractive site for a world-wide company. The Oulu style of business oriented university has been key to the success. Oulu recruits about 70% of its students from Northern Finland and about two third of its graduates stay in the Northern region.

Before the Oulu success, the academic world thought it was not proper to work with industry. The mindset changed gradually and nowadays co-operation between university and industry is good. University and business agree on education and innovation going hand in hand. Research facts are always part of the innovation process and economic performance: Innovation is turning ideas into profits.

POINTER 5
Make innovation a vertical policy, driven by enterprise success and entrepreneurship.

Government programs, based on a shared strategic vision supplied by the STPC, have been key drivers to innovation. This can take place by not dictating or planning the desired outcome but by creating an environment conducive to innovation.

As an example, in 1996, it was decided by the ministry of Trade and industry to reinforce the Finnish research capacity. Based on privatisation funds, public investment has been designed to reinforce firm driven success: The growth of Nokia was turned into on-going growth for Finland. This synchronisation of sudden increased effort created a new environment conducive to research and PhD training. Everything became easier and more flexible. A lot of new thinking found its way.

Adaptation to globalisation took the form of enterprise-driven restructuring of the innovation system in terms of openness and competitive partnerships building. Search of attractiveness for all partners involved has been and still is the key driver, instead of the traditional distinction between public and private research.

POINTER 6
Shift to post-medieval university by stopping the cloning of professors

A new approach to knowledge and learning is needed.

The shift from the medieval "cloning" approach where professors teach and students are taught towards a new paradigm based on multi-clonal approach where learning from several clones is more important than being taught how to clone new adepts,

opens the way to structural reform:

- To gain success from multi-cloning approach you need multidisciplinary programs: Have Technology, science, education and business administration under the same roof is the recipe of Oulu university.
- Create focus teams to support research programs where you are strong.
- Build up connections between research programs: the Oulu university example: IT, Biotechnology, Environment technology, Northern issues. You must become the experts on the changing conditions which are dependant on your context and background. The knowledge base specialised in the inter-linkages and interactions which shape your own experience. It then shapes the ground on which to deliver world-wide competitive advantage.
- University has to be internationally recognised in order to bring economic development. Also create virtual university to seek partners doing the same research than you do.
- Give more resources to fewer people/projects to expand the knowledge base and the idea marketplace faster. Applicants for the Science and technology policy council funding are researchers, not universities.
- Make professors compete for PhD students and doctorate training.

Industry has to know what it needs and the university can help by launching adequate research programs, training skilled people, providing industry with world class researchers and engineers, strengthening technology and innovation in the SME supply chain.

University has to remain competitive when mobility can be both an asset - by providing a strong new network of partners - and a weakness - when successful departments loose their main researchers. Industry can help by supplying resources for equipment and professors recruitment. 87 out of 235 professors at Oulu University are totally or partly funded through the support of industry (only 2, 8 years ago).

POINTER 7

Focus more on research quality by introducing the adequate level of competition for funding

Self adapting mechanisms rather than solutions are needed to be prepared for the unknown future.

Quality is often assessed based on previous successes. There is no reason to believe that newcomers with an unseen strategy must be assessed by looking back at previous success.

There is a need to find a methodology to discover promising facts in research plans: to discover the new instruments you need in order to have the effort you want.

Define methodology and indicators to monitor meeting points and crossroads which turn knowledge into competitive growth.

Balance brain drain and brain gain

III – POWERFUL MUNICIPALITIES, THE EMPLOYMENT DRIVER THROUGH INNOVATION EFFICIENCY AT LOCAL LEVEL

POINTER 8

Promotion of social, economic and cultural development

How does research affect employment? Impact of R&D on employment has been evaluated positively by all parties involved in the public debate, including the

employees' organisation. It is a precondition for maintaining and developing the welfare society in the years to come. Business enterprises need supportive measures from the public sector in certain areas.... Cluster-based activities constitute a new form of support for social and economic development: Ministries, research and financing organisation, and business enterprises together have created research entities in support of technological and industrial development

Education guarantees employment and salaries. 17% of young Finns, i.e. 10, 000 a year, do not end up with a higher secondary degree.
Public and private partnership must bring them to that level through adult education, lifelong learning and vocational training.

POINTER 9
Expand and develop knowledge cities on the basis of university and public-private partnership

Municipality and privately owned polytechnics institutes have been created by upgrading existing vocational establishments. They offer limited R&D opportunities and are geared towards delivering teaching programmes.

Centres of expertise and regional economic development agencies are local level task forces for setting up innovative partnerships between universities, cities, science parks, chambers of commerce.

It can be seen as a task force to implement the networking capacity. Their role is to raise money for science parks and surroundings. From a planning perspective, there is also a need for working on improving local infrastructure by promoting better communication (road/rail) links to better connect science parks and local industry to develop some sort of test bed for innovation. This is a new kind of Urban Policy programme and a fight against social deprivation.

Social competitiveness i.e. the role of social structure, social distances between people, plays an important role in the transmission of tacit knowledge (it must be made easy to get in contact with anybody for good reasons) which sets the foundation of every innovation. Because this local embeddedness is seen as a key factor to better distribute wealth creation, it is a case of micro-geography of innovation. In the knowledge driven economy, urban policy could be the driver to prevent social segregation and poverty.

LOCAL CO-ORDINATION FOR INNOVATION

- Horizontal co-ordination must come first. The decision making process must be brought as close as possible to the implementation level.
- Multipolis program: a strategy to duplicate dynamics of growth and employment in Northern Finland, supported by EC structural funds;
- Integration of new economy and old economy
- New business concept of many subcontractors working together, new business process.
- Need for further links between global, social, organisational innovation and technological innovation

THIS DOCUMENT IS BASED ON A SERIES OF MEETINGS AND INTERVIEWS WITH REPRESENTATIVES OF THE SCIENCE AND TECHNOLOGY POLICY COUNCIL OF FINLAND, THE ACADEMY OF FINLAND, THE TEKES RESEARCH CENTRE, THE NOKIA GROUP, THE UNIVERSITY OF OULU, CULMINATUM OY, THE MINISTRY OF TRADE AND INDUSTRY AND THE CONFEDERATION OF FINNISH INDUSTRY. THESE MEETINGS TOOK PLACE IN PARIS AND HELSINKI IN NOVEMBER AND DECEMBER 2001.

About the study

The study being carried out for DG Enterprise of the European Commission is entitled, 'Innovation policy and the regulatory framework. Making innovation an integral part of the broader structural agenda'. The context for the study is DG Enterprise's work to promote a regulatory environment that is conducive to innovation so as to advance the strategy, set out at the Lisbon European Council, to make the European Union the most competitive and dynamic knowledge-based economy in the world by 2010.

The study deals centrally with the interface of these two areas:
- What implications do the move into a creative knowledge-based society, and its associated changes in innovation processes, have for other policy areas?
- To what extent and how should other policy areas be utilised in order to advance innovation policy in Europe?

The study will focus on 14 regulatory and community policies: Competition, Regulatory reform, Financial services and risk-capital plans, Trade, Protection of IPR, Taxation, Employment, R&D, Regional policy (with especial focus on structural funds), Policies fostering ICT, Education and Culture, Environment, Enterprise, Governance.

A high level working group has been established, in order to widen the scope of the project's analysis and ensure the input of views from the perspective of the different policy areas that make up the Community regulatory framework :
- Bruno AMABLE, Cepremap-CNRS, France
- Augustus BERKHOUT, Delft University of Technology, Netherlands
- Raoul KNEUCKER, Head of Division "Scientific Research and International Affairs", Federal Ministry of Education, Science and Culture, Austria
- John BARBER, director of TESE, Technology, Economics, Statistics & Evaluation Directorate, Department of Trade and Industry, United Kingdom - Representative : Martin RIDGE, DTI
- Horst SOBOLL Director of research policy at of DaimlerChrysler AG., Germany - Representative : Donald HILLEBRAND
- Reinhold ENQVIST managing director of the Nordic Industrial Fund, Nordic countries
- Juan MULET, general manager of COTEC Foundation, Spain
- Riccardo VIALE Fondazione Rosselli, Italy - Representative : Davide DIAMANTINI

Innovation policy and the regulatory framework

Making innovation an integral part of the broader structural agenda

POLICY OVERVIEWS - ISSUE N°3 - MAY 2002 ENTREPRENEURSHIP/CULTURE OF INNOVATION, INDUSTRY-SCIENCE RELATIONSHIP AND R&D&INNOVATION IN CATALONIA

CONTENTS:

HOW TO TAKE ADVANTAGE OF THE CATALONIAN EXPERIENCE?

Catalonia offers a remarkable situation to watch considering its unusual background :
1. From the 19th century, Catalonia has developed manufacturing valuable knowledge. Catalonian experts are in industry.
2. Spain used to be a closed and collusive economy until the mid 70s
3. What several Catalonian officials named a "democratic shock" lead to a quickly upgrading economy to become an open one at the edge of this century. People suddenly understood that business had to radically change.
4. Catalonia belongs to the Spanish model of "Autonomy", a subsidiarity principle bordering state government power to what is written in an explicit manner in the constitution law. Everything else is left to the national government of Catalonia and similars from other Spanish regions to deal with.
5. Spain and Catalonia are fast growing areas in Europe in the field of technology and research.

Indicators

- 1.1% R&D/GDP (1.3% in 2002 forecast) (0.9% for Spain) (1.9% EU average)
- 64% of research investments are business expenditure
- Catalonia accounts for 23% of Spanish research (second to Madrid region)
- And 35% of Spanish patents (first to Madrid region)
- 3.7 Researchers per thousand inhabitants (5.3 EU average)

6. Hence, the Catalonia system of innovation shows specific features that has demonstrated strong efficiency in a catching up economy in Europe.

This case study has a focus on local conditions and policy. Nevertheless, it must be acknowledged that the central government strongly reformed its own framework towards innovation in the recent years:

■ Tax credit for technological innovation was introduced on January 1 st , 2000. Beyond the existing law on tax credit for research and development, tax rebate is permitted for technological innovation which has an outcome in terms of new products or processes, or which significantly improves existing ones. Rate is 15% of the eligible costs.

■ This tax reduction is part of a wider National plan for scientific research, development and technological innovation (2000-2003)

■ Ramón y Cajal program (Name of a famous Spanish Nobel prize) was introduced by the Ministry of science and technology to hire post-doc researchers having spent at least 1,5 year abroad on five-year contracts to be full time researchers, 80% being funded by the ministry to widen human resources of universities. So far, 200 out of 800 went to Catalonia.

The aim of this case study is to take advantage of the experience of Catalonia and Spain to focus on a limited number of basic conditions for innovation that need to be met in order to enter structural reform to promote innovation. In the case of Catalonia, the role of public policy is to systematically support every valuable aspect of each condition for innovation to be promoted and only these.

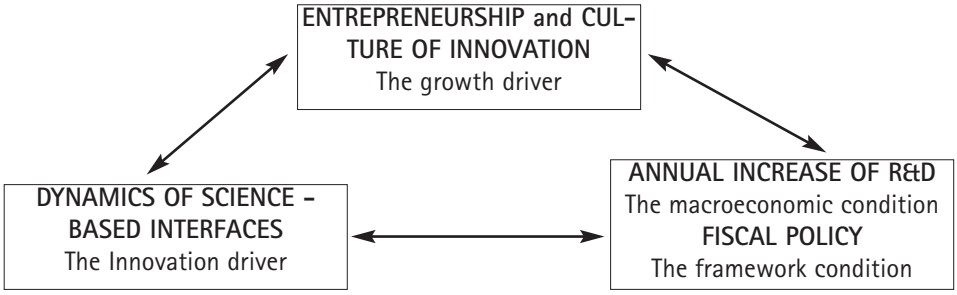
In comparison with the situation of most European countries situation, Catalonia successful achievements are somehow unexpected given the fact that Regional achievements are mainly based on regional entrepreneurial behaviours that came out a set of local circumstances. Catalonian entrepreneurs take advantage of framework conditions given by both the Spanish and Catalonian government.

As this paper is the third case study under the umbrella of this on-going work, it is worth mentioning a convergence between regions and countries in Europe when considering global competition and global innovation. While having different sets of circumstances and background, Finland and Catalonia demonstrate converging features with different emphasis and weight to achieve different trade-offs in terms of regulation of risk and uncertainty.

It is also worth paying attention to the growing importance of cities and metropolitan area planning in the innovation process. Innovation "just happens" thanks to local conditions for clustering and networking both in physical and virtual terms. Conditions for living, working, transportation, availability of commodities must be seen as conditions for innovation.

Innovation policy in Catalonia focuses on three major conditions to create an environment conducive to innovation: Entrepreneurship and fostering the culture of innovation, Dynamics of science-based interfaces, Budgetary and fiscal policy for R&D&Innovation.

THREE MAJOR CONDITIONS FOR INNOVATION



I – ENTREPRENEURSHIP AND CULTURE OF INNOVATION

CONDITION FOR INNOVATION N°1
1.1. CATALAN ENTREPRENEURS AND SMES

Catalonia can be described as a highly entrepreneurial and family driven economy. It is not a surprise that achieving self financing remains a strong option for entrepreneurs and that the banking system is very conservative and risk adverse. However, the current changes in the economy are calling for more partnership, networking and shareholders: the challenge for Catalonia is to shift from an open economy to an innovative economy able to compete globally on worldwide markets.

Metropolitan area coordination networks are hardly expected to be welcomed by industry as a relevant means to better deliver coordination of activities, services and commodities such as stable electric power supply. This is a strong lesson to be learnt from the Catalonian case: a pre-requisite for innovation is to bring up physical conditions where you want innovation to "just happen", i.e. to implement facilities and commodities because at the end of the day, in the self adapting society innovation is calling for, people have to live, work and meet, at least sometimes, and certainly somewhere.

Hence, in order to progress towards the innovative economy, industry is calling for new interesting movements outside the traditional institutional way. To give an example, at the present stage of development, innovation may come out from what you see in Fairs and Exhibitions and from what you learn from suppliers. This part of the micro-economy of innovation is often underestimated. Creativity is then the process of matching parts of information collected with the ability to understand what best fits business competitive assets and tacit knowledge of the company.

New schemes for in house training and validation of acquired knowledge are needed: training is the most important tool to support innovation capacity at low skill level. The Institute of Catalonia for Technology – ICT - is one of the main providers of training and lifelong learning.

CONDITION FOR INNOVATION N°1
1.2. COMMITMENT TO FOSTER THE CULTURE OF INNOVATION

Catalonia has a strong tradition of entrepreneurship. Therefore, the innovation policy aims at strengthening would-be entrepreneurs and local conditions, making a project out of an idea, labelling innovative entrepreneurs, promoting and supporting existing capacities.

The Catalonian model of entrepreneurial spirit is based on project attraction, project consolidation and project selection leading to enterprise creation

The 1st innovation Plan of Catalonia (2001-2004) was adopted recently, showing that global competition policy, be it called innovation policy or total factor productivity, can only be set up when the first steps of an open economy based on quality and productivity have been achieved.

This is why Innovation policy is understood as a set of measures and public actions aiming at enhancing the innovation capacity of firms. Innovation policy must understand how firms innovate so as to define the appropriate supporting tools. The supporting actions must have an impact on the environment to promote business innovation

both at domestic and international level.

The Innovation plan includes 5 lines of action to improve the innovation capacity of enterprises:

- Innovation management
- Technology market
- Entrepreneurial spirit
- Digitalisation of companies
- Manufacturing and logistics

Support project maturation and promote deal flows: Quasi companies.

From idea, i.e. non previously existing innovation, to a consolidated project, the strengthening process is supported by Cidem (the Catalonian centre for innovation and technology).

Before the market exists, there is no venture. A project is the developing of a technology which could form the basis of a marketable product. Projects up to 2 Million Euro can be supported at a risk. Public support ranges from 60 000 to 120 000 Euro and is given by an ad hoc Committee, of which 3 members out of 4 are venture capitalist or industrialists. 24 projects were supported in 2001.

To give an example of the limited amount of support given and its important advantage, the Catalan government can provide funds to hire a project manager and help find him or her. It can the case than no other support will be given, maximising the cost/benefit ratio of the public incentive.

This scheme is called the "Technological trampolines network". It refers to technological jumping springboard actions to close the existing cultural gap that can be found in Catalonia between researchers, private investors and senior managers by networking them. They must be seen as entrepreneurship Centres. They are not incubators but deal flow generators. The process also decreases appraisal costs for investors by giving them more visibility to a list of consolidated projects.

Boost the trendsetters: 42 groups of university researchers are supported:
Based on existing capacities and groups and entrepreneurial behaviour of professors, Government of Catalonia policy is designed to help and to promote. It labels and supports professors having contractual agreements with industry in order to promote the existing behaviour. To boost existing capacities it can fund 50% of the cost incurred by a technological research centre contracting with the industry.

Develop commercial system of university
These 42 technological research centres are to be further developed to sell university capacities. Nowadays, most contracts come from person to person contacts. Professors are negotiating low prices, i.e. price covering only extra people involved and additional equipment (no overheads, no margin).

INOVA program was launched to improve the entrepreneurial mood of researchers and universitarians. It offers good conditions to create a company: a new entrepreneur can remain a part-time professor. It is jointly run by the Catalan Institute of technology – ICT - and Politechnics University of Catalonia – UPC -.

Support medium size companies that go very fast and form the backbone of the regional economy: The 254 Gazelles (Springboks) companies.
Innovation is not an in-house process. According to a Catalonia survey, on average, 25% of innovation comes from outsourcing to the so called "Gazelle" companies. Incentives related to outsourcing research

and technology development and other functions should be promoted.

The goal of the Catalonian government is to clearly understand what SMEs are trying to achieve in order to supply them with the best surrounding environment. The "Gazelle companies" have developed sales and exports alongside healthy profits in the 90s (and they are based in Catalonia, including affiliates of multinational companies). They have been able to concurrently achieve success in different ways for a lasting period of success.

Competitiveness is the main driver of Gazelle companies. The reasons for high growth are frequently found in a change of entrepreneurial strategy in order to get closer to new markets, new products or new services. A new director general or executive officer is usually nominated.
Outsourcing and subcontracting is one of the fundamental factors for growth: marketing, Investment funds and investors, non executive advisors can be outsourced when appropriate.

Develop transnational partnership to support start-ups
Barcelona, Milan and Munich committed themselves to a Pyrenean-Alpine network of entrepreneurial liaison – Panel -. This network addresses policy makers and focuses on mutual learning based on practices and experiments in the field of support to new firms, and the need of shared support infrastructure and direct cooperation between start-ups and SMEs. It is supported by the Innovation and SME program of the European Commission.

In respect to the policy framework for innovation, **the role of the European Commission is to constantly review how the basic conditions operate:** updating is preparing the next generation of innovation policy. Make people aware of how others think to apply technology to business: as an example, the first road transportation company to use the GPS in Europe, applied to truck movements, was Pedrosa, a Catalonian company based in Figueras, north of the country.

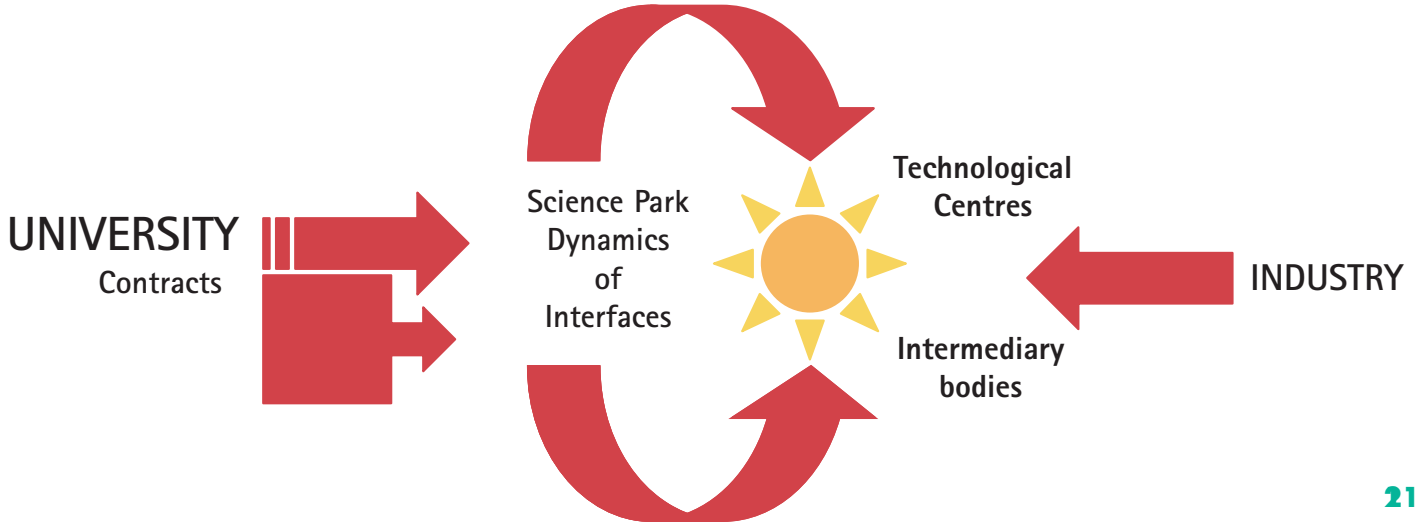
II – BUILDING SCIENCE BASED DYNAMIC INTERFACES

CONDITION FOR INNOVATION N°2
DENSIFICATION OF KNOWLEDGE FLOW SURROUNDING FIRMS

To inoculate innovation is to inoculate knowledge into business. The major needs to develop innovation in Catalonia can be summarised as follows:
- Better infrastructures based on joint public-private funding and use.
- Programs to promote innovation in enterprises
- Agreement with multinationals to act as innovation drivers

This densification of knowledge flows is a strong rationale of the policy conducted in Catalonia and several examples of this "Gateway to knowledge" are underlying actions to promote innovation.

THE CATALONIAN FERTILIZER



Barcelona science-park: Gateway to knowledge

These "Intelligent square meters" were funded by ERDF - European Regional Development Fund - from 1994. The science park of Barcelona was designed to be a tool making science closer to industry and developing the absorption capacity of industry.

To promote technology outsourcing and to consolidate emerging technological markets, it is necessary to guarantee the professionalism of universities. In this science-park Catalonia took the option to develop dynamic interfaces and services at university level.

This approach can be benchmarked against industry intermediaries called technological centres which are usually set up in other Spanish regions.

The Barcelona science park creates favourable conditions to develop the ability to recognize the value of external resources through direct contacts and business services. This approach is a distinctive feature of Catalonia. It shows clear commitment to promote science-based innovative industry when European innovation survey (CIS) shows that Spanish industry is not highly innovative.

The trade-offs between science-based activities and industry-driven technology demand reflect a complex issue when scaling up is the challenge.

The Barcelona Science-park is designed as a research center of excellence. Its activities are based on four integrated pillars:

- Public R&D&Innovation to shape a critical mass (in biomedical research)
- Private R&D&Innovation to host business R&D and start-ups
- Technological platform to set up multidisciplinary thinking (Social sciences, humanities, bioethics, public health,...)
- Innovation services (Transfer of technology and know-how, business development, spin-offs, risk capital support services, consultancy services, patents centre, technological trampoline networks).

Other programs such as BILAB - Business laboratory – driven by business schools analyse the relationship between university and economic development in a feed-back loop to better understand how science and business interact.

The industry participation made the science-park a reasonable success whereas student were somehow reluctant to that shift. Nowadays, they consider it a good tool to support their research work.

The next step: Barcelona Science and Technology Park.
University of Barcelona Science-Park and Polytechnics University of Catalonia Technology Park are settled back to back. A joint effort to launch a new area of research, engineering, technology and innovation in nano-sciences and nanotechnology is to be considered.

Barcelona: a knowledge city for the South of Europe.
At the end of the nineties, the institutions in Barcelona brought together by the Strategic planning association put forward a new strategy for the metropolitan area of Barcelona.

It focused on innovation, entrepreneurship and learning describing it as some of the driving forces for the new concept of the City of knowledge.

Barcelona Economic and Social Strategic Plan (1999-2005) set up a map of knowledge in Barcelona. This strategic urban plan covers the Metropolitan area of Barcelona and not only Barcelona city. It targets at becoming "a land of constant innovation". (territori d'innovació constant). It aims at shaping the future of the greater Barcelona and to build a consensus or shape a common vision from scattered initiatives.

Similarly, "22@" is a new concept for a new urban zone. Over 7 million square metres are planned for new economic activities. Its rationale: In large cities it is difficult to create a climate conducive to innovation for activities related to knowledge. Clustering local competencies in one location to create favourable condition to new development and world level specialisation can only be achieved through a higher level of integration. Multi-level coordination (central and national government, municipalities and metropolitan area) can sometimes be difficult. From the business and innovation point of view, Metropolitan areas should play a greater role in the next innovation policy framework.

III – MACROECONOMIC CONDITION: ANNUAL INCREASE OF R&D

CONDITION FOR INNOVATION 3
12% ANNUAL INCREASE OF R&D INVESTMENT

The rationale is the need to continuously improve the quality, relevance and impact of research. These are recognised as strategic resources and assets by ministries. Investment in public R&D is necessary.

R&D to GDP used to be 0.6% in 1995, it is currently at the level of 1.1% and Catalonia government aims at raising it at 1.4% in 2004. A 12% a year growth is needed to be on target on time.

The Catalan government decided to have one plan for research and one for innovation. The decision was made not to merge both to have more multipliers to reach that ambitious goal. Anyhow, one of the major reasons for the research plan is the interaction between research, development and innovation.

The 3rd Research Plan - 2001-2004 – is focussing on 6 areas:

- Stimulate the growth and quality of the Catalan science and technology system
- Boost human resources dedicated to R&D
- Promote the internationalisation of research carried out in Catalonia
- Stimulate a more active participation of business, multinational companies and SMEs, in research, development and innovation
- Co-sponsoring and management of the Innovation plan.
- Promote better management and greater communication of R&D activities

As a general rule, public funding is used to strengthen the links with the knowledge base and collaborations are strongly encouraged.

Another example of this is the Catalan government also co-funds the Ramón y Cajal program of the Ministry of Science and technology in Madrid.

Increase the Human Resources for R&D

ICREA (Institute of Catalonia for REsearch and Advanced technologies) is fully funded by the government of Catalonia to contract with Spanish or foreign researchers willing to join or to come back to Catalonia for their research.

They will receive approximately 10% higher wages than in the public sector, permanent private contracts to work full time on research.

They are paid by ICREA and used by universities providing that University offers the best working condition and equipment.

THIS DOCUMENT IS BASED ON A SERIES OF MEETINGS AND INTERVIEWS WITH REPRESENTATIVES OF OF THE GOVERNMENT OF CATALONIA – DIRECTORATE GENERAL FOR INDUSTRY, CENTER FOR INNOVATION AND ENTREPRENEURSHIP, COMMISSION ON RESEARCH INNOVATION AND TECHNOLOGY –, PARLIAMENT OF CATALONIA, STRATEGIC PLAN OF BARCELONA, UNIVERSITIES – POLYTECHNICS OF CATALONIA, BARCELONA SCIENCE PARK –, CATALONIAN INSTITUTE OF TECHNOLOGY AND SMES. THESE MEETINGS TOOK PLACE IN BARCELONA IN MARCH 2002.

About the study

The study being carried out for DG Enterprise of the European Commission is entitled, 'Innovation policy and the regulatory framework. Making innovation an integral part of the broader structural agenda'. The context for the study is DG Enterprise's work to promote a regulatory environment that is conducive to innovation so as to advance the strategy, set out at the Lisbon European Council, to make the European Union the most competitive and dynamic knowledge-based economy in the world by 2010.

The study deals centrally with the interface of these two areas:
- What implications do the move into a creative knowledge-based society, and its associated changes in innovation processes, have for other policy areas?
- To what extent and how should other policy areas be utilised in order to advance innovation policy in Europe?

The study will focus on 14 regulatory and community policies: Competition, Regulatory reform, Financial services and risk-capital plans, Trade, Protection of IPR, Taxation, Employment, R&D, Regional policy (with especial focus on structural funds), Policies fostering ICT, Education and Culture, Environment, Enterprise, Governance.

A high level working group has been established, in order to widen the scope of the project's analysis and ensure the input of views from the perspective of the different policy areas that make up the Community regulatory framework :
- Bruno AMABLE, Cepremap-CNRS, France
- Augustus BERKHOUT, Delft University of Technology, Netherlands
- Raoul KNEUCKER, Head of Division "Scientific Research and International Affairs", Federal Ministry of Education, Science and Culture, Austria
- John BARBER, director of TESE, Technology, Economics, Statistics & Evaluation Directorate, Department of Trade and Industry, United Kingdom
- Horst SOBOLL Director of research policy at of DaimlerChrysler AG., Germany - Representative : Donald HILLEBRAND
- Reinhold ENQVIST managing director of the Nordic Industrial Fund, Nordic countries
- Juan MULET, general manager of COTEC Foundation, Spain
- Riccardo VIALE Fondazione Rosselli, Italy - Representative : Davide DIAMANTINI

CONTACTS DETAILS

EUROPEAN COMMISSION
DG ENTERPRISE, INNOVATION UNIT
JOSÉ RAMON TISCAR - JOSE.TISCAR@CEC.EU.INT
STUDY TEAM
LL&A (VERSAILLES) : LOUIS LENGRAND - LOUIS@LL-A.FR
PREST (UNIVERSITY OF MANCHESTER) : IAN MILES - IAN.MILES@MAN.AC.UK
ANRT (PARIS) : ALAIN QUEVREUX - QUEVREUX@ANRT.ASSO.FR
WEB SITE
HTTP://WWW.EU-INNOVATION.NET

European Commission

EUR 17052 - Innovation tomorrow

Luxembourg: Office for Official Publications of the European Communities

2002 - 218 pp. - 21 x 29.7 cm

ISBN 92-894-4549-1