

Innovation Policy in a Knowledge-Based Economy

June 2000

A MERIT STUDY COMMISSIONED BY THE EUROPEAN COMMISSION

ENTERPRISE DIRECTORATE GENERAL

Innovation Directorate

Further information about the activities of the Innovation Directorate can be obtained at the Innovation Programme Help-Desk: innovation@cec.eu.int

EXECUTIVE SUMMARY

This report is based upon a Commission supported innovation policy study entitled “Innovation Policy in a Knowledge-Based Economy”. It is the result of a series of expert group meetings, co-ordinated by MERIT. The focus is on innovation theory and policy approaches in a knowledge-based economy, with particular emphasis on policies geared towards improving innovation in and technology diffusion among small and medium-sized enterprises (SMEs).

The process of European integration has resulted in significant, successful rationalisation of industry, removing duplication, and taking advantage of economies of scale that arose with the Single European Market. However, many policies have led firms to focus their attention on the single market, and the question arises as to whether a sort of cocooning has taken place — do European firms tend to be too inward looking? The new European challenge, thus is two-fold. One aspect is to open up the field of vision of European firms to view the entire world as their potential markets. The second is to take advantage of Europe. That is, having alleviated many of the previous weaknesses of Europe, policy should change focus to take advantage of European strengths such as economies arising from variety. Recalling that competition is the ultimate driver of innovation, this calls for more entrepreneurial dynamism, a greater mobility of knowledge and more innovative risk taking of European enterprises. Innovation policy for the knowledge economy should focus on these aspects.

The System-Based Approach towards Innovation and the Importance of Knowledge

In this report the system-based approach to technical change and innovation is used as a conceptual framework to assess the increasing impact of knowledge on the European Innovation System. In the system-based model, technical change and innovation are understood as taking place within a dynamic innovation system. Innovation activities are seen to be wide-ranging, involving many different activities, and many different actors or institutions. Further, the links between the various actors, institutions and modes of innovation are multidirectional and interdependent. Learning plays a central role in this model, occurring in many places, and learning in one location (the Research & Development lab, the production line, the marketing department, consumer activities) can inform any other learning activity. This means that within the system-based approach, there is a central role for the diffusion of knowledge, and active links operating through the transmission of knowledge, among all parts of the system.

The system-based approach to innovation emphasises learning and diffusion as central to the performance of the innovation system.

The Green Paper on Innovation (com 95, 688 final) was also based on this system approach: a broad perspective was taken on innovation and on the factors hampering or facilitating the

generation and diffusion of new technologies. In the years following its publication, the recommended routes of action were translated into more concrete policy actions, which were laid out in the “First Action Plan for Innovation in Europe” (com 96, 589 final). The Action Plan rested on three pillars believed to hold the key to improving innovation in Europe: fostering a genuine innovation culture, creating a legal, regulatory and financial framework conducive to innovation, and gearing research more closely to innovation at both the national and Community levels.

In the mid and late 1990s, the important place of knowledge in the modern economy became increasingly obvious. It is important enough to induce the claim that we have moved into a knowledge-based economy, in which the role and significance of knowledge for economic activities have fundamentally changed. At the outset of this report, we suggest a change in terminology from “knowledge-based economy” to “knowledge-driven economy”, which moves us away from historical parochialism, since *all* economies are based on knowledge, while emphasising that current contributions of knowledge are very much to the dynamics of our economy. This knowledge drivenness is not restricted to a few glamorous industries, but applies to all European industries, high or low tech. We identify the three most important changes associated with knowledge as an economic driver in today’s economy. They have to do with knowledge and the market place, technologies that interact directly and explicitly with knowledge, and the nature and structure of the transactions and interactions among “knowledge agents”.

Knowledge flows are the glue of the innovation system.

- **Knowledge is increasingly considered to be a commodity. It is packaged, bought and sold in ways and to extents never seen before**
- **Information and Communication Technologies (ICTs) lower the costs of various aspects of knowledge activities, such as knowledge gathering and diffusion**
- **The degree of connectivity among knowledge agents has increased dramatically**

New Insights: The Essential Features of the New Knowledge-Driven Economy

Improved understanding of the nature of knowledge, and how it is both employed and created have changed our views regarding its use and its diffusion. Most of the innovation that has economic impact is recombination of existing knowledge into new products or processes. For recombination to work well as a process itself, agents must have rapid, easy, cheap access to a large amount and wide variety of knowledge. This indicates the importance of knowledge diffusion or distribution. But equally, it must be stressed that central to the effective diffusion of knowledge is its absorption by new agents. Tacit knowledge is central to the process of absorption. Tacit knowledge is stored in the brains of people or the routines of organisations, whereas codified knowledge is recorded in some form (in digital format or

The increasing importance of knowledge in economic activities has brought us into a knowledge-driven economy.

in a document like a scientific article, a manual or a patent application for instance). Emphasis on the importance of tacit, as well as specialised knowledge, or any form of human capital that takes time and expense to generate, implies that human mobility may be an important facet of the distribution power, and one that differentiates between successful and unsuccessful systems of innovation. More generally, this report also underlines the importance of humans as holders and carriers of that knowledge.

Knowledge mobility is the impetus for innovation.

The renewed interest in innovation clustering is also closely related to issues of diffusion, since it is difficulties in diffusion of certain types of knowledge (tacit knowledge, in particular) that give clustering its impetus.

Closer examination of the multiple sources of knowledge creation and the knowledge supporting production in high *and* low tech industries has revealed that the knowledge bases on which innovating firms rest their activities have become broader and more complex. This holds for all innovating firms, regardless of the R&D intensiveness of their industry. Hence, there is a need to increase the absorptive capacity of European firms, especially small and medium-sized firms. Further, the view of innovation as recombination of existing knowledge indicates that variety in diffusion of and access to knowledge must be seen as vital, and

Knowledge is created by using knowledge.

learning without research is an idea which must be treated as central to the innovation process. Finally, there is a growing number of knowledge- or science-based firms, partly associated with the increasing importance of high tech service sectors in Western economies. This has created issues in measurement of economic assets, and again has called

attention to the importance of humans, this time as economic assets, in the knowledge-driven economy. The modern firm comes to resemble a professional football club — the assets of the organisation rest not in physical machines or buildings, but rather in the skills of its employees. One difference remains is that a firm can patent, and thereby assert property rights over, some of the knowledge or skills developed by its employees. Four main “knowledge” themes emerge.

- **Diffusion of knowledge throughout the system of innovation is a key element of innovation and technical change**
- **Innovation without research deserves attention as an important source of technical advance**
- **The complexity of the knowledge base has increased, for all firms, in all industries and in all service sectors**
- **Humans are central as holders of (vital) knowledge assets**

Consequences for Innovation Policy

An important question, and a central theme in this report is how innovation policy should respond to these developments.

Innovation as recombination and the growing number of science-based firms highlight the importance of absorptive capacity, individuals as knowledge agents, and the importance of knowledge distribution.

We define innovation policy as a **set of policy actions to raise the quantity and efficiency of** innovative activities, whereby “innovative activities” refers to the creation, adaptation and adoption of new or improved products, processes, or services. **Although these policy actions can be developed and implemented at various levels (local, regional, national, European) the focus in**

this report is specifically on policy actions that can be taken at the EU level. This is a narrow **interpretation** of innovation policy and as such has two implications. First, it follows that policy should be guided by the question: “At the EU level, how can we define policy, which can not be implemented as efficiently at other levels?” This question focuses attention on the subsidiarity principle and its counterpart, the principle of additionality.

Secondly, this report discusses the scope of innovation policy and its relationship to other policy areas. The systems view of innovation forces one to take a very wide perspective on innovation. In doing so, however, there is the risk that the issue is enlarged so much that innovation policy becomes too pervasive. All policy actions would in the end have an effect on innovation and could therefore be considered as part of the innovation policy. A circumscribed policy sphere demands attention to the relationships between innovation policy and other policies, both in terms of policy actions, and in terms of policy goals. Different policy actions can contradict each other, and the pursuit of one goal may also interfere with the pursuit of others. A strong effort should therefore be made to detect the way innovation policies interact with other policies and other policy goals. These effects should be used in judging policy, both ex ante and ex post. Efforts at policy co-ordination can be extremely valuable here, watching out for possible negative (or positive) interactions, in order to initiate timely discussions with other policy-makers. Thus there is a need to re-focus, to define the limits of innovation policy and to create priorities for policy actions.

Innovation policy is circumscribed, but embedded in overall enterprise policy actions. It must be co-ordinated with other policies and policy goals at the EU level.

We propose to redefine the role of the EU and Community Action in the field of innovation and clearly to imbed this within overall enterprise policy actions. We can see immediately two backdrop policy approaches that will be useful:

- **Co-ordinate the innovation policies among Member States**
- **Harness a coherent strategy for innovation, by updating the analytical and empirical foundation of policy action, through studies and benchmarking activities that directly link innovation research to specific policy actions, such as the Trendchart project**

Policy Priorities for the Knowledge-Driven Economy

The rise of the knowledge-driven economy has drawn attention to different aspects of the innovation system as important in its performance, as described above. These new pillars of success map to new policy priorities to improve enterprise performance in innovation, and to create the conditions under which enterprises can capitalise on the new situation. The diffusion or distribution properties of an innovation system are affected directly by the mobility and training of knowledge workers who hold tacit and specialised knowledge. Diffusion, particularly of codified knowledge, is further affected by the intellectual property rights system, and by the ability of firms to exploit the new information and communication technologies. The centrality of individuals as creators, holders and carriers of knowledge reflects mobility and training, but in addition raises issues having to do with financing innovation — how can the financial markets, whether venture capital or traditional equity markets, evaluate the assets of a firm when they are intensely embedded in its employees. Whether an enterprise can adapt to the increasing complexity of its knowledge base will be determined in part by the training of its employees, whether it is able to hire the expertise it needs, and whether it can find and employ the knowledge it needs, that is, on the state of the intellectual property rights and information and communication technology (ICT) systems. Innovation without research is much more effective if the knowledge created outside “usual” knowledge-creation activities (the Research & Development laboratory for instance) is transmitted efficiently to other parts of the systems. Mobility and training, and exploiting the new ICTs hold the key here. The policy priorities mapped here are seen again in the results of the Community Innovation Survey regarding the experiences of enterprises, which have suffered set-backs in innovation projects.

- **Information and Communication Technology 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**

It is the combination of these priorities, access to knowledge and finance that will enable and stimulate European firms to undertake innovative activities. It should expand their innovative potential, in particular that of SMEs, and ultimately ensure their competitiveness in the long run.

Policy Directions

General Policy Considerations

- Innovation is important in all industries, from high to low tech. Policy makers must not be seduced by the glamorous industries. When it comes to innovation policy all industries should be targeted.
- European heterogeneity or variety can be exploited through networking of firms and scientists, to create a vibrant learning culture in which many different ideas and approaches are available as inputs to firms' innovation and learning.
- Small and medium-sized enterprises need a variety of institutions, which take into account their heterogeneity, to assist in improving their ability to absorb new knowledge and technology.

Information and Communication Technology Exploitation and Networking

- Invest in new technologies and infrastructure to increase European capacity to transmit knowledge that is not easily codified, but which can be transmitted electronically. This would permit the growth of European expertise in fields that require very specific inputs that are either too rare or too costly to be available extensively throughout Europe.
- Programmes to encourage networking of firms and centres of excellence within Europe should be expanded to include agents *outside* Europe who can provide Europeans with "knowledge-value-added". SME participation in alliances should be encouraged both internationally and with larger firms that typically have experience in this venture.
- Co-ordinate national telecom infrastructure investments to facilitate European networking to create knowledge sharing among firms through permitting them to undertake joint innovation projects at a distance. One goal is to create a truly European very high speed backbone.

Intellectual Property Rights

- The European patent system needs to be harmonised, thereby reducing part of the economic costs of gaining a patent and increasing transparency for enterprises. Therefore, the European patent must continue to be developed.
- The intellectual property rights system must be used as a way to distribute information effectively, especially among small and medium-sized enterprises. This could be achieved by limiting patent width and increasing patent height in order to reduce the ability of patents to block competitors from using and further developing enabling technologies. In the same line, it may be worth increasing the level of the inventive step to prevent nuisance patents. In return for limiting patents, a better system for resolving patent infringement cases would be worthwhile. In particular, the system should be designed so that large firms do not have a distinct advantage over small firms. Any moves to extend patent protection to software must ensure that this does not have anti-competitive, and anti-distribution effects.

Knowledge Mobility and Training

- Mobility of knowledge among firms must be facilitated. This could be achieved by stimulating co-operation among firms in their knowledge activities, or by facilitating senior knowledge workers visiting, for a medium term period, other firms, universities, or research institutes. To this end the creation of a “European College” should be considered. Such an institution would provide experts with the financial and career infrastructure to move for extended periods of time without a disruption in their career paths and without disrupting their social security arrangements.
- Life-long-training programmes must be designed to reduce the polarising effect from the tendency to train even further already highly-skilled labour. Training programmes should be available for workers at all skill levels particularly in services, as human skills are a crucial input to innovation in that sector. European accreditation standards would permit cross-border mobility at more levels of the labour force.

Funding Conditions (financial and fiscal)

- The ability of banks and venture capital funds to tap European technological and entrepreneurial expertise regarding new and novel technologies must be improved by creating a European network of expertise, including technical (from the European research community), and entrepreneurial expertise, (from business angels for example) on which banks and other financing institutions can draw.
- Standards for reporting and documenting the value of intangible assets should be explored. A European standard is desirable to facilitate a European capital market and thus the EU can play a co-ordinating role.
- An innovation-friendly fiscal environment needs to be further developed. A review of taxation policies should be undertaken to evaluate their effects on innovation activities, and taxation should be designed considering their stimulating effects on innovation.