Chapter 5

Innovation, Technology and Productivity: Why Europe Lags Behind the United States and Why Various European Economies Differ in Innovation and Productivity[1]

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Introduction

It seems particularly appropriate to discuss in more detail the core of what has become known in the European debate as the Lisbon challenge. As the most recent Economist Intelligence Unit report[2] argues, "The new economy story linked with ICT appears to come nearest to explaining divergent trends in the US and euro zone, although it is not definitive and important issues remain unclear, including the precise relationship between ICT and the overall policy framework." Following Dale Jorgenson's detailed overview of the evidence on international comparisons among the G-7 nations in productivity growth, I will focus here on some of the underlying main underlying policy issues for the European economies.

If there is any general policy slogan that might be appropriate in describing the challenge European countries face today in trying to achieve the Lisbon knowledge agenda[3] it would be, I submit, the need for policies "*activating knowledge*." The most relevant comparison to

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[1] Paper presented at the Conference: "The Network Society and the Knowledge Economy: Portugal in the global context" Lisbon, March 5-6, 2005.

[2] EIU executive briefing, *US/EU economy: Is it a "new economy" story after all?* February 22, 2005, http://eb.eiu.com/index.asp?layout=show_article_print&article_id=6

[3] In the following paragraphs, I limit myself to that part of the Lisbon agenda dealing with policies aimed at strengthening incentives for knowledge investments, not the social dimension.

be made here is with policies for "activating labor," which rose to popularity in Europe, and the UK in particular, in the early 1990s and were instrumental in reducing long term, structural unemployment.[4] Such policies focused on the many "passive" features of the highly regulated European labor markets, and the way these features had contributed to a rise in the structural component of long-term unemployment. "Active labor" market reforms aimed in the first instance at reducing labor market entry barriers, and in particular low wage unemployment traps, and increasing labor market flexibility, without putting in jeopardy the essence of the social security protection model typical of most European countries' welfare systems. In countries which went furthest ahead in such "active labor" market reforms such as the UK, the Scandinavian countries and The Netherlands, the result was not only a significant reduction in unemployment, but also sometimes impressive increases in employment participation rates of particular, underrepresented groups in the labor market which had become "activated" such as women and youngsters. Over time and with the formal assessment at the European level of such labor market reform policies—the so-called Luxembourg process—active labor market policies became a full and integral part of employment policies in most European countries.

The challenge today appears more or less similar, but this time with respect to the need for "activating knowledge," the essential ingredient for any policy aimed at increasing growth incentives in Europe.

As noted in the Sapir report,[5] since Lisbon (March 2000) European growth performance has been, contrary to expectations, weak, highlighting in particular the failure of the current European Union policy framework to provide sufficient national as well as EU-wide growth inducing incentives. This holds both for the Growth and Stability Pact as well as for structural, sector specific EU policies such as the Common Agricultural Policy or Social Cohesion Policy, which have been poor in bringing about structural growth enhancing reform. Also with respect to ICT use, research and development, innovation and

[4] See in particular the OECD's so-called *Job Study* (1994), which became a staunch defender of the need for such policies in Europe.

[5] See Sapir, A. et al. *An Agenda for a Growing Europe, The Sapir Report*, Oxford University Press, 2004.

knowledge more generally, policies pursued both in member countries and at the EU level seem to have been dominated by the old scale intensive industrial type, too much based on strengthening the competitiveness of existing firms and sectors and too little of the growth enhancing, innovation and creative destruction type.

Without such specific growth enhancing policies, the restrictive macro-economic policies introduced within the framework of the Growth and Stability pact in the euro zone countries have, if anything, exacerbated the "*non-active*" nature of knowledge activities. Under this low growth, restrictive fiscal scenario, public knowledge funding activities such as the delivery of (highly) skilled youngsters from universities, professional and technical high schools, or the research carried out within universities and public research laboratories, have remained by and large passive. Because of the lack of growth opportunities, public research output has remained by and large unused and unexploited in the rest of the economy and in particular the private sector. In the best (some might say worst) case they have only contributed to efforts abroad, i.e. to other countries through migration or through the transfer of knowledge to foreign firms and universities. Private knowledge funding activities on the other hand, due to lack of domestic growth opportunities, have been cut, rationalized, outsourced to foreign countries, or simply frozen. The Lisbon knowledge growth challenge is more than ever a real one: many countries particularly in continental Europe are in danger of a long term downward adjustment to a low knowledge intensive, low growth economy.[6]

Notwithstanding what was noted above about the particular need in continental Europe for innovative, creative destruction renewal, a policy of "*activating knowledge*" should, and probably first, build on existing strengths in knowledge creation and use. At the same time it should, however, aim at activating competencies, risk taking and readiness to innovate. In short, a policy aimed at activating knowledge should be directed towards the activation of unexploited forms of knowledge.

[6] In a recent Dutch article, two civil servants from the Ministry of Finance actually made the claim that the Dutch economy has, and I quote: "no comparative advantage in high tech goods." Furthermore, by importing high tech goods, the Dutch economy would actually benefit much more from those foreign productivity gains. See Donders, J. en N. Nahuis "De risico's van kiezen," ESB, 5 maart 2004, p.207. Similar arguments have been made at the EU level by John Kay.

The claim made here is that there are many of such forms, covering the full spectrum of knowledge creation, knowledge application and knowledge diffusion. ICT plays a crucial role in each of these areas. Furthermore, such policies should be directed towards public knowledge institutions, including higher education institutions; financial institutions not just venture capital providers; private firms in manufacturing as well as services; and last but not least individuals, as entrepreneurs, employee or employer, producer or consumer.

In this short contribution, the focus is very much on the first of these areas, the one governments have actually the biggest latitude for intervention and attempting at least to activate knowledge: public knowledge institutions. Five aspects of such knowledge investments, which are at the heart of the Lisbon agenda, will be discussed.

First is the issue of public investments in research and development. In most member countries public research institutions including universities have become increasingly under funded. "Activating" national budgets so as to free more money for public investment in such knowledge investments appears the easiest and most straightforward policy measure to be implemented given the commitment EU member countries already took in Barcelona.

Second, there is the need for improving the matching between private and public knowledge investment efforts. Increasingly, I would argue, European countries are confronted with a growing mismatch between private and public research investments.

Third, there appears also an urgent need for activating research in universities and other public research institutions in Europe. If there is one reservoir of unused knowledge potential it is likely to be found in those institutions.

Fourth, policies should be designed to activate human capital and knowledge workers. Shortages of research personnel loom large on the European horizon.

Fifth and foremost, there is in Europe a need for policies activating innovation.

Maybe there is a trade-off between innovation and creative destruction on the one hand and social security and stability on the other

hand. But maybe existing social security policies can also become "activated" towards innovation, creative destruction, and entrepreneurship.

1. "Activating Lisbon": beyond the simple Barcelona targets

It was the growing awareness of Europe's falling behind in knowledge creation and knowledge diffusion which induced European heads of state to set the objective at the Lisbon summit in March 2000 to become the world's most competitive and dynamic knowledge economy by 2010. The Lisbon knowledge objective were translated into the so-called Barcelona target in the spring of 2002, whereby European countries would aim to spend approximately 3% of their Gross Domestic Product on investment in research, development, and innovation by 2010, a figure comparable to the current investment percentages in the United States and Japan.

It is unfortunate that the European Lisbon target was so explicitly translated into the Barcelona objective of 3%, an investment cost objective. Equally important, if not more so, is the question what the results—in terms of efficiency and effectiveness—of these investments would be. Furthermore, the separation of the 3% norm into a public component set at 1% of GDP, and a private component set at 2% of GDP, ignored some of the more fundamental differences between the United States (on which this separation was based) and most European countries' taxing regimes (neutral versus progressive) and the implications thereof for private and public parties, and in particular the role of public authorities in the funding of research and development. Particularly in continental European countries, it can be expected that both enterprises and individual citizens will, given the progressiveness of their income taxes, expect a higher contribution of public authorities in the financing of higher education and research. Their relatively "passive" attitude towards private investments in knowledge (most European citizens are perfectly happy to increase their indebtedness to acquire private property, and have large parts of their income spent most of their working life on mortgage repayments, but not to invest in their or their children's education and schooling) is to some extent the direct consequence of the progressive tax regimes most middle and high income families are confronted with over their working and family life.

To aim for a double effort of the private sector compared to the public one in knowledge investment is to ignore the different role of public authorities in Europe as opposed to the U.S. Furthermore, given the relatively limited leeway European public authorities have in inducing private firms to increase their R&D investments (the only feasible instrument: national R&D tax advantages contains substantial beggar-thy-neighbour elements in it and is likely to become increasingly challenged at the European court level), the Barcelona target appears ultimately a rather weak policy "focusing device" on the road to Lisbon.

Nevertheless, attainment of the public funding target of 1% of GDP in so far as it is something practical governments can do, could be elevated to an absolute minimum policy priority. How to achieve this within the current, highly restrictive budgetary framework conditions of most EU member countries? By "activating national budgets" in a growth enhancing direction, one could argue, redirecting government expenditures towards such knowledge investments, just as the Sapir report forcefully argued with respect to the EU budget.

But as will also be clear from what was said before, the setting of simplistic target objectives in the area of knowledge dynamics and innovation, even limited to the public sector, raises many questions.

First and foremost, there are factual questions. How real is the knowledge gap? The Barcelona target only addressed one highly imperfect, knowledge input indicator: R&D expenditures. Firms are not interested in increasing R&D expenditures just for the sake of it but because they expect new production technology concepts, new products responding to market needs, to improve their own efficiency or strengthen their competitiveness. If at all possible, firms will actually try to license such technologies or alternatively outsource at least part of the most expensive knowledge investments to suppliers of machinery, rather than have to forego themselves those costly investments. Today most firms are actually keen on increasing the efficiency of R&D by rationalizing, or reducing the risks involved in carrying out R&D, outsourcing it to separate small high tech companies which operate at arms length but can be taken over, once successful. Furthermore industrial R&D investment on which the Barcelona tar-

gets are based is heavily biased in favour of industrial production. Service sectors but also more engineering based activities are likely to be strongly underrepresented. As a result, the question about the "real" knowledge gap of Europe with respect to the U.S. remains very much subject to debate.

Central in this debate is the extent to which the commercial benefits of knowledge investments can be appropriated and by whom—the firm within the sector having made the R&D efforts, or a firm upstream or downstream? Or the final consumer, imitation taking place so quickly that none of the new product rents could be appropriated by the innovator?

It might well be that sectors and activities with little registered R&D-effort have a complex and actually deep knowledge base. Some of the most competitive European industries e.g., the offshore and dredge industry, the food processing, finance or insurance industry, carry out little if no R&D. According to OECD classifications, these are typically medium to low-technology industries. The knowledge bases appropriate to these industries display, however, great technical depth and variety. The list of institutions providing support and development of these different knowledge bases is similarly long and diverse. Thus a low-R&D industry may well be a major user of knowledge generated elsewhere. The same holds of course for many service sectors, where the introduction of new process or organizational structures as well as new product innovations, is unlikely to involve much formal R&D investment. But here too, the crucial question will be the extent to which such innovations can be easily imitated or can be formally protected through trademarks, copyrights or other forms of intellectual property, or kept secret.

The same argument holds at the international level. Again the central question will be whether the commercial benefits of knowledge investments can be appropriated domestically or are "leaking" elsewhere, to other countries. In the economic growth literature, the phenomenon of catching-up growth is typically characterized by lagging countries benefiting from the import, transfer of technology and knowledge, formally and particularly informally. In the current, increasingly global world economy, increasing R&D investment is hence unlikely to benefit only the domestic economy. This holds *a forteriori* for the EU with its twenty five independent member countries.

Thus, as highlighted by Meister and Verspagen (2003), achieving the 3% Barcelona target by 2010 is not really going to reduce the income gap with the U.S., the benefits of the increased R&D efforts not only accruing to Europe but also to the U.S. and the rest of the world.

In a similar vein, Griffith, Harrison and Van Reenen (2004) have illustrated how the U.S. innovation boom of the 1990s had major benefits for the UK economy, and in particular for UK firms that had shifted their R&D to the U.S. A UK firm shifting 10% of its innovative activity to the U.S. from the UK while keeping its overall level the same, would be associated with an additional increase in productivity of about 3%. "This effect is of the same order of magnitude as that of a doubling in its R&D stock" (Griffith et al. 2004, p.25).

In short, the link between the location of "national" firms' private R&D activities and national productivity gains is, in the current, increasingly global R&D world, at best tenuous.

To conclude this first section: achieving the Barcelona target should be brought back to what governments can practically achieve in the area of knowledge investment. Setting a common European target, such as the Barcelona one, can be useful if, but only if, it sharpens policy priorities. The current translation of those targets in public and private targets does anything but sharpen policy priorities. On the contrary, the debate on government expenditures in the euro zone countries is completely dominated by the other European 3% fiscal norm. That norm provides, however, no incentive to redirect public funding in the direction of knowledge enhancing investments. The most immediate measure policy makers should take is to reform their budget priorities in the direction of knowledge enhancing growth activities by raising as a minimum the public funding of R&D to the 1% of GDP level.

2. Activating the "joint production" of knowledge: attracting private R&D

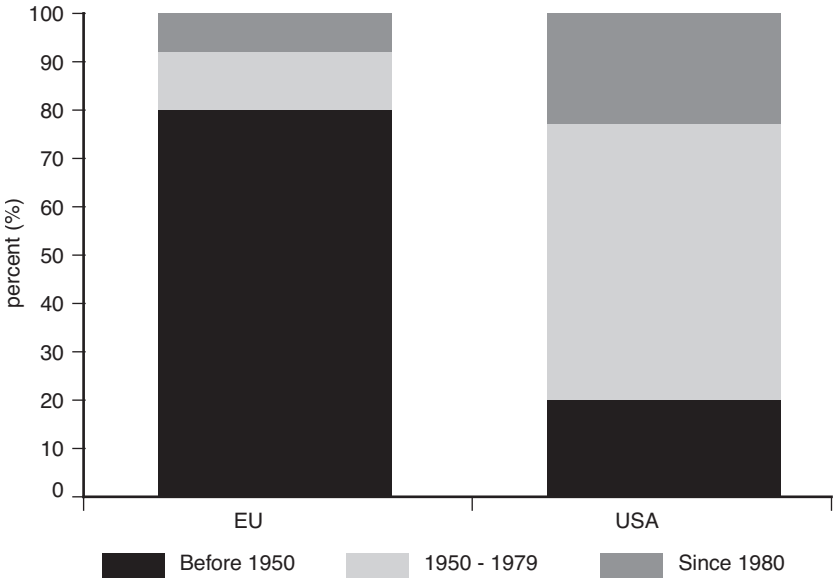
Knowledge production is typically characterized by so-called "joint production" features: what modern growth economists have described as the increasing returns features of knowledge growth accumulation. In more down to earth terminology, knowledge investments by both

private and public authorities have been characterized by strong complementarities and from a geographical perspective strong agglomeration features. In most continental European countries this led over the postwar period to a rapid catching up in public and private R&D[7] investments, particularly by large domestic firms in their home country. Such investments were often rather closely in line with national public R&D investments. In the late 1970s and early 1980s most European countries had actually caught up with the U.S. in private R&D investment. Technical high schools and universities were often closely integrated in this privately led knowledge investment growth path. This "national champion" led R&D catching up process led actually to a strong "over-concentration" of domestic R&D investments of such firms in their country of origin, certainly when compared to their international production activities. Along with the further internationalization (and 'Europeanization' in the running up to the 1992 European single market) of production, R&D investments became also more subject to internationalization. Initially, this was limited to R&D activities strongly linked to the maintenance and adjustment of production processes and product technology to the foreign market conditions, later on it involved also more fundamental research activities.

In short, a sheer natural trend towards the international spread of private R&D of the large European multinationals took place, on which much of individual member countries' knowledge strength had been built. By the same token, many of the close domestic connections between private and local public research institutions became weaker. This process is far from over, given the still wide disparities in the concentration of domestic R&D versus international sales. At the same time the renewal rate of R&D intensive firms in Europe was particularly poor. The rapid growth in the gap in the 1990s between the total amount of R&D spent by private firms in Europe and by private firms in the U.S., is a reflection of this lack in renewal of high growth firms in Europe as compared to the U.S., as illustrated in Figure 4.1 below.

[7] The UK's R&D spending remained in the early postwar period at a much higher level, more or less in line with that of the U.S., than that of most continental European countries primarily as a result of the large government spending in the military, aerospace industries and other public utilities sectors.

Figure 4.1 EU and US firms' renewal in the post-war period

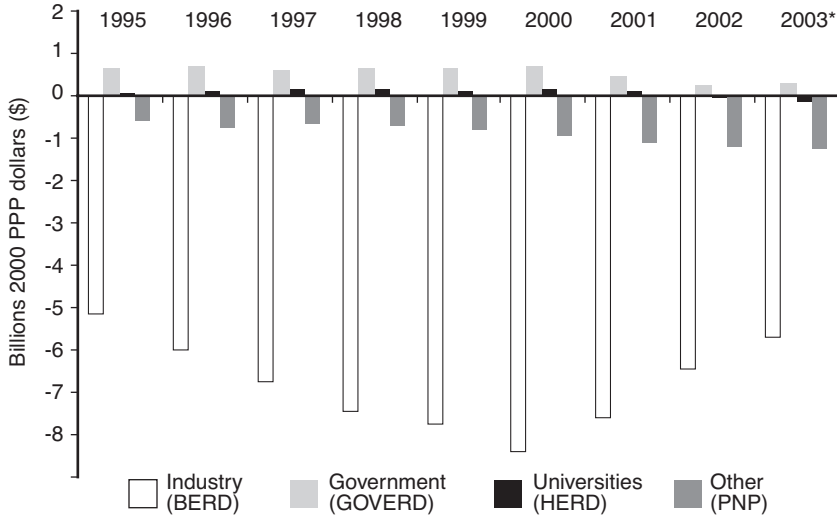


It is worthwhile noting that the gap between Europe and the U.S. in privately *financed* R&D, as illustrated in Figure 4.2a, is first and foremost a gap in R&D *performed* in the private sector (Figure 4.2b), i.e. R&D carried out in the private sector but funded both by private as well as public funds (including in the latter case in the U.S. primarily military R&D). Actually with respect to R&D *performed* in the public sector, there is no gap between Europe and the U.S., yet there remains a substantial gap in publicly *financed* R&D. The widening of the EU-U.S. gap over the 1990s between privately *performed* R&D suggests that firms under the pressure of internationalization increasingly turned their back on national European public research institutes and concentrated rather their R&D activities elsewhere in the world, and particularly in the U.S. Surprisingly since 2000, the gap between the U.S. and the EU has actually declined significantly. However, this decline is first and foremost the result of a decline in the R&D performed in the business sector in the U.S.

Universities and other public research institutes in Europe, under funded, failed by and large, and in contrast to their counterparts in the U.S., to provide the attractor pole to European (and foreign) firms for

joint knowledge production—a role they actually fulfilled for many years within their secure national "cocooning" borders. It seems hence reasonable to conclude that Europe suffered from the fragmentation of what were relatively closed national, joint production R&D systems, with national R&D champions internationalizing their R&D activities due to both internal EU pressures in the late 1980s and external competition pressures in the 1990s, while public research institutions remained incapable of providing sufficient private R&D renewal.

Figure 4.2A Gap in EU25—US R&D spending



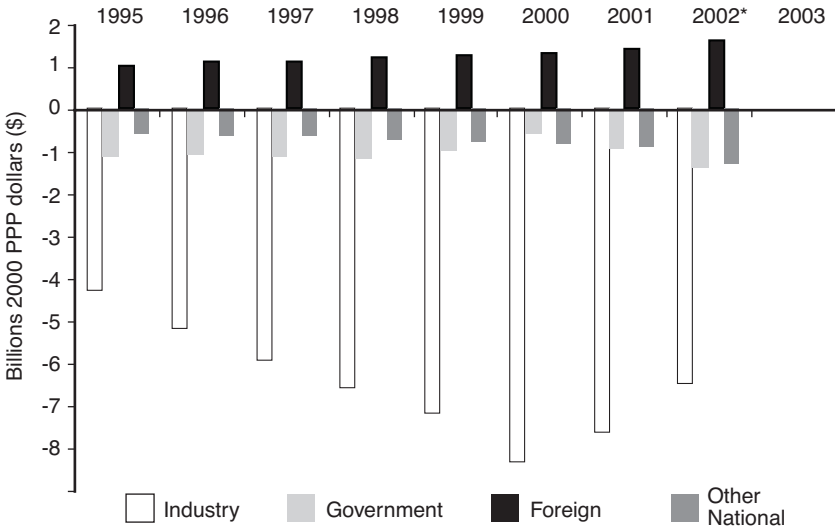
Source: OECD-MSTI. 2003* MERIT estimate

3. Activating university and fundamental research

The internationalization process described above has also been accompanied by a process of "*crowding out*" of fundamental, basic research from private firms' R&D activities. This process took place in most large firms in the 1980s and found its most explicit expression in the reorganization of R&D activities, from often autonomous laboratories directly under the responsibility of the Board of Directors in the 1960s to more decentralized R&D activities integrated and fully part of separate business units. Today only firms in the pharmaceutical sector

and a couple of large firms outside of this sector are still involved in the funding and carrying out of fundamental research, as reflected e.g. in authorship of scientific publications. And even in those cases, firms rely heavily on outside, mostly public sources of fundamental research. For most firms the increased complexity of science and technology has meant a greater focus on applied and development research and a more explicit reliance on external, university or other, often public, knowledge centres for more fundamental research input. In line with what was discussed above, firms increasingly "shop" on the world market for access to basic and fundamental research and chose the best locations to locate their R&D laboratories. In doing so they will not only hope to make their own, in-house R&D more efficient, but also look to the efficiency, quality, and dynamics of the external, local knowledge institutions, such as universities and public R&D institutions.

Figure 4.2B Gap in EU25—US R&D financing



Source: OECD-MSTI. 2002* MERIT estimate. 2003 not available.

At the other end of the spectrum, over the 1980s and 1990s in most European countries public knowledge investments in universities and other public research institutes became subject to increased national public scrutiny, systematic performance assessment and academic peer

review. As a result academic performance became even more explicitly the dominant incentive in public research institutes: applied, more immediate relevant research became second rated. Effectively it could be said that applied research became "crowded out" of the university environment. Today, the actual national performance of scientific research, measured, for example, in terms of the number of publications per researcher, or per million of euros spent on public R&D is actually not inferior in Europe to that of the United States. Throughout the years, with the increasing dominance of English as the language of scientific communication, the growth in the total "production" of internationally read and reviewed scientific articles in Europe has been much higher than in the United States.

One characteristic of public research is, to some extent, its national embeddedness.[8] From this perspective, the policy towards increasing "competition" between national universities and public research centers, led undoubtedly to important quality impulses to public research in many European countries, but did ultimately *not* lead to specialization of research in Europe[9] but rather, one might argue, to further research duplication. Practically every national university jumped on the same, new, promising research areas (life sciences, nanotechnology, information technology, new materials, etc.), competing nationally, Europe-wide and world-wide to recruit leading researchers. This resulted in a multitude of different, relatively small research groups, each of them seeking additional funding and networks through European funding programs.

The opposing "crowding out" trends in the nature of private research dominated by internationalization and specialization on the one hand and public research dominated by nationalization and duplication on the other hand, warrant a policy of activating public, fundamental research institutions in playing their role in a much more

[8] As a parenthesis, it can be noted that, based on this perspective, the concept of "*national* systems of innovation" developed by (primarily European) authors in the innovation literature such as Christopher Freeman, Charles Edquist, Bengt-Ake Lundvall and Richard Nelson: differences between countries in the set-up and nature of *national* institutions, in particular university education and the public research infrastructure, seems to be able to explain to a large extent differences between countries in innovation strength.

[9] With only a couple of exceptions in areas of so-called "big science" where the use of large instruments and other expensive infrastructures warrants ultimately close cooperation between different countries scientific communities.

dynamic fashion as local attractors of private R&D activities and generators of private firms' research renewal. In short, the activating knowledge policies falling under this heading have to deal with (re-) activating the formal and informal connections between the public and private knowledge investment of the various European "national" systems of innovation. The building of such new formal bridges could take various forms, exploiting to the maximum the institutional variety in Europe. One may think of the technology platforms currently proposed by the EC. Topics should obviously not only include private sector research interests but also public research interests (security, mobility, etc.). Alongside such re-activating linkage policies, one should also focus on activating all other forms of joint knowledge production policies: e.g. policies providing stronger and more effective incentives for scientific entrepreneurs, policies aimed at increasing mobility between public and private research labs, policies opening up private research labs to public (and other private) research interests, etc.

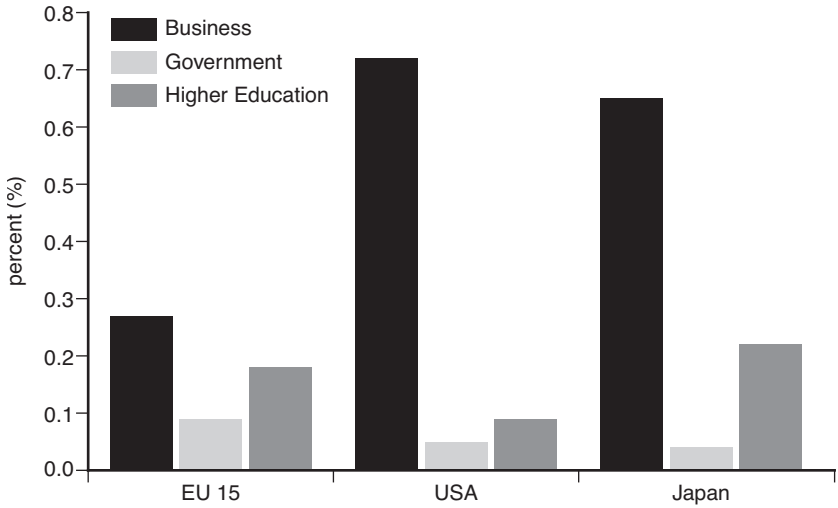
4. Activating Human Knowledge

In the end, private or public research investments depend to a large extent on the availability of highly qualified research personnel. The greatest part of research expenditures, about 70% of total R&D resources on average, goes to the salaries of research personnel. The available data on scientific personnel, formalized under the term "scientists & engineers" (S&E) presented in Figure 4.3, point again to an increasing gap between the U.S. and Europe in privately oriented research. Not only is the percentage of S&E in total employment in the private sector 2 to 3 times higher in the U.S. and Japan than in Europe, but its growth is also significantly lower in Europe than in those countries.

The availability of sufficiently qualified personnel is central in the development of any "sustainable" knowledge economy, also within the context of the Barcelona objective. Without the availability of highly qualified research personnel, the aim to increase substantially knowledge investments in less than a decade, will merely lead to a tighter labor market for S&E and the "poaching" of personnel by the private sector from universities and other public research centres or between European countries. Looking at the current labor costs for R&D per-

sonnel, realization of the Barcelona objective implies a need for an additional supply of researchers between now and 2010 of between 500,000 and 800,000 full-time equivalents[10] (EU Gago Report, 2004). This should be added to the specific European problem of an aging population, which also affects the knowledge sector: from the growing shortage of teachers in a large number of European countries to the rapid increase in the greying of academic staff in practically all European countries.

Figure 4.3 S&E as % of labour force (growth rates 1995-2000)



Two factors appear to be of primordial importance in this discussion. On the one hand, the capacity of a country's own educational system to deliver, year upon year, new cohorts of highly-qualified, scientists and engineers; and on the other hand, the attractiveness and dynamism of the profession of researcher and the attractiveness of the surrounding environment—the quality of the local physical environment, facilities available, presence of other research labs, etc.

[10] Based on the broad estimations made in the so-called Gago High Level Expert Group, *Europe needs more scientists*, DG Research, April 2004.

1. When referring to the supply of S&E within a country, use is sometimes made of the 'pipeline' analogy, which illustrates how, from secondary education onwards, the flow of scientifically trained S&E finally seeps through to the various components of the R&D world. A number of factors will be important in the flow of sufficient S&E supply to, for example, the private R&D sector, despite a decreasing inflow following e.g. demographic factors at the beginning of the pipeline. Thus, there are countless obstacles preventing pupils, students, graduates, and PhD students, throughout each of the different education and training stages from continuing a research career trajectory. The Appendix to the *Benchmark report on Human Resources in RTD*[11] lists these different obstacles, the different possible policy leverages and objectives. At first sight, these seem to be equally applicable to the U.S. or the EU.

So far, mainly the southern European countries have witnessed a large increase in the numbers of students as part of a European catching-up growth process and the relatively high unemployment rate among youngsters, which resulted in, among other things, a considerable expansion of the number of universities and polytechnics. Yet this is a temporary process, which, incidentally, has not led so far to a proportional increase in the demand from the private sector for highly qualified personnel in these countries. The new accession East European countries represent a very different story. Here the higher education systems have a long tradition in delivering highly qualified S&E particularly in the hard sciences. The lack of knowledge relates primarily to commercial and financial access to worldwide market opportunities. Foreign direct investment exploiting the unused technical human capital potential has been quick in picking up this unused human capital knowledge potential. But here too, the long-term demographic trends are negative; raising questions as to the long-term sustainability of the supply of highly qualified human capital.

2. The importance of the dynamics of the local environment is increasingly recognised as being a crucial factor for innovation and the development of knowledge. Many economic geographers emphasized

[11] See *Benchmark report on Human Resources in RTD*, DG Research, European Commission, Brussels, 2002.

the importance of the regional clustering of knowledge activities. Despite the fact that the local supply of S&E remains a crucial determinant for the localisation of private research activities as is clear from the location of many private R&D labs near universities, the demand for knowledge is increasingly also influenced by physical, social and local, cultural factors that will in fact operate as pools of attraction in exerting a pull on highly educated people, in Richard Florida's words: "the creative class." In this sense, the tendency to regionally cluster knowledge centres observed both inside the U.S. and individual European countries is again a logical consequence of the agglomeration and joint production effects of knowledge and its appeal to researchers and entrepreneurs.

Up to now, the various policy proposals aimed at the development of a European Research Area have not really led to a significant rise within Europe of the labour mobility of S&E and European wide knowledge clustering. The barriers to such labor mobility—differences in pension systems, in rules and regulations governing university appointments, in use of foreign languages in higher education teaching—appear all much more significant across European member countries than with respect to the emigration of European S&E towards the U.S. Increased mobility and migration of highly qualified personnel is of course likely to put strongly under question the European ideals of "social cohesion."[12] It is actually surprising that so little thought has been given up to now, to the internal inconsistencies of European ambitions in this area.

To summarize: investments in human capital provide the mirror picture of the knowledge investments described under the previous heading. The crucial distinction here is the one between knowledge, which is codified and can be traded; is embodied in new products or machines. In other words knowledge, which can be "commodified" is ready for use. And on the other hand knowledge, which is tacit, embodied in the brains of individuals, in their competences, in their schooling and training, in their years of life-long experience. Tradable

[12] See for example David, P. "ERA visions and Economic realities: A cautionary approach to the restructuring of Europe's research system," EC STRATA Workshop "New challenges and new responses for S&T policies in Europe," Brussels, 22-23 April 2002, mimeo, for a detailed analysis of the possible, undesirable, regional effects of the ERA as a result of mobility effects.

knowledge looses, depending on the effectiveness of intellectual property protection, rapidly, sometimes the day it is brought on to the market, much of its commercial value. It becomes routine, more or less public knowledge. Tacit knowledge by contrast is difficult to transfer and disappears in the extreme case with the death or the retirement of the scientist or researcher.

Recognition of this distinction is essential for policy making. Indeed, it brings to the forefront the local growth dynamics aspects of joint knowledge production based on so-called "co-location" advantages of the physical agglomeration of human knowledge capital. It illustrates why even in our current Internet world with easy access to codified knowledge, scientists, researchers and highly skilled employees still like to cluster together in similar locations. Activating knowledge will hence imply strengthening the local/regional agglomeration aspects of joint knowledge production. In the case of Europe, it means a more fundamental recognition of regional knowledge strengths, of the particular role of regional authorities in helping their regions to become attractor poles for knowledge workers, in having to make regional choices.

Ultimately it is the success of regional knowledge attractor poles, which will determine whether Europe has any chance of achieving its Lisbon ambitions. A knowledge policy that only focuses on international, tradable knowledge, ignores the essential complementarities between codified and tacit knowledge; by contrast a national knowledge policy aimed at belonging to the technological "lead" reflects often an outdated degree of techno-nationalism. Within the current European context of a union of member states, it could be argued that knowledge policies have been too heavily dominated by national aims and have insufficiently recognized the regional dimension of knowledge production and diffusion. This has been exacerbated in many member countries[13] by the national institutional focus of public research funding organisations.

[13] The exception being member countries such as Belgium or Spain, where the regional decentralization structures has given way to quite explicit regional research and innovation policies.

5. Activating Innovation

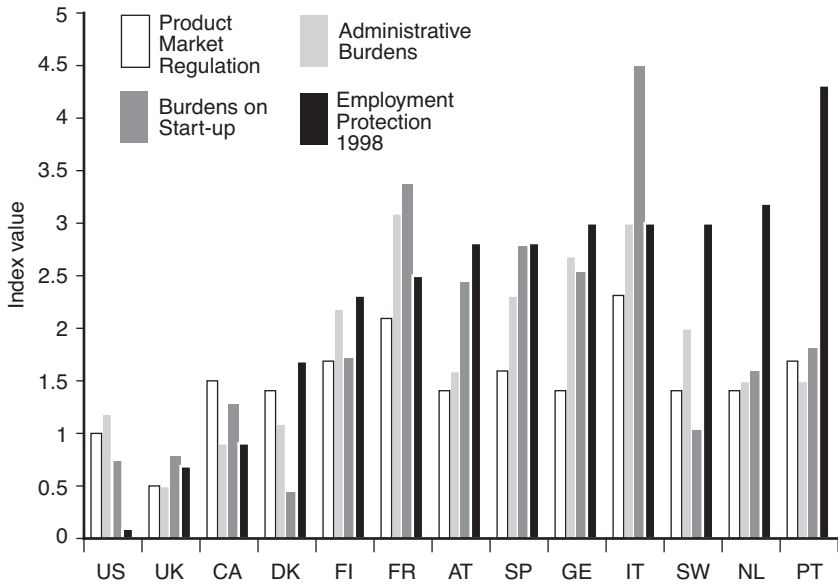
So far, the analysis presented has focused mainly on the technological aspects of knowledge creation and development, specifically the link between private and public research expenditure and the demand for highly educated researchers. Outside of this sphere, however, there are other factors that also play an essential role in the innovation process: the introduction of new products onto the market, the implementation of new production techniques, the right organisational set up, the setting up new, innovative companies, the local innovative and entrepreneurial culture, etc.

This raises the question of the possible existence of intrinsic, institutional, social and cultural barriers in Europe that may have a negative impact on knowledge development and innovation. Besides the well-known institutional barriers to innovation in Europe (the lack of harmonization in the area of the European patent, the difficulties in creating an effective European venture capital market, etc.), the question can be raised to what extent certain aspects of the European continental social welfare model might contain intrinsic obstacles to "entrepreneurship and innovation culture," especially in light of Europe's increasing structural disadvantages in the areas of innovation and high-tech entrepreneurship. The Lisbon declaration was not only an expression of the political desire to strive for a Europe belonging by 2010 to the world's most knowledge-intensive regions, but also that this was to happen within the context of a strengthened, 'activated' social Europe that would have an eye for past social achievements. The question that has in fact *not* been addressed in Lisbon is how activating labour markets and what we have termed here "activating knowledge" can go together and when one is confronted with economic trade-offs.

Based on the so-called regulatory barriers index estimated by the OECD, Figure 4.4, represents e.g. for the U.S. and a number of European countries the various, most common barriers to innovation associated with product market regulations, specific burdens on start ups, administrative burdens and last but not least employment protection costs associated with hiring and firing. This last one appears significantly higher in all European countries than in the U.S., with the UK not surprisingly with the lowest index level.

Economists such as Giles Saint-Paul[14] have analyzed the relationship between labor market institutions, and in particular the costs of dismissing employees, and the development of innovations from a purely theoretical perspective. Hiring and firing costs are in many ways the most explicit manifestation of the social welfare state in most continental European countries. They have led to stability in labor relations and represent an incentive for employers and employees alike to invest in human capital. However, in terms of innovation, and in particular the Schumpeterian process of creative destruction, the cost of developing new activities—whether concerned with new product, process or organizational innovations—will crucially depend on the ease with which "destruction" can be realized. Thus, as shown in Saint-Paul's model, the U.S., with lower firing costs, will eventually gain a competitive advantage in the introduction of new, innovative products and process developments onto the market, while Europe will become specialized in technology-following activities, based on secondary, less radical improvement innovations.

Figure 4.4 Regulatory barriers index (OECD)



[14] Saint-Paul, G., 2002, "Employment protection, international specialisation and innovation," *European Economic Review*, vol. 46, pp. 375-95.

In other words, the dynamics of innovation, of entrepreneurship, of creative destruction thrives better, practically by definition, in an environment providing higher rewards for creativity and curiosity than in an environment putting a higher premium on the security and protection of employment. Viewed from this perspective, the gap between Europe, and in particular continental Europe, and the United States in terms of innovative capacity, efficiency, and wealth creation may also, at first sight look like the price Europe has to pay for not wanting to give up its social model and in particular social securities and achievements.

To summarize: it might be argued that the Lisbon declaration was not really clearly formulated. A better way would have been: how much of the social achievements of the European model is Europe prepared to give up to keep up with the United States, let alone develop Europe into one of the most prosperous and dynamic regions in the world? Or alternatively: which elements of the European social model are sacred and which elements are worth paying a dynamic growth price for?[15]

Many of the proposals on "activating the labor market" with by now popular concepts like "empowerment" and "employability" appear to go hand in hand with innovation and growth dynamics, others though do not. Some European countries such as the UK and Denmark appear to have been much more successful in reducing dismissing costs than others, and appear to have benefited from it much more in terms of growth dynamics. The central question which must be raised within this context is whether the social security model developed at the time of the industrial society is not increasingly inappropriate for the large majority of what could be best described as "knowledge workers" who are likely to be less physically (and by contrast possibly more mentally) worn out by work than the old type of blue collar, industrial workers. The short working hours, or early retirement schemes might well appear to knowledge workers less of a social achievement, work not really representing a "disutility" but more an essential motivating activity, providing even a meaning to life.

[15] As Wim Duisenberg, the previous chairman of the European Central Bank, once stated: maybe we should accept that Europe will always face a growth and productivity gap with the U.S. simply because of existing differences in Europe in language, culture, and customs. As long as we value maintaining those, we will get joy out of our lagging behind the U.S.

There is in other words an urgent need for a complete rethought of the universality of the social security systems in Europe, recognizing explicitly that depending on the kind of work citizens get involved in, social achievements including employment security, a relatively short working life and short weekly working hours are important social achievements and elements of the quality of life, which should not be given up, and the case, probably exemplified by the highly qualified researcher, where exactly the opposite holds. It is in other words urgent time to broaden the discussions in science, technology and innovation policy circles to include social innovation.