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5. RESPONDING TO THE EU INNOVATION STRATEGY

The Need for Institutional Profiling in European Higher Education and Research

5.1 INTRODUCTION

In this chapter I will focus on the content of the innovation strategy of the European Union (EU) and its potential consequences for the European higher education landscape and more particularly on its higher education and research institutions. The EU innovation strategy is being developed and implemented in response to the ongoing process of globalisation, which, in the economic sense, is characterised by increasingly interconnected markets. Innovation is seen as a crucial response to the global economic crisis. And in innovation processes knowledge is assumed to be the new strategic production factor. Like elsewhere in Europe, the creation, transfer and application of knowledge are assumed to be of prime importance for a process of economic reorientation and further social and economic development. Higher education and research are interpreted as cornerstones of the larger overall European innovation strategy. To allow Europe to create stronger, sustainable lasting growth and more and better jobs, the EU has set an innovation agenda to which the higher education and research organisations must contribute. Hence, the EU has become more active and assertive in its efforts to influence the behaviour of these organisations and some major effects of this are already becoming visible. As I will argue in this chapter, this implies that European higher education and research organisations are being challenged to develop their 'institutional profiles' in an increasingly competitive European higher education and research system.

5.2 THE INNOVATION SYSTEMS PERSPECTIVE

Since the early 1980s the literature on the economics of innovation has reflected the emergence of a perspective on innovation policy being promoted by international organisations like OECD and the World Bank. This perspective takes an explicit policy position which emphasises the interactive character of the generation of ideas, scientific research and the development and introduction of new products and processes. Innovation perspectives have been discussed under various rubrics—the evolutionary approach (Nelson & Winter, 1977), the technological paradigm (Dosi, 1982), the technological innovation systems approach (Carlsson, 2002) and the concept of sectoral systems of innovation (Malerba, 2002). In this chapter I will

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use the term 'innovation systems approach', inspired by authors such as Freeman (1982) and Dosi (1984) and which was further developed by Lundvall (1992), Nelson (1993) and Edquist (1997).

In the innovation systems approach the basic assumption is that the key to international competitiveness is national 'factors that influence the development, diffusion and use of innovation' (Edquist, 1997, 14). This perspective argues that industrial innovation is decidedly non-linear. Instead, innovation is an interactive, reciprocal process involving different actors and organisations (Nelson, 1993). From the outset, academic institutions were identified as playing a critical role in the innovation systems approach and the evidence suggests that, if anything, their influence has grown over time (Mowery & Sampat, 2004). However, while the tangible outputs of academic research—publications and patents—remain important, equally significant to successful innovation is the production of highly skilled human capital (Cohen, Nelson & Walsh, 2002). Most importantly, and in sharp contrast to the linear assumptions of the traditional 'science-push model', the innovation systems perspective stresses the role of linkages between the various actors and organisations in the overall innovation process (Edquist, 1997; Nelson, 1993). These linkages include not only formal knowledge transfer arrangements between universities and industry, such as science parks and joint university-industry research ventures, but also soft linkages – the many channels of communication by which knowledge is exchanged.

In the last decades, the innovation systems approach has clearly influenced policies and reforms in higher education and research (Laredo & Muster, 2001; Lundvall & Borrás, 2004; Rammer, 2006). Many countries are now implementing policies that aim to improve the effectiveness of higher education and research in the context of innovation. The EU's innovation strategy clearly fits into this general picture. In several 'Communications' of the European Commission the innovation systems approach can clearly be recognised as a major source of inspiration. According to the theoretical bases of the innovation systems approach, innovation processes are assumed to be founded on both new knowledge and larger numbers of employable knowledge workers. In the EU innovation strategy the creation of knowledge should lead to new products and services, as well as to higher levels of productivity. The increase in trained knowledge workers should allow the EU to address the skills needs of the knowledge economy. The EU innovation strategy thus addresses higher education and research organisations both in terms of the ways knowledge creation processes are organised and as the producers of skilled human capital.

5.3 THE EU POLITICAL CONTEXT

The European policy domains of higher education and research are embedded in the broader European integration process. To analyse these policy domains one must first look at the broader European political context.

In the aftermath of World War II and during the onset of the Cold War, the wish to create peace and stability in Europe became a common aim, and the idea of pooling European countries' interests seemed highly attractive. The results were the gradual

creation of a supranational policy context, with the European Council (the heads of state and government and the EC-president) and the European Commission (EC) as the major supranational entities with political scope. The EU operates on the principle that decisions are taken as closely as possible to the citizens of Europe. The EU is assumed not to take action, except in areas that fall within its exclusive competence, unless the member states cannot themselves achieve the intended results – the principle of subsidiarity.

In terms of content, the most crucial recent phase in the European integration process to have had a major impact on developments in higher education and research policy was the 'Lisbon process' which began in 2000. At their Lisbon meeting, EU leaders decided on a process to boost the Union's competitiveness and growth. Inspired by the ideas and concepts of the innovation systems approach, they wanted to create 'a Europe of knowledge' and formulated the goal that, by 2010, the EU should be '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' (European Council 2000, paragraph. 5).

As was shown in the evaluation report of a special high-level group (European Communities, 2004), by 2005, the ambitious political goals of the Lisbon summit appeared to be very difficult to reach. While weak economic growth in the larger member states had been a major factor, the design and implementation of a policy to reach the targets which relied strongly on the efforts of member states and industry were also identified as major reasons for the failure of the Lisbon process (Weber, 2006).

The European Commission re-launched the process in 2005 with the New Lisbon Partnership for Growth and Jobs (EC, 2005c), identifying 'knowledge and innovation for growth' as one of the main areas for action. In addition, it developed integrated guidelines for the preparation of three-year National Reform Programmes (NRPs) by member states, as well as the Community Lisbon Programme consisting of a set of Actions for Growth and Employment (EC, 2005a), building a new, overarching community-member states partnership. With this new partnership, the EC created the foundations of the EU innovation agenda, known as the Lisbon agenda.

More recently the EU has embarked on a further renewed innovation strategy: 'EU 2020'. In this new long-term policy strategy, the EU intends to create the sources for sustainable economic growth and employment by focusing more strongly on knowledge and innovation. The EU 2020 Strategy, which forms the basis of the work for the current European Commission, builds on the achievements of the Lisbon Strategy and intends to renew it in order to meet the new global challenges. Key priorities of the EU 2020 Strategy are:

- creating value by basing growth on knowledge
- empowering people in inclusive societies
- creating a competitive, connected and greener economy (EC, 2010)

The EU 2020 strategy is the EU's most recent answer to the pressure of globalisation and the challenges of the economic crisis. And it clearly shows a strong belief in the potential strengths of Europe's higher education and research. The EU innovation strategy.

The supranational EU innovation strategy that has emerged during the last decades includes a number of inter-related policy fields. Two major policy domains are higher education policy (including doctoral education policy) and research policy (including knowledge transfer).

Since the re-launch of this agenda in the 2005 New Lisbon Partnership, the EC has tried to develop a general strategy that provides a solid base for the further development of the EU. Europe has recently been confronted with a sharp economic contraction and an unemployment rate rising to double digit figures. As a reaction, the EU is increasing its internal cooperation to successfully exit from the crisis and build a new, sustainable social market economy for which knowledge will be the key input. 'The Commission's aim is for Europe to lead, compete and prosper as a knowledge-based, connected, greener and more inclusive economy, growing fast and sustainably, creating higher levels of employment and social progress' (EC, 2010, 4).

The Union sees it as a major task to develop a comprehensive innovation agenda, and higher education and research policy has become a crucial element of this broader agenda. According to the EC, 'knowledge and innovation are at the … heart of European growth … public authorities at all levels in the member states must work to support innovation, making a reality of our vision of a knowledge society…more investments by both the public and the private sector spending on research and development are needed … our universities should be able to compete with the best in the world …' (EC, 2005c, 4–9).

5.3.1 EU Higher Education Policy

Generally speaking, higher education has come to the supranational European agenda only slowly. Although some educational activities were developed at the European level during the 1970s (in particular in the field of vocational training and the education of migrant workers' children), the education sector was for a long time 'taboo' for European policy initiatives (Neave, 1984, 6).

However, since 2001, the political view has developed that the EU can contribute to quality education by encouraging cooperation between member states through a wide range of actions, such as promoting the mobility of citizens, designing joint study programmes, establishing networks, exchanging information, and teaching languages to all citizens of the EU. The basic idea is that, although legislative power for education in general and higher education in particular remains at the level of the member states, the Union has a complementary role to play.

The main tool for implementing this ambition was the Socrates programme. The first phase ran from 1995–1999 and the second from 2000–2006. The Socrates II programme supported European cooperation in eight areas, from school to higher education, and from new technologies to adult learners. The higher education section of the programme continued the older Erasmus programme, established in 1987. Like the higher education Action of Socrates II, the Erasmus programme aimed to enhance the quality and reinforce the European dimension of higher education by encouraging transnational cooperation between universities, boosting mobility, and improving the transparency and recognition of studies and qualifications.

However, the roots of the current European higher education policy are to be found in a broader, intergovernmental European political context: the Bologna Process. In 1999, 29 European ministers of education signed the Bologna Declaration to create the European higher education area (EHEA), promote mobility and employability, and increase the compatibility and comparability of European higher education systems. It also emphasises the need to increase the 'international competitiveness' of Europe's higher education and its 'worldwide degree of attraction' (Bologna Declaration, 1999). The process has accelerated since the Bologna conference. Follow-up conferences were held in Prague (2001), Berlin (2003), Bergen (2005) London (2007), Leuven (2009). The 'Bologna ministers' (47 nations in 2010) added new actions on lifelong learning, on a common framework of qualifications, on a coherent quality assurance and accreditation mechanism, and on an additional focus on the doctorate level (third cycle) of the Bologna process. In 2009, the 'Bologna ministers' met in Leuven and decided that 'transparency' should be an important additional aspect of the Bologna Process.

Parallel to this Bologna Process, the European Commission initiated a debate in 2005 on the 'place and role of European universities in society and the knowledge economy' (EC, 2003, 4). Since the European universities are at the heart of the European knowledge society, being responsible for 80% of Europe's fundamental research, the EC intended to explore the conditions under which Europe's universities would be better able to play their role in the knowledge society and economy.

The Commission's analysis was stern: 'the European university world is not trouble-free, and the European universities are not at present globally competitive'. They should realise, the Commission continued, that the traditional model of Wilhelm van Humboldt no longer fits the current international context and that the high degree of fragmentation of the European university landscape prevents Europe from responding to new global challenges. These challenges go beyond national frontiers and have to be addressed at a European level. 'More specifically, they require a joint and coordinated endeavour by the member states…., backed up and supported by the European Union' (EC, 2003, 10).

According to the EC, European universities have failed to unleash their full potential to stimulate economic growth, social cohesion, and improvement in the quality and quantity of jobs. In a policy paper in 2005, the EC identified several bottlenecks: a tendency to uniformity and egalitarianism in many national higher education systems, too much emphasis on monodisciplinarity and traditional learning and learners, and too little world-class excellence (EC, 2005b). European higher education remains fragmented into medium or small clusters with different regulations and languages; it is largely isolated from industry; graduates lack entrepreneurship; and there is a strong dependency on the state. European higher education is also over-regulated and therefore inefficient and inflexible. In addition, European universities are underfunded. This leads to low enrolment rates, failure to prepare students for the labour market, and difficulties in attracting and retaining top talent.

In the view of the Commission, the quality and attractiveness of European universities need to increase, human resources need to be strengthened both in numbers and in quality, and the diversity of the European higher education system

needs to be combined with greater compatibility. In this sense, the Commission subscribes to the general philosophy of the Bologna Process. But it also developed its own policy tools. In 2004, the Commission launched the Integrated Lifelong Learning Programme (2007–2013) with the general objective of contributing to the European knowledge society. The Lifelong Learning Programme consists of four sub-programmes, one of which is the Erasmus programme. One of its prime aims is to reinforce the contribution of higher education institutions to the European innovation agenda (EC, 2004a).

5.3.2 EU Doctoral Training Policy

A crucial dimension of the overall European higher education policy is the growing attention paid to the importance of doctoral training, including at several Bologna ministerial summits. The ministers emphasised the importance of research and research training in enhancing the competitiveness of European higher education and called for greater mobility at the doctoral level and stronger inter-institutional cooperation (Berlin Communiqué, 2003, 7). They urged European universities 'to ensure that their doctoral programmes promote interdisciplinary training and the development of transferable skills, thus meeting the needs of the wider employment market'. Also, the number of doctoral candidates should be increased to contribute to the needs of the knowledge society (Bergen Communiqué, 2005, 4). At their London (2007) and Leuven (2009) meetings, the ministers invited universities to reinforce their efforts to embed doctoral programmes in their institutional strategies and develop career paths for doctoral candidates and early-stage researchers.

Doctoral training is beginning to feature more prominently on the European research and education agendas. It is assumed to be able to play a major role in creating a highly trained labour force for the knowledge society, which is understood to need professionals who have the competencies to work in highly complex, knowledge-intensive environments. Europe indeed seems to have discovered the full potential of the third cycle in higher education (Bartelse & Huisman, 2008). Doctoral training is considered to be the major link between the Bologna Process and EU policies (Aghion et al., 2008), and, more specifically, between the European higher education and research areas. Not only has it become an official part of the European political agenda in the Bologna process, it is also a crucial point of attention in the EU innovation strategy. The EC strives for an open, single and competitive labour market for researchers with attractive career prospects and incentives for mobility. In the near future, it is assumed that doctoral graduates will find their careers not only in academia and government, but also in private sector R&D laboratories and general management positions.

5.3.3 EU Research Policy

Although the EU has been active in research policy from the outset, EU research policy has only developed fully since the 1980s. A crucial step was the creation of the multi-annual research and technological development framework programmes (FPs) which have developed into the central EU instrument in research and technology

policy. They have become *the* strategic documents describing broad strategic EU research priorities, each to be implemented through specific programmes. In addition, they address the overall EU budget for the duration of the programme, the breakdown of this budget into priority areas, and how funding will be made available to projects (Caracostas & Muldur, 2001).

However, while the financial and political strengths of the FPs are considerable, the share of their research investments on a Europe-wide scale is limited. In the sixth framework programme, it was only 5%. The other 95% came from the member states. The overall European research landscape suffers from fragmentation and unnecessary duplication of efforts and resources (Andersson, 2006). The major challenge in the European research and policy domain is to create a critical mass and joint investment schemes. This is the challenge that is being addressed in the proposals for the European Research Area (ERA).

The ERA was formally launched in 2000 (EC, 2000). The Lisbon summit of that year endorsed the creation of the ERA as a key component of the Lisbon agenda. However, it was only in 2002 that the ERA took further shape. The EC noted that European research represented a jigsaw of 15 often very different national scientific and technological policies. The FPs seemed to be no more than a 'sort of 16th research policy, coming on top of [the then 15 member states'] national effects, but not dynamic enough to have a truly integrating effect' (EC, 2002a, 8). The result was compartmentalisation, dispersion and duplication, as well as a failure to assemble the critical mass of human, technological and financial resources that major scientific advances now demand.

The EC also stated that the only way to reach the ambitious targets was to increase general investment in research to 3% of GDP and that a substantial part of this effort should come from business and industry. In March 2002, the 3% figure (of which two-thirds were expected to come from private funding) was accepted as the target to be reached by 2010. But this seemed difficult, with European R&D expenditure by business and industry lagging well behind the US, and, at mid term, the EU was far from its target. It was concluded that 'halfway to 2010 the overall picture is very mixed and much needs to be done to prevent Lisbon from becoming a synonym for missed objectives and failed promises' (European Communities, 2004, 10). There was a large gap between the political rhetoric about the knowledge society and the realities of budgetary and other priorities. Action was urgently needed.

The most recent FPs (FP6: 2002–06; FP7: 2007–13) address this issue by improving the coordination of national research funding programmes. They underline the need for an EU research policy framework that creates incentives for the member states to contribute to the joint EU innovation strategy. Without the active involvement of member states the EU cannot succeed in building the European knowledge society.

The current FP7, with a budget of €53.2 billion, is a major programme for achieving the ambitions of the EU innovation strategy. It is the current chief instrument for funding research and innovation and is creating a dialogue and cooperation with industry (in the Technology Platforms and Joint Technology Initiatives) and with the academic world through the creation of the European Research Council (ERC) which provides support for the best European 'frontier research'.

With FP7 the ERA's scope has broadened from a focus on how to improve the effectiveness and efficiency of the fragmented European research landscape to an awareness that more public and private investment in research is needed and that research policy should be related to other EU policies to achieve coherence and synergies in the context of the overall Lisbon strategy. According to the Commission, the expanded ERA must comprise six features: (1) an adequate flow of competent researchers with high levels of mobility among institutions, disciplines, sectors and countries; (2) world-class research infrastructure, accessible to all; (3) excellent research institutions engaged in public-private cooperation, attracting human and financial resources; (4) effective knowledge-sharing between the public and private sectors and with the public at large; (5) well-coordinated research programmes and priorities; and (6) the opening of the ERA to the world, with special emphasis on neighbouring countries.

5.3.4 EU Knowledge Transfer Policy

The basic philosophy of the EU research policy is that excellence in research can be promoted by increasing cooperation and further investments. But stronger links with business and industry are also needed and knowledge transfer processes must be strengthened.

In 2006, the EC published a policy paper to stimulate 'putting knowledge into practice' (EC, 2006) and to frame policy discussions on innovation at national and European levels. It outlines the most important planned and ongoing initiatives, identifies new areas of action, and in particular introduces a more focused strategy to facilitate the creation and marketing of innovative products and services in promising areas—'the lead markets' (EC, 2006, 3).

According to the Commission, there are major barriers to greater knowledge transfer in the EU, including cultural differences between the academic and the business communities, legal barriers, fragmented markets and lack of incentives. Some member states have set up initiatives to promote knowledge transfer, but these largely ignore its international dimensions (EC, 2007b).

In this context, a number of measures are suggested by the Commission, including creating a workforce of skilled knowledge transfer staff in universities (and a professional qualification and accreditation scheme), developing a more entrepreneurial mindset in universities, and providing for exchanges of staff between research organisations and industry. In addition, voluntary guidelines to help to improve knowledge transfer cover issues such as intellectual property management, incentives for researchers to participate in knowledge transfer activities, and the development of knowledge transfer resources (EC, 2007c).

5.4 ISSUES FOR EUROPEAN HIGHER EDUCATION AND RESEARCH INSTITUTIONS

From the previous sections it becomes clear that higher education and research institutions are increasingly addressed by EU- and related national policy initiatives.

The political expectations regarding their performances are rising. In combination with other changes in the environment of higher education institutions, these institutions are increasingly confronted with major challenges. Will higher education and research institutions be able to live up to the rising political expectations? What are the major issues that, from the perspective of the EU innovation agenda, will have to be addressed by these institutions? In the following sections I will present an inventory of issues that may be expected to affect the policy and management agendas of the European institutions for higher education and research in the years to come.

5.4.1 Enrolments and Labour Market Needs

The first issue to be discussed concerns demographic developments in Europe that affect the educational role of higher education institutions, particularly with respect to the challenge to produce sufficient numbers of qualified professionals for the labour market.

In the EU innovation strategy, higher education institutions are confronted with the demand to educate large numbers of professional knowledge workers, able to contribute to an increase in the EU's overall innovation capacity. This is already a major challenge. But it becomes even larger if the current demographic developments in Europe are taken into account.

The projected demographic situation in Europe creates special problems for its innovation capacity. Projections by EUROSTAT show that the population of the EU will rise gradually from 495.4 million in 2008 to 519.9 million in 2030, and will gradually decline to reach 505.7 in 2060. Moreover, the EU population is becoming older, with the median age projected to rise from 40.4 years in 2008 to 47.9 years in 2060. The working age population (15–64 years old) is expected to fall to 56% of the total population in 2060, while the share of people over 65 is expected to increase to 31%. Hence, the old age dependency ratio is expected to increase substantially from its current level of 26% to 54% in 2060. In 2008, there were 4 persons of working age for every person aged 65 or over; in 2060, this ratio will be 2 to 1 (EC, 2009).

In the last 20 years or so, the number of young people in the EU has declined steadily. Between 1985 and 2007, the population aged 0–9 decreased by 17%, the population aged 10–19 by 19%, and the population aged 20–29 by 8%. The pupil intakes in primary and lower secondary education will fall substantially until 2010, and then slowly increase (EC, 2009). These trends have different impacts on the different levels of education. While primary and lower secondary education are directly impacted by smaller cohorts, increases in participation rates in upper secondary and higher education may counteract a demographic decline.

Between 1960 and 1980, enrolments in European higher education increased by a factor of ten. Rising social demand and the absorption capacity of the labour market created a massification of higher education leading to a substantial expansion of the EU higher education systems and a changing position of these systems in society from elite training to manpower production. However, in 2008, the higher educational attainment level of the EU adult population (ISCED levels, 25–64 year old) is still

limited (24.3%) and is outperformed by both the US (39%) and Japan (40%) (EC, 2009).

The combination of a potential future decline in the traditional age cohorts enrolling in higher education and the still relatively low higher educational attainment level of the adult population confronts the EU with a major challenge for its innovation agenda. The labour market in industrialised countries shows that the 'race between higher education and technology' (Tinbergen, 1977) is still being lost by education: the demand for higher education graduates keeps increasing beyond the increase in supply. Like many other nations in the world, the EU member states will have to reduce the gap between the demand and supply of graduates. Raising higher education enrolment rates, particularly in undergraduate higher education, is not only a matter of social cohesion and stability, but also a necessity in a knowledge-based economy. The EU needs more graduates who must be directly employable. So the massification of European higher education will need to continue and enrolments will need to continue to grow. Recent skills forecasts for the EU indicate that the demand for skills and qualifications is growing in most occupations. The total employment increase in Europe between 2006 and 2015 will be around 13.5 million new jobs, comprising over 12.5 million additional jobs at higher education level and almost 9.5 million jobs at medium education level, while the demand for jobs requiring low qualifications will fall by 8.5 million (CEDEFOP, 2008). In 2015, some 30% of jobs in the EU will need higher education qualifications. To address this demand, the undergraduate education systems of the EU member states will have to grow and larger numbers of first degree students will have to enrol. However, given the demographic trends, the EU urgently needs to address new recruitment areas such as international students and adult learners. With a shrinking labour force (the population aged 15–65), it becomes crucial to ensure that people on the labour market have the right skills. In addition, the rapidly growing share of people over 65 increases the need to address the future demand in the care sector.

In addition to increasing higher education enrolments, 'access and equity' will also need attention. Despite the rapid expansion of European higher education, students from lower socio-economic groups continue to be underrepresented. An important dimension of the 'European model' is the political wish to ensure that talent rather than socio-economic background counts in admission to higher education. While this objective has been kept in mind during the massification of European higher education, lower socio-economic under-representation remains a problem. In particular, the children of immigrants with low or no educational attainment have difficulty in reaching higher education. While these participation rates have been increasing, they are still below those of the original population. Increasing them is important for social cohesion and to address the problem of future shortages of higher education graduates (Ritzen, 2010).

The challenges for EU higher education institutions are clear: they will have to find ways to expand their student bodies, particularly by enrolling non-traditional students. Hence, they will have to diversify their educational programmes and adapt them to new categories of students. A second challenge is to strengthen the employability of their graduates in the context of the knowledge economy. The future labour

market will ask for high qualifications levels and high-level skills. With a shrinking labour force, there will be increasing pressure to relate graduates skills to labour market needs.

In doctoral training, universities will have to recognise the need to offer candidates a broader experience than core disciplinary research skills. They will have to introduce courses and modules that offer transferable skills and train and prepare candidates for career opportunities in labour market sectors beyond academic institutions. The traditional Humboldtian doctorate may have to be supplemented by a variety of new professional doctorates.

5.4.2 Research Excellence and Knowledge Transfer

The EC has characterised the quality of the EU research output as 'generally good on average, but with a very limited basis of universities at world-level' (EC, 2007a, 50). In terms of total number and world share of scientific publications, the EU is the world leader. In 2006, its world share was 37.6%, compared to 31.5% for the US, 8.4% for China and 7.8% for Japan. However, the picture changes when publications are compared to population. Then the US leads, with 1.047 publications per million population, compared to 756 in the EU (EC, 2008b).

There are indications that the EU's scientific impact lags behind that of the US in almost all disciplines. The data on the field-normalised Citation Impact Score per scientific discipline show that the EU's scientific impact is around or below world average in almost all disciplines. The EU scores above world average in only 6 out of the 37 fields and has lower scores than the US in 35 of the 37 disciplines.

An institutional citation impact analysis per discipline shows that of the universities that are world leaders in at least one discipline, only 26% are EU universities, whilst 81% are US universities. In addition, the number of disciplines in which an EU university is the world leader is on average substantially lower than that for US universities. A number of EU universities are considered among the top universities in the world, but their top is generally less broad than that of US universities (EC, 2007c).

To increase their performance in terms of world-class research excellence the European universities and research organisations will need to strengthen their research base. The brain drain of EU graduates and researchers, particularly to the US, will need to be curtailed. Currently, some 5% to 8% of the total EU researcher population are working in the US. Many are reluctant to return to Europe, primarily because of a lack of attractive research conditions and career prospects. Universities will need to focus on their relative research strengths and create attractive conditions for top-level researchers. They will need to profile their research portfolios using investment and cooperation strategies and develop joint research networks with attractive research infrastructure and academic career paths. The current EU research policy (particularly FP7) offers broad opportunities to address these challenges.

The EU also needs to increase its performance in the process of knowledge transfer. The number of full-time equivalent (FTE) researchers per thousand labour force participants amounted to 6.3 in the EU in 2007, compared to 10.8 in Japan

(EC, 2009). The EU deficit in the proportion of researchers in the labour force is mainly found in the business sector. In the EU in 2003, 49% of all researchers were employed by the business sector, compared to nearly 69% in Japan and over 80% in the US (EC, 2007a).

In 2005, EU patent applications accounted for nearly 31% of the total number of patent applications in the world. The US has more than 33% of all patent applications and Japan over 16%. Between 2000 and 2005, the applications from Asian countries increased dramatically (India 241%; China 137%), which resulted in a decline of the world share of both the EU and US. In the enabling technologies (biotechnology, ICT, nanotechnology), the EU share of patent applications is lower that that of the US, indicating a concentration of US inventions in these areas (EC, 2008b, 69).

The European higher education and research institutions have recently increased their knowledge transfer activities. More and more have established technology management and technology transfer offices. The number of patents applied for by higher education institutions in the EU has increased by more than 28% in the last decade (EC, 2008b, 132). Yet the EU higher education and research institutions will have to further increase their efforts in this field. The links with business and industry will have to be intensified. Regional knowledge application clusters need to be developed and 'soft knowledge transfer' processes (applied research, internships, guest lectures, projects) will have to expand.

5.4.3 Public and Private Funding

The ideal of public financing of higher education and research is still widely shared in Europe. But the EU innovation strategy implies a major challenge to this ideal. Government finance is simply unable to provide sufficient funds for the new challenges that European higher education institutions are confronted with. If European higher education is to contribute to the innovative capacity of the EU, provide professional and academic training for growing numbers of students, and perform world-class research, it cannot be funded solely from the public purse. The increasing demands on higher education institutions in terms of numbers and quality on the one hand and the limitations of public finance on the other will not allow the EU to close the present funding gaps between the US and the EU.

EU R&D intensity (Gross Domestic Expenditure on R&D as % of GDP) lags behind the US and Japan. In 2006, it was 1.84%, significantly lower than that of Japan (3.39%) and the US (2.61%). Government expenditure on R&D as a percentage of GDP was 0.63% in 2005, which is 15% higher than in Japan (0.55%) but 21% lower than in the US (0,76%). Business expenditure on R&D in the EU as a percentage of GDP stands at 1%, compared to 2.62% for Japan and 1.69% for the US (EC, 2008). In terms of R&D expenditure, the EU is still a long way from its ambitious target—3% of GDP (EC, 2008b),

EU investments in higher education show a similar gap with the US and Japan. Total investments (public and private expenditure) in higher education institutions in the EU (2006) is 1.2% of GDP, while in the US and Japan it is 2.9% and

1.5% respectively. The difference between the EU and the US and Japan is largely the effect of a much higher private investment level in both the US and Japan compared to the EU (EC, 2009).

Given these funding gaps in research and higher education, the differences in performance and attractiveness between the US and the EU systems are likely to remain. If the EU wants to be a world-class higher education and research performer, it needs to boost its expenditure in these domains. And for this there seems to be only one solution: to increase private finance for higher education and research.

These funding differences have become a major concern of EU policy. The EC has pointed out that the funding gaps are a serious obstacle to meeting the innovation goals and has emphasised the importance of fiscal rules enabling the increase of private investments in both higher education and research. The EC also points to the need for cost-sharing and suggests that member states critically examine their current mixes of student fees and support schemes in the light of their efficiency and equity outcomes.

EU higher education and research institutions are therefore confronted with the challenge of increasing their private income in education and research. In education, the major option is the introduction of tuition fees, coupled with the adoption of student financial support systems. In OECD countries, private contributions to higher education (household expenditure as a percentage of total higher education expenditure) increased on average by 5% between 1995 and 2005 (with large increases in Japan and Australia). However, most EU countries remain very hesitant in this respect and there is considerable ambiguity over whether tuition fees should be charged.

An increase in private income for research can result from closer cooperation with business and industry, including in knowledge transfer processes. While further developing their research portfolios, universities and research institutions can diversify their funding base by responding to the knowledge needs of business and industry and prioritising their research programmes in accordance with major clients in sectoral or regional clusters.

5.4.4 Multi-Level Governance

Unlike in the days before the innovation strategy, the EU has become a major higher education and research policy actor and many universities and academics have experienced its conditions and effects. The supranational EU policy level has become part of the multi-level governance system that European higher education and research organisations are dealing with. There seems to be an increasing alignment of EU higher education and research policies with the various national policies. The recent EU-2020 strategy will only create extra pressure on member states to align their national policy efforts to the EU innovation agenda. As a result, higher education and research institutions are working in a multi-level policy context in which the focus is increasingly on the roles institutions can play in enhancing innovation.

Two effects of the dynamics of this multi-level governance system ssem to create important challenges for EU higher education and research institutions. The first can

be described as the academic stratification of the European higher education system, with increasing vertical diversity. This is the combined result of the changing participation processes of European higher education institutions in the research Framework Programmes (FPs) and the counterproductive consequence of the reinforcement policy on the interaction between higher education and industry. With regard to the former, it has been noted that past success in the FPs seems to be an indicator of successful future participation in these programmes (David & Keeley, 2003). What appears to be emerging is the well-known Matthew Effect, with research groups that have been successful in obtaining funding appearing to increase their chances of obtaining future funds. The other process is the counterproductive effect of the EU's push towards closer links between higher education and industry. It seems that institutions in a relatively weak financial position are increasingly forced to accept industrial funding for often routine contract research. Faced with the impossibility of charging real research costs, they are confronted with a further weakening of their financial situation and a decrease in their capacity to undertake academic research (Geuna, 1999). The combined outcome of these processes is a greater differentiation between academically and financially stronger and weaker institutions, and hence a growing vertical diversity in the overall European higher education and research system.

The second unintended effect is a growing regional differentiation in European higher education and research. This seems to be the outcome of three interrelated processes emerging from EU policies (Frenken et al., 2008). The first is the preference of researchers in 'excellent regions' to collaborate with each other rather than with colleagues in lagging regions. EU research policy appears to stimulate the concentration of talent in the richer and academically better-equipped regions of Europe. Lagging regions find it difficult to participate in successful EU research networks and seem to have to cross a threshold of quality and size before they can do so. Secondly, the EU policy objective of the free movement of people appears to not only lead to greater mobility of researchers, but also to the concentration of talent in a selected number of excellent regions. The most talented researchers compete for positions at the most prestigious universities, rendering it difficult for lagging regions to retain talent. Thirdly, the sectoral structure of the poorer European regions is usually characterised by a dominance of low-tech and medium-tech activities that do not fit the thematic priorities of EU research policy. The FPs almost exclusively concern high-tech sectors, thus creating a situation in which the research subsidies are concentrated in the richer regions. The result is an unintended but nevertheless real effect of regional differentiation. The geography of European higher education and research is changing from one based on the priority of national borders into one based on the clustering of talent. Wealthier regions are increasingly able to profit from the general European innovation policy, while poorer regions are left with the resources of the cohesion policy. This process also seems to contribute to the growing academic stratification in the EU higher education and research system.

Academic stratification and regional differentiation confront European higher education and research institutions with the challenge to acknowledge and profile their position and role at the European level. The innovation agenda seems to have

increased competition for funding and reputation. Higher education and research institutions cannot ignore the effects of the multi-level processes by which they are governed.

In the context of the EU innovation strategy, the European higher education and research institutions are confronted with a number of major challenges. The need to increase enrolment and graduate numbers, the levels of access and equity, research performance and knowledge transfer capacity and private income and to react to the processes of academic stratification and regional differentiation are crucial challenges that force higher education and research institutions to consider their strategic positions. In the concluding section I will argue that, in order to be able to play a role in the new dynamics of EU higher education and research together with their national governments, higher education and research organisations will need to design and implement their 'institutional profiles'.

5.5 INSTITUTIONAL PROFILES

In recent decades, the higher education and research systems of Europe have become increasingly integrated. Because of the Bologna Process and the EU innovation strategy, European higher education is no longer only a fragmented collection of larger and smaller national systems, but increasingly also a European-wide system. The alignment of national and EU policies regarding higher education and research has created a European system in which national systems still play major roles, but in which the system dynamics are also recognisable on a European scale. The processes of academic stratification and regional differentiation mentioned before are manifestations of effects taking place on a European scale, often with important repercussions at national and institutional levels.

As a result of the newly developing system dynamics of European higher education and research, the positions and roles of individual higher education and research institutions are changing. Both national governments and individual institutions realise that they must react to these new developments and find answers to the challenges resulting from the processes of academic stratification and regional differentiation. In several European countries (e.g. Denmark and Germany) the recent higher education and research policies show that these challenges have been recognised and that the new national policy efforts focus on (re)positioning (a number of) national higher education and research institutions on a European (and even a global) scale. National higher education and research systems are increasingly being diversified in order to allow institutions to find (or perhaps conquer) prominent positions in the European (and global) competition for funding and reputation.

Not all higher education and research organisations in the various national systems will be able to position themselves in the same way in this process of increasing diversification. Some (but certainly not all) will be able to develop into major comprehensive, research intensive institutions that are able to compete internationally. Others will be able to capture a strong role as regional innovator or as a major provider of high-level professionals. Both national governments and higher education and research organisations are increasingly finding out that 'institutional profiling'

will have to be a crucial answer to the new European higher education system dynamics.

The development of 'institutional profiles' will also allow the European higher education and research institutions to respond to the various issues emerging from the EU innovation strategy discussed before. Developing their institutional profiles should, in other words, enable them to identify and propagate their specific institutional strengths, specialisations and orientations and hence their contributions to the EU innovation agenda. .

Institutional profiles are to be seen as the empirically determinable reflections of the specific institutional efforts and performances regarding their core activities (education, research, knowledge exchange). Two new European 'transparency instruments' (U-Map and U-Multirank) are being designed that intend to exactly bring out these institutional profiles. They[1] allow the empirical determination of the profiles of an institution's efforts and of an institution's performance in its core activities.

With their institutional profiles, higher education and research organisations will be able to provide transparency and accountability regarding their various activities and choices. With these profiles, they will also be able to show how they address the various challenges emerging from the EU innovation strategy: the relationships between educational programmes and the labour market, the composition of the student body, graduates' employability and quality, the orientation and performance of research, the links with regional development, the international orientation, etc.

In the years to come, institutional profiling may become a major tool for institutional management. Institutional profiles can be the basis for internal budget allocations, external benchmarking, inter-institutional cooperation, external networking, or simply for effective communication. The institutions will profit from clear and realistic choices in all these applications.

The EU innovation agenda confronts the European higher education and research institutions with the challenges to show how and to what extent they can contribute to the newly arising 'Europe of knowledge'. Clear and realistic institutional profiles are probably the best answers to these challenges.

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