

# **Closing the European Knowledge Gap?**

Challenges for the European universities  
of the twenty-first century

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## **Introduction**

This paper discusses the present condition of European universities in the context of the European ambition to be a world-class knowledge economy. It explores both this political ambition and the realities of the European knowledge economy. In addition, it compares these European realities with the performance of the US knowledge economy and analyses the background to the 'knowledge gap' between Europe and the US.

In the second part of this paper the traditional European academic culture and some key European university characteristics are discussed. The argument presented is that both this culture and these sometimes 'distorted' characteristics need to be fundamentally changed in order to allow Europe to realise its ambitions to become a world-class knowledge economy. At the end of the paper some suggestions are formulated to enhance the role of the European universities in the knowledge economy as well as with respect to a number of crucial policy initiatives in the European higher education and research system.

## **Globalisation and the knowledge economy**

Since the 1970s the world has been going through a rapid process of increasing globalisation. Partly as a result of this globalisation the world's economic production has increased six-fold over the past fifty years while the world's population has only increased by a factor of two and a half. The result has been increasing prosperity for a large number (but unfortunately not the whole) of the world's population. The ongoing economic integration that has characterised the world since the Second World War appears to be an important source of increasing prosperity. Globalisation is a process that is characterised in economic terms by a sharp increase in trade in goods and services, as well as, more recently, an expansion of international flows of capital. The crucial driver behind these developments is the rapid development of technology over recent decades that has led to significant cost reductions in production, communication and transport, and a major increase in our capacity to process information. Clearly international policy agreements concerning free trade and the limitation on tariff barriers have played their role, but technological advances appear to be the most important cause of the continuing integration of markets.

In the meantime, the significance of these developments and their effects grows even more powerful. The competitive strength of companies increasingly rests on their ability to respond to the wishes of customers at the right moment. Adequate information processing and flexibility and efficiency in production are important advantages in this respect. Regions, countries and even entire continents benefit from the increased competitiveness of their

business and industry sectors and concentrate increasingly on attracting investment for economic activities. The result is a growing competition between geographical entities.

In this context knowledge is a crucial factor. Globalisation has given rise to a situation in which economic and social development is increasingly based on knowledge. We live today in a knowledge society and our economy is strongly dependent on the creation and distribution of knowledge. Our markets, production processes and institutions are knowledge-based. Our working and living conditions are determined by knowledge.

### **The European knowledge economy**

Europe stands on the threshold of a number of major socio-economic changes. The coming years will see fundamental changes not only in the sphere of politics and governance but also in the areas of social life and economic structures – some of these changes have already been set in motion. Europe will have to meet the challenge of ever increasing globalisation (Van Vught, a.o.,2002).

Europe realises that it has arrived in the era of knowledge and that European and national policies must be grafted on to this new reality. This was most clearly seen when the political leaders of the European Union governments met in Lisbon in March 2000 to agree on strategic goals. They agreed that in 2010 (less than 10 years from now) the European Union must be the world's most dynamic and competitive knowledge economy. To achieve this more knowledge must be created faster, and more knowledge workers must be educated.

But Europe is changing in terms of the composition of its population. Demographic indicators show that the proportion of Europeans in the world's population is declining to an unprecedented level: from 35% in the 1950s to 13% today and a predicted 8% in 2050. Alongside this trend is the phenomenon of ageing. Europe is already the continent with the largest proportion of the population 65 years or older and this percentage is increasing: it is expected to double from around 14% today to almost 28% in 2050. The 'greying of the population' in Europe is the fastest in the world (European Commission, 2003a, p. 5). A European demographic policy is clearly called for and needs to be a counterpart to the strategic approach to the knowledge economy.

A declining labour force requires a major immigration of new knowledge workers. In Germany it has been calculated that until 2020 an annual immigration of a million immigrants is needed to maintain its labour force at current levels. The focus here needs to be on young, highly

educated researchers of which there are already significantly fewer in Europe than in the United States (European Commission, 2003a, p. 253).

Even if Europe succeeds in achieving an effective immigration of young talent and limits the decline in the labour force there still remains a need to achieve a significant increase in labour productivity. If we want to maintain our current levels of welfare then we need to improve our international competitiveness, our economic growth and our productivity. This is why the emphasis on knowledge is critically important. Only through technological progress and a highly educated labour force will we be in a position to achieve heightened levels of productivity. In a knowledge economy, investment in education and research is the most important factor in guaranteeing long term welfare and prosperity.

As indicated earlier, Europe realises that it has arrived in the era of the knowledge economy. Since the 1970s the European economic structures have undergone a number of changes whereby the economy has developed from an industrialised to a knowledge intensive economy. The emphasis on labour, raw materials and available capital has shifted to the creation, distribution and application of knowledge. Most notable is the structural intensification of research activity. In the knowledge economy economic growth depends more on investment in knowledge than on traditional factors of production. In a production function where knowledge has become the most important factor, the quality of human capital is decisive. It is, after all, the professional skills of researchers and those who apply knowledge that make the development and application of knowledge possible.

The development of the knowledge society appears to bring with it a number of social effects that warrant our attention. Now that the production and distribution of knowledge has reached a pace unknown before in our history it appears that there are a range of attendant social consequences. Institutional and organisational changes seem necessary, existing patterns of rules and agreements are no longer adequate, while new professions and ways of organising work appear to be developing. Knowledge seems to change not only economic production processes but also penetrates our social, institutional and organisational structures and processes. We live not only in a knowledge economy but also in a knowledge society.

In this knowledge society, technological progress is not an exogenous fact. Technological progress does not reach us from outside but is the result precisely of these structures and processes within the knowledge society. The way in which we organise our knowledge society determines to a large measure the nature and extent of technological progress. This progress does not happen automatically – the production and application of knowledge must be organised and stimulated. In other words, political and executive responsibility has to be taken for active policy in this field. The cornerstone of such policy should be an investment

strategy to increase the possibilities of the generation, distribution and application of knowledge – in short, an investment policy for education and research.

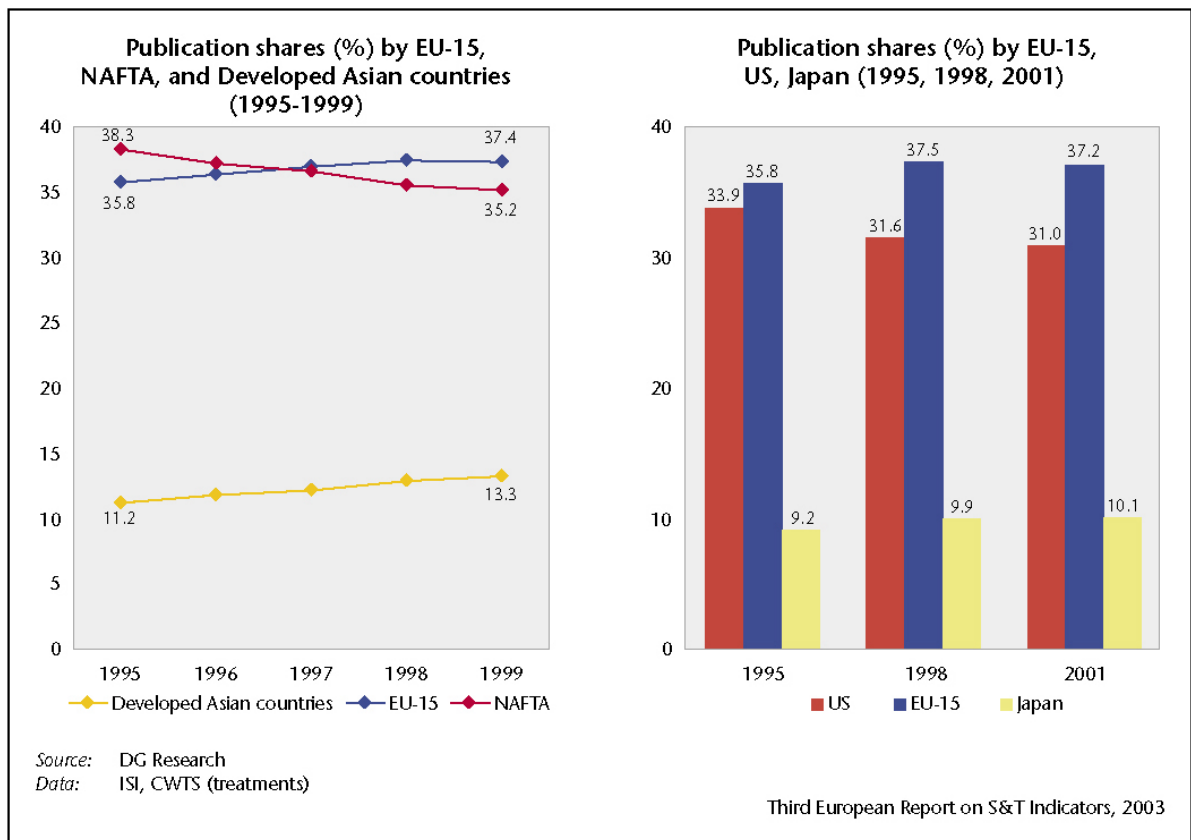
### **Ambitions and realities in the European knowledge economy**

At a European level such a policy is currently in development. The ambitions of Europe's top political leadership, for example, have been translated into a new form of steering referred to as 'the open co-ordination method'. This steering instrument (which implies a leading role for the European Commission) aims to compare the policy achievements of EU member states in relation to the Lisbon objectives using indicators and benchmarks. Through this process a form of peer pressure is brought to bear on less well achieving member states who feel almost forced to match the policy results of the better performing countries. In addition, the Lisbon ambition has been given further effect by the agreement reached during the top political meeting in Barcelona (15 and 16 March, 2002) that each member state should strive to spend 3% of GNP on research.

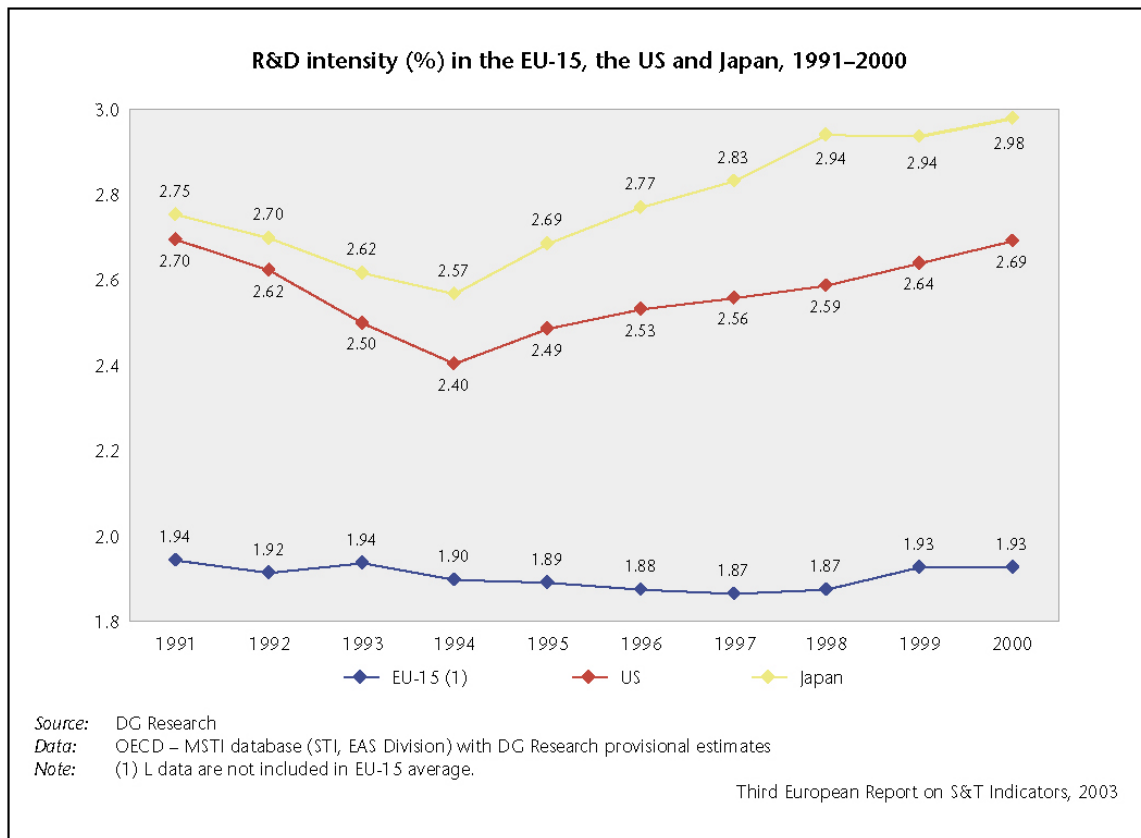
Let us be absolutely clear that we in Europe still have a long way to go. The ambitious goals set in Lisbon – to be the world's most competitive and dynamic knowledge economy by 2010 – are still a long way away from being realised, and it is a legitimate question to ask whether the goals are still achievable. The reports published to date by the European Commission on the progress made in terms of the Lisbon strategy make it clear that much work remains to be done. The European Union continues to lag behind the USA and Japan both in terms of levels of investment in the knowledge economy (for example, expenditure on R&D and education) and the growth in these investments. This disappointing picture is also seen in the indicators used to measure the performance of the European knowledge economy (such as the number of patents). Europe as a whole performs less good than the USA. In addition, the rates of growth in the performance of European countries appear too limited to close the existing gap between Europe and the USA by 2010 (European Commission, 2003a; 2003b).

This brings us to the question of the nature of the difference in knowledge economy achievements between Europe and the USA. What actually explains this clear 'knowledge gap' between America and Europe? Much has been spoken about the 'European paradox' since the 1980s. On the one hand Europe has become the world's largest producer of scientific publications, but on the other hand Europe is clearly behind the USA when it comes to turning scientific knowledge into economic growth (Soete, 2002). Recent statistics demonstrate that the EU member states' combined share of the world's scientific publication output since 1997 exceeds that of the NAFTA countries (USA, Canada and Mexico). Europe

is thus unquestionably the world's leading producer of scientific output (European Commission, 2003a, p. 279).



However, if we look at actual investment in higher education and in R&D see a completely different picture. The average expenditure on higher education within the European Union amounts to 1,1% of GNP. In the USA this figure is more than double at 2,3%. The difference can be traced mainly to the near absent private contribution in European higher education (0,2% compared to 1,2% in the USA). (European Commission, 2002b; 2003c, p.12)



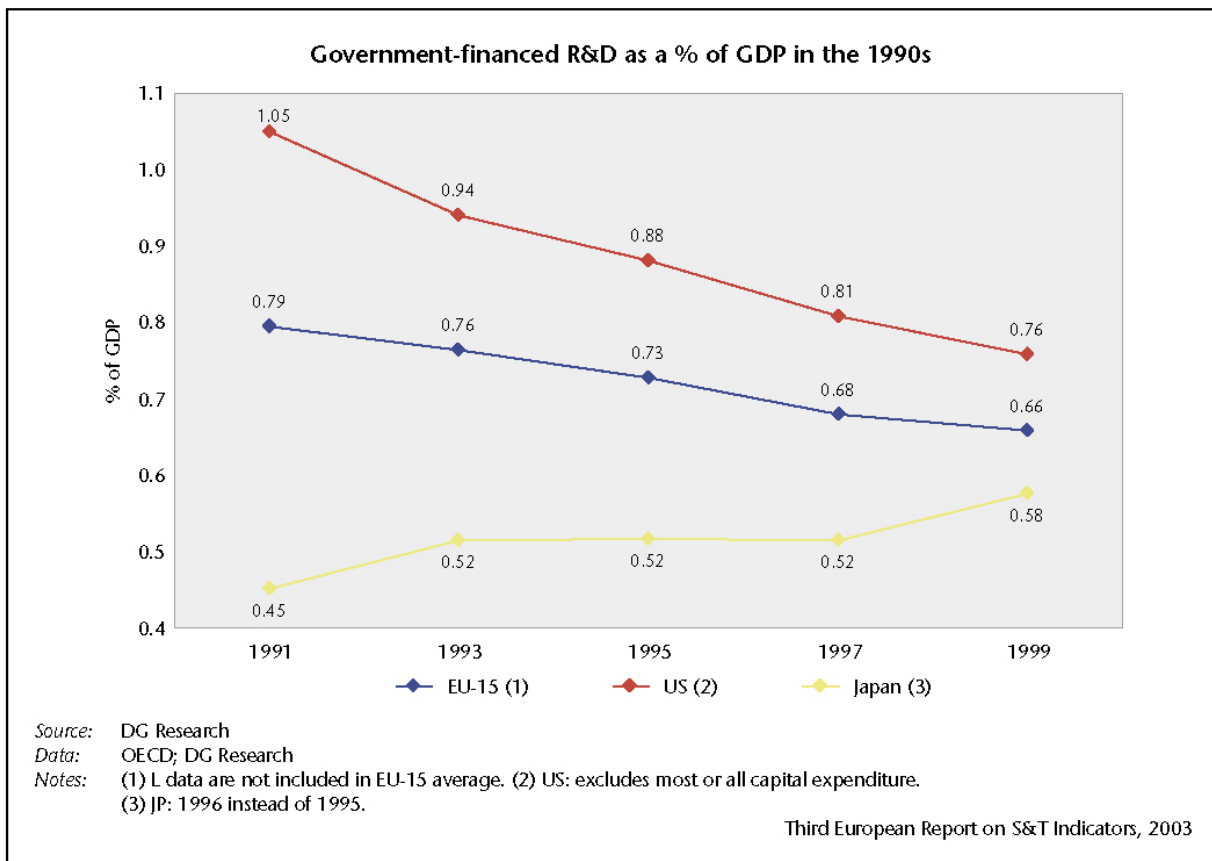
European expenditure on R&D as a percentage of GNP has hovered around the level of 1,9% since 1990. It is anticipated that without changes in policy this will fall somewhere between 1,8 and 2,2% in 2010 – considerably lower than the 3% target agreed at the political summit in Barcelona.

In the USA, expenditure on R&D is increasing – from a low of 2,4% in 1994 to almost 2,7% in 2000. In 2000 Japan had already reached almost 3,0%. For the USA, 3% is seen as a realistic future expenditure level.

Europe thus lags behind both the USA and Japan in terms of R&D intensity (expenditure as a proportion of GDP). And the gap is growing – in 1994 it was 0,5%, by 2000 it had reached 0,8%.

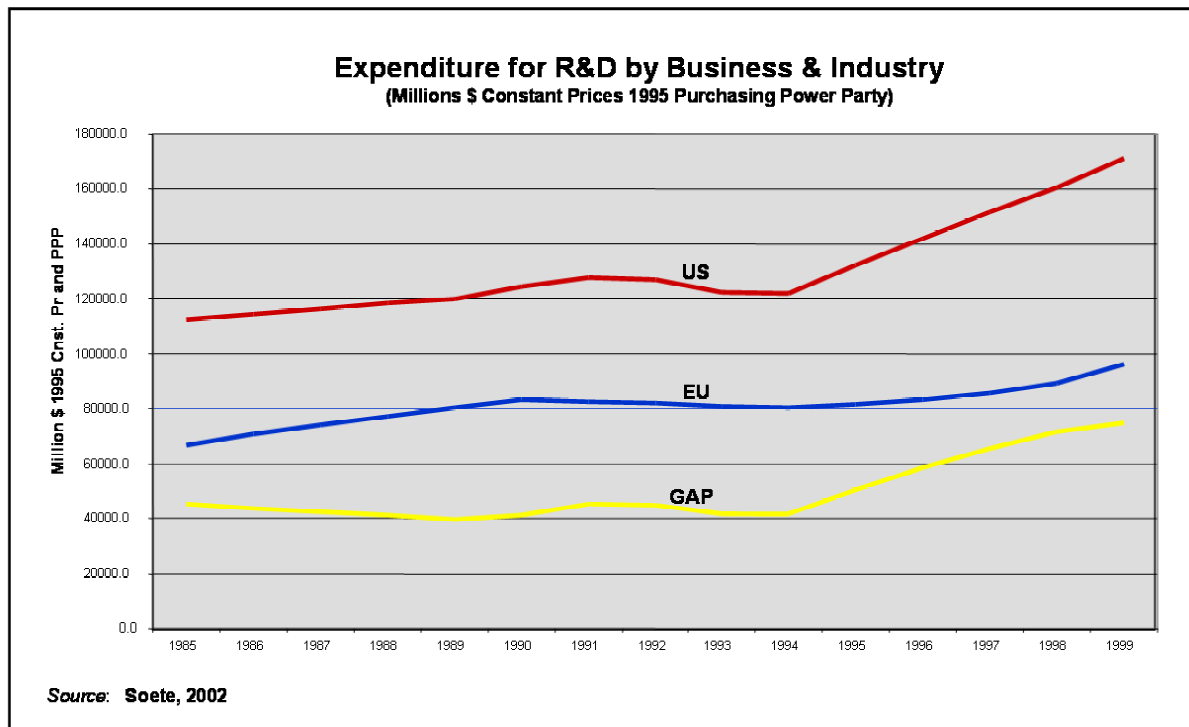
### The European ‘knowledge gap’

Let us look more closely at how this gap can be interpreted. Government R&D expenditure in the EU and USA is at a comparable level (in 1999 0,8% of GDP in the USA and 0,7% in the EU). However, in Europe (as in the USA) there is concern that government expenditure may decline – an alarming situation when seen against the Barcelona target.



R&D expenditure by business and industry companies in the USA appears to be considerably higher than in Europe, and is growing more rapidly. In the following figure Soete (2002) shows the extent of this largest part of the “knowledge gap” between the USA and the EU – a gap that appears to be increasing.





It could well be these differences in both private investment and the expenditure by business and industry in between the USA and Europe provide an explanation for the European paradox. In Europe investment in higher education and research is still seen primarily as a task for government, while in the USA individuals also invest in their higher education and business and industry invests more broadly in R&D. In the USA the focus on the relevance of the application of knowledge is evidently stronger than in Europe, which could also be the reason why in the USA more economic growth is generated from knowledge than in Europe.

This hypothesis is supported by statistics on the proportion of researchers in the labour force. In the USA in 1999 this was 8,7 FTE (full time equivalent) per 1000 employees, compared to 5,4 in the EU. In the USA there are thus relatively more 'knowledge workers' active in the economy than in Europe. Furthermore, these knowledge workers are predominantly employed by companies in the USA (almost 83%) whereas in Europe 50% are in positions in government or universities (European Commission, 2003a, p. 183). This is another indication that companies in the USA appear to be more orientated to knowledge than their counterparts in Europe.

The 'knowledge gap' between America and Europe can be traced back to differences in investment in higher education as well as in R&D. In the USA higher education is not only publicly financed but there are also significant private contributions. Investments in R&D in the USA are made not only by government but also to an important extent by business and

industry. In Europe higher education and scientific research are seen as activities to be financed from public sources. In Europe higher education and scientific research have traditionally been seen as the primary domain of the universities – which in Europe are almost exclusively (semi-) public institutions.

In Europe the generation of knowledge predominantly takes place in largely publicly funded universities, and these European “knowledge institutions” are exceptionally good at this. In the European universities knowledge generation is a goal in its own right. Knowledge as a resource directed towards economic productivity, however, is a concept still relatively novel in Europe. In the USA there is a more pragmatic approach to the social function of knowledge. Although much of the fundamental, cutting-edge, leading research in the world takes place at American research universities, focused attention is nevertheless paid to an intensive relationship between science and economic productivity. In particular, the number of patents and spin-off companies has grown rapidly since the American universities were given the opportunity to commercialise their own scientific output in 1980 (by the Bayh-Dole Act). An important outcome has been a substantial increase in job opportunities in the high-tech sector.

Now that we in Europe realise that the era of the knowledge economy has arrived, we need to ask whether adjustments are needed to the ways we organise our processes of knowledge generation and application. The knowledge economy creates challenges that can not be bypassed. This applies not only to political leadership at a European level but to European universities as well. Developments concerning the knowledge society, and European ambitions and achievements to date, must challenge universities to reassess their own outlook and their own functioning.

### **The Humboldtian ideology**

Knowledge plays a role in the knowledge society and knowledge economy in four ways. First and foremost is the creation of knowledge, primarily through scientific research. Secondly, the transmission of knowledge through higher education. Thirdly, the distribution of knowledge through knowledge transfer (and naturally through publications). Finally, the application of knowledge primarily through technological and other innovations. These four functions become increasingly interwoven in the knowledge society. Whereas in the past each could be performed by distinct processes and organisations, they now appear to be integrated in networks and co-operative linkages. Universities occupy a unique place in such co-operative

linkages. Although they no longer have a monopoly on knowledge production and transfer, they nevertheless play a crucial role in modern knowledge-intensive processes.

European universities are responsible for 80% of Europe's fundamental research and employ 34% of its knowledge workers. Universities (and other higher education institutions) train almost all of Europe's highly educated citizens. Universities are clearly important institutions in the knowledge society. However, the European ambition to become the leading knowledge economy confronts the European university with new challenges that reach to the very heart of the classical European academic culture.

The roots of the European university lie in classical antiquity. Plato founded the Athenian Academy in 387 BC with the goal to remove the 'veils of ignorance' from students and to bring them into contact with 'eternal knowledge'. Plato's Academy served as the model for the diverse variants of the European University. If we consider the continental monastery universities of the Middle Ages (such as those in Bologna and Salamanca) or the British academic guild communities (Oxford and Cambridge), the driving force was the disinterested search for true knowledge.

On the European continent the proposals of Wilhelm von Humboldt for the establishment of the University of Berlin (written around 1810) have had a far-reaching influence on the structure and functioning of the European universities over the past 200 years. Von Humboldt's lucid but succinct proposals grew over time into an academic ideology that has guided many European universities and the academics that work in them to this day. Since the publication of his proposals, an almost endless stream of essays about and references to his work have been published, and Von Humboldt crops up frequently in the current literature on universities.

Von Humboldt's - at the time radical - proposals were aimed particularly at constructing an institutional framework for modern science that would prevent the search for new knowledge being corrupted or even destroyed by others – themselves legitimate social forces such as politics, the economy or religion. The solution proposed by Von Humboldt was state guaranteed autonomy for the universities and academic freedom for those within them whose business was the search for true knowledge. In his famous words this search should be undertaken in 'solitude and freedom' (*'Einseimkeit und Freiheit'*) and universities and academics should enjoy the greatest possible autonomy (Nybom, 2003). When Von Humboldt's proposals for almost unlimited autonomy were embraced, the result was that German (and many other European) academics surrendered their political and other social ambitions so that they could dedicate themselves to science without disturbance. In the end this arrangement had exceptionally positive academic consequences but it strengthened the conviction amongst academics that beyond their academic work they had no further social obligations (Lepenies, 1992).

The Humboldtian ideology brought much academic success and great prestige to the European universities. At the end of the nineteenth century European universities enjoyed high social respect. The late nineteenth century German universities served as a model for the European university supremacy at that time and it was these universities that were the source of inspiration for the establishment of the American research university. The Humboldtian ideology, however, has also served as a facade behind which universities and academics have found it easy to hide. The ideology has become a more or less taken for granted, intrinsic dimension of European academic life. Many academics use this ideology to distance themselves from societal issues and the contribution that science might possibly make to social development.

### **The distortion of university characteristics**

The position adopted by European universities to pay only scant attention to societal issues contributed in the second half of the twentieth century to what can be described as 'the distortion of university characteristics'. These university characteristics are directly linked to the most essential feature of the university – that it is in the business of knowledge. In universities knowledge is created, stored, transferred and (even if sometimes reluctantly in Europe) applied. As a result of this essential feature, universities all over the world are characterised by a strong emphasis on the professional autonomy of academic experts, by extensive organisational fragmentation (where the constituent elements of the university are only 'loosely coupled' to each other - Weick, 1976) and by a wide distribution of decision making authority (Clark, 1983).

On the face of it there is nothing wrong with these characteristics of the university. The professional character of the university organisation, organisational fragmentation and wide distribution of authority are seen as an important explanation for the miraculous historical stability of the university (Van Vught, 1995). The fact that the form of the university as an institution has changed little since its mediaeval form may well be related to these fundamental organisational and governance features. These ensure a high level of redundancy that allows universities to adapt themselves to a wide variety of environmental conditions, including those that cause the failure of a constituent part(s) (Landau, 1969).

Nevertheless, the European university also faces the danger of its fundamental characteristics being distorted. The risk of such distortion occurs when these organisational

and governance principles permeate the university in extreme form. What are these principles, and what dangers do they entail?

First and foremost is the increasing specialisation of professional academic experts. Both the natural sciences and the human and social sciences have witnessed acceleration in the division of fields of knowledge, particularly since the second half of the nineteenth century. Universities have developed a large number of new scientific fields of study, with the result that what was originally a clear scientific territory has now come to resemble an academic labyrinth. In all fields new disciplines and sub-disciplines are created, and the university becomes a conglomerate of narrower and narrower sub-disciplines. The university of today is a university of specialists. This increasing specialisation implies that even within a speciality new sub-specialities develop and these are so narrowly separated from each other that for many scientists high level mutual discussion of their work is now impossible. Scientific hyper-specialisation, however, is also the key to scientific success. Through hyper-specialisation the modern scientist reaches the international publication fora which bring not only recognition and prestige but also tenure and an enhanced salary.

But these hyper-specialisations also have disadvantages. As indicated, scientific communication is seriously inhibited – even within the specialist group scientific discussion takes place less and less. Researchers are compelled by necessity to retreat inside the bastions of their specialist areas of knowledge, communicating only by e-mail with handfuls of colleagues elsewhere in the world. In the university this extensive permeation of hyper-specialisation seems to lead to a form of academic atomism. The division of scientific fields has resulted in the almost inevitable scientific isolation of individual specialists, and in an inability to communicate with others at a scientific level. Researchers find themselves more and more restricted to their own specialities to which are linked their desires for recognition and status. The interests of the university recede further into the background. The university threatens to become a coincidental location for a barely coherent and ostentatious collection of specialities. Collegiality as a binding force is slowly being siphoned out of our universities.

The second characteristic of the university, organisational fragmentation, can also take an extreme form. This fragmentation threatens to lead to a Balkanisation with extremely negative consequences when seen from an academic perspective. Many European universities and academics view the current American research universities as the paragon of the modern university. The world's best education and its leading research take place there, and more importantly, these are held in a mutually strengthening equilibrium. The American research universities are a product of the end of the nineteenth century and were a modification of the Humboldtian ideals of the German universities applied to the practical realities of earlier American colleges. The establishment of Johns Hopkins University in 1836 marked the birth of the modern research university (Geiger, 1986), and it was soon followed by sister

institutions such as Stanford and Chicago. The original American colleges (with their traditional English educational model) adjusted either rapidly (such as Harvard and Columbia) or followed dragging their feet (such as Yale and Princeton) (Kennedy, 1995). The research universities consolidated their position in the first decades of the twentieth century and soon developed into an attractive model for many universities across the world.

The model of the research university in combination with the Humboldtian ideology led the late twentieth century European university to embrace the principle of the organisational separation of scientific fields into distinct faculties, institutes, centres and schools. Every self-respecting group of specialist researchers drew from the research university model a right to be an independent organisational entity, with in consequence as little interaction as possible with the other units within the university. In the extreme case this leads to the various university entities behaving as small sovereign states with little interest in their outside world.

The former President of Harvard, Derek Bok, suggests that successful specialist groups have the tendency to slide into self-sufficiency and introversion, and to distance themselves from academic debate about the university as a whole (Bok, 1990, p. 111). Independent academic entities limit themselves to scientific communication with like-minded specialists outside their own institution and have no interest in discussion inside or outside the university. In addition, in our contemporary universities a non-interventionist mentality appears to be on the rise. Given the irreversible trend towards further specialisation and the dominance of the ideology of the Humboldtian principles of autonomy and academic freedom, researchers are reluctant to engage in serious assessment of each other's work. The danger of extreme organisational fragmentation within the university is that it becomes a random and ineffective federation of sovereign mini-states that are concerned only with their own interests – they are not interested in the welfare of their federal allies, nor of the institution as a whole, nor of the society of which they form part.

The third characteristic of universities is the wide distribution of decision-making authority. This characteristic also contains the risk that it will become a threat to the European university. In particular, in combination with the extreme organisational fragmentation and the development of a non-interventionist mentality discussed earlier, the wide distribution of authority can become an effective block to any change in the university. Universities have the reputation of being places that are difficult to change. The higher education literature is full of witnesses to the conservative character of academic institutions (Kerr, 1982; Van Vught, 1992). Behind extreme conservatism lurks a real and not to be underestimated danger: that of a widening gulf between university and society. Since the Second World War, European universities have grown rapidly to become mass institutions, but in the process they have lost prestige. Their proverbial conservatism and their somewhat haughty emphasis of their autonomy have led to a widening gulf between university and society. In many European

countries social and political support for universities has declined since the 1980s, and in some cases there is even a certain aversion to these previously very prestigious institutions.

### **Major new challenges**

The advent of the knowledge society has seen a resurgence in the political and social interest in universities in Europe in recent times. Various governments, and certainly the European Commission, realise that universities have an important role to play in the knowledge society. European universities, however, need to recognise that they are now in a different position compared to where they stood in the times of Von Humboldt. The knowledge society and knowledge economy demand more than an ideological affirmation that the generation of knowledge is a primary goal. They also demand a greater social involvement than has often been evidenced in the academic isolation and conservatism of the European universities over previous decades. The knowledge society does not benefit from universities that elevate themselves above their societies as ivory towers. It requires knowledge institutions able to give effect to the integration of knowledge functions (creation, transmission, distribution and application) in a broad social context. Knowledge in the knowledge society is not just a goal in its own right, but also a resource directed at productivity and economic growth.

Here lies the greatest challenge for European universities. They must have the courage to cast off the old Humboldtian ideology, or at least to complement it with a pragmatic, utilitarian vision of knowledge. They must ensure that the characteristics of the university are not transformed into distorted characteristics. In this regard the European universities have much to learn from their American cousins. In the same way that the American research universities were based on the model of the nineteenth century German university, so can the European universities of today learn valuable lessons from their American peers.

European universities are no longer the best in the world. They have had to surrender their supremacy of the nineteenth and early twentieth centuries to their American colleagues. This can be seen most clearly in the award of Nobel prizes: before the Second World War only 11% of the prizes were awarded outside Europe, since then 75% have gone to American universities (Davis Graham & Diamond, 1997, p. 10; Lindqvist, 2003).

European universities also appear to be less popular with foreign students than American universities. In 2000, European universities attracted some 450,000 foreign students, while American institutions enrolled 540,000 (primarily from Asia). American universities are also more successful in recruiting students to the natural sciences and technological disciplines

that are critical for the further development of the knowledge economy. Perhaps even more importantly, American universities are able to retain more of their foreign graduates and PhDs. Even in the case of European graduates of American universities, half stay in the USA for a number of years or even permanently (European Commission, 2003 c, p.7).

The American research universities clearly offer a more attractive working environment for top researchers as well as for foreign students. They obviously have considerably greater financial capacity than European universities – they have between two to five times the financial resources per student at their disposal than do European universities. Ultimately this is a result of the higher private contributions for higher education in America. In particular, American research universities are able to generate considerable income from private sources and donations (including from alumni organisations) alongside their public income (from their States and Federal research programmes). This private income mirrors the social formation of these American universities. From the beginning of the 1980s American universities 'embraced the notion of economic relevance, specially furthering economic development through technology transfer and closer involvement with the productive economy' (Geiger, 1999, p. 65). Apart from the generation of knowledge, many American research universities have incorporated the goal of distributing and applying knowledge. Knowledge transfer is an essential part of their mission, as is evident in, for example, the research parks associated with Stanford, the Harvard-MIT axis and the North Carolina Research Triangle. 'In the knowledge-based economy of the future, the American research universities are proven engines for knowledge creation' (Davis Graham & Diamond, 1997, p. 221).

European universities must intensify their relations with business and industry if they are to play a meaningful role in the knowledge society. Universities in Europe must orientate themselves more than in the past to the distribution and application of knowledge. They must concentrate on operating in networks and, in co-operation with companies and other organisations, on the registration of patents and the starting of new businesses. They must expand links with commerce and industry, strengthen their regional role, and make their services and facilities available to third parties. In short, European universities must meet the challenge of transforming their traditional – Humboldtian – academic culture to a culture of external orientation and co-operation directed at economic productivity.

In addition, also European governments as well as the European Commission face some major challenges. In order to be able to reach the high ambition of the European political summit of Lisbon 2000, the following policy-initiatives need to be taken.

First, the 'European higher education area' and 'the European research area' will have to be further developed. Compared to the US system of higher education, the European system still



hardly exists. The European higher education system is a multi-national system with little in the way of common organisational forms or professional standards. Compared to the US higher education system, there is no higher education market and student and staff mobility is very limited. In order to create a European higher education area, the so-called 'Bologna-process' (which aims to bring about a European higher education space without borders) will have to be intensified.

The creation of a European research area should be developed further in order to bring an end to the tendencies of national protectionism in European research. The scale of a pan-European research market will be necessary to address the problems of the lack of sufficient funding for R&D in Europe. Moreover, critical mass, mobility of researchers, integrated research networks and especially one or more European research councils will all be needed to face global competition in knowledge creation (see for further details the paper by L. Weber in this book).

A special problem Europe needs to solve with respect to its research capacity is the lack of young researchers. The European Commission has calculated that if Europe wishes to have as many researchers at its disposal as the USA by 2010 there will need to be 850,000 extra researchers in that year, or approximately 80,000 per year – this implies a 6% annual growth rate compared to 2,6% at present (European Commission, 2003a, p. 189). The lion's share of new researchers needs to be in the natural and technological sciences. To be able to increase the number of young researchers, European universities will have to attract far more foreign graduate students than they are doing so far. European immigration incentives for young academic talent are an obvious instrument in this context.

Secondly, the higher education and research systems of Europe will have to be functionally diversified. Compared to the US university system, the European system lacks a base for the classification of institutions. The implicit assumption in European higher education appears to be that all universities are alike. A 'pseudo uniformity' of institutional functions appears to exist, based on the Humboldtian ideology that all institutions and all academics should have the opportunity to be equally involved in academic activities. However, only about 100 of the 3000 higher education institutions in the USA are judged to be real research universities. Why should this be different for the 3300 higher education institutions of the European Union, or the nearly 4000 of greater Europe? We need the courage in Europe to identify our best research universities and to develop and implement research stimulation policies that strive for top quality.

Finally, in order to face the challenges of Europe's ambition with respect to the knowledge economy, both the private sector (especially business and industry) and universities should be stimulated to increase their mutual co-operation. The private sector should be stimulated

to increase its financial support for R&D, especially by co-funding university research programmes. Universities should be stimulated to address their research efforts to the needs of the knowledge economy and the knowledge society. If Europe wants to close the knowledge gap it needs strong bridges between society and its universities.

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