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European Universities:

Enhancing Europe's Research Base

Report by the Forum on
University-based Research



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Report by the Forum on University-based Research

May 2005

Directorate-General for Research
Science and Society

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European universities: Enhancing Europe's Research Base

In the year 2000, in Lisbon, the European Union committed itself to achieve a very ambitious target by 2010: to become a knowledge-based society and be the most competitive economy in the world.

Research is a key factor in achieving this objective. It is a major driving force for economic growth, competitiveness and employment. But, if Europe wants to remain competitive at an international level, more investment in both the public and private sectors is required to generate scientific and technological progress that can be compared to the levels of performance in the USA, Japan, Canada or South Korea to name a few.

Europe, more than other parts of the world, depends on the brains and the creativity of its people to guarantee its future prosperity and its model of society. It is that creativity, coupled with an entrepreneurial spirit within an innovation-friendly framework, which will produce new products, new services and new jobs in a highly competitive global economy.

The building of "Europe of knowledge" is a goal that Europeans, and particularly younger generations, can identify with and adhere to.

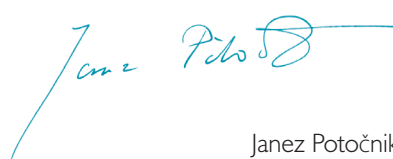
Today, knowledge is and should be at the very core of economy and society. To become the most competitive economy in the world, the European Union must capitalise on the creativity of its people by strengthening the three sides of the "knowledge triangle": research, education and innovation.

In this context, universities are obvious key players. Firstly because they create knowledge: universities represent 20% of European research, the majority of fundamental research (80%) and employ one third of European researchers. Secondly because they transmit knowledge by educating and training researchers. Thirdly because universities have an increasing role in innovation and are becoming an essential factor in enhancing regional development.

However, despite recognition of their vital role, analysis shows that most European universities are not well equipped to face the new challenges of global competition. Major structural reforms are needed and measures should be taken by universities themselves. Equally, one of the main conditions for success is strong support by the European Union and more importantly, by national governments and regional authorities.

This report gives some timely concrete recommendations on measures that could improve the current working environment of European universities. Produced by a core group of 15 high level experts it is focused on university-based research.

I am sure that the European Commission, the Member States and the regional authorities will reflect on the points made by this report and will find elements that will help them to better define their policies.



Janez Potočnik



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Executive Summary and Recommendations for Action



Executive Summary

The European Union aims to be the most competitive and dynamic knowledge-based society and economy in the world. Universities are key actors in constructing this knowledge-based society and economy. There is a requirement for Europe's Universities to become more competitive in their research, and to improve their interactions with the local society and industry. The proposals given in this report are a means to achieving these goals.

This report by the Forum on University-based Research established by the former European Commissioner for Research should help define policy frameworks that will support universities in their efforts to remain relevant in the face of changing challenges of the future, and thereby contribute to building a European Research Area (ERA) that achieves the Lisbon and Barcelona objectives. Its starting point is University-based research. However, the Forum recognises that research, training, teaching and other activities are strongly inter-related, and are complementary, equally-important missions for Universities.

Competence for actions regarding Universities lies primarily with authorities at the national and regional levels and with the universities themselves. The EU can play an important catalytic role in fostering the debate at European level and promoting the exchange of good practice amongst the key stakeholders.

The Forum has considered many issues facing the university system. These are primarily about changing roles in the face of changing requirements. In responding, autonomy is a good orientating principle because there is no single model for the European University, just as there is no model for the American University. The Forum believes that Universities should be given more freedom to respond to the changes that are occurring, based on a desire to maintain and reinforce strength. Governments should enable Universities to accept these responsibilities while setting and checking the implementation of tough strategic goals.

The following section summarizes recommendations for concrete actions. These recommendations stem from the analysis made in the report. The Forum urges their implementation at EU, national/regional or university level, including actions to be integrated in the next Research Framework Programme, in order to create the conditions that will strengthen research-active universities and support their efforts to enhance their performance.

Knowledge Creation and Production in Universities

Why this is particularly relevant

The manner in which new knowledge is created and brought into use is changing. There is now far closer and tighter interaction between players. Universities have a fundamental role to play in knowledge production, but must adapt to this new environment.

What the benefits are to be gained from these actions

A more pro-active role for universities within European society, in turn strengthening research-active universities.

What potential barriers and problems exist

Traditional attitudes within universities and in society as a whole.

Recommendations for Action

- Give universities the autonomy and financial instruments to enable them to build research capacities that will be globally competitive. The European Research Council offers a powerful signal to this effect.
- Provide incentives and mechanisms for universities to recognize non-traditional academic knowledge creation, and to promote flexibility and interaction amongst the different actors of knowledge creation.
- Reinforce Life-long learning programmes, so that Universities provide continuing education not only to individuals but also to companies.
- Encourage Member States and Universities to implement the principles of the European Charter for Researchers and the Code of Conduct for the recruitment of Researchers.
- Obtain proper insight into the career paths and future educational requirements of the human capital that is trained by the universities, for example by progressing this as an initiative within the OECD.

Universities' Role in the Exchange and Transfer of Knowledge with Industry and Society

Why this is particularly relevant

A key challenge for Europe is to become better at implementing knowledge – the fruit of research – within Industry and Society at large.

What the benefits are to be gained from these actions

Exploitation of knowledge through innovation is key to sustainable economic growth and improved welfare and living conditions.

What potential barriers and problems exist

Restrictive social security and health and safety regulations. Lack of understanding of how far the “third mission” should be addressed. The need to learn good ways to handle commercial issues such as confidentiality.

Recommendations for Action

- Reinforce programmes that encourage the mobility of trained people between Universities, Industry (in particular SMEs) and surrounding society.
- Build up concrete synergies between universities and surrounding society (companies, chambers of commerce, public authorities, etc.).
- Support Universities in having access to the professional skills and resources needed to manage the transfer and valorisation of their research activities, keeping in mind that there is by now considerable experience and established “good practice” but that not all Universities have a strong enough research base to justify dedicated staff to this area.
- Enhance access to critical, credible knowledge, reference and teaching material from Universities through the use of the web.
- Promote the creation and the advancement of Science Shops at Universities.
- Improve the existing legislative framework, notably through the pursuit of the Community Patent.

Trans-disciplinarity as an Emerging Principle

Why this is particularly relevant

New ways are needed to address the asymmetry between relevant scientific and societal problems and the disciplinary structures underpinning the University.

What the benefits are to be gained from these actions

Integration of the trans-disciplinary principle in the research culture and institutional organization of research-active universities will allow them to more fruitfully attempt to solve scientific problems and those faced by society.

What potential barriers and problems exist

Funding and evaluation procedures and internal structures that encourage single disciplinary approaches.

Recommendations for Action

- Encourage the creation of doctoral or postgraduate schools or centres organised along the trans-disciplinary principle.
- Strengthen trans-disciplinarity through the promotion of networking within and between universities, as well as greater exchange of students between disciplines (including support for trans-disciplinary coverage of European Credit Transfer System, and recognition of trans-disciplinary degrees).
- Reinforce trans-disciplinary research in all FP instruments, including in the ERC, and the trans-disciplinary dimension of FP evaluation procedures (through expertise of individual experts, the names of committees and their composition).
- Promote the trans-disciplinary culture (through summer training courses or support to conferences similar to the USA's Gordon Research Conferences), and promote debate at national level on the need to remove barriers to trans-disciplinary research and teaching, including the identification of good-practices in this area
- Develop national and European funding and evaluation mechanisms and structures that encourage transdisciplinarity.

Governance and the role of Universities as institutions

Why this is particularly relevant

In order to address all the points identified above, it is also necessary to address governance in Universities

What the benefits are to be gained from these actions

Increased internal and external accountability of Universities, and greater ability to raise the funds necessary to carry out leading edge research and make their leadership and management more efficient.

What potential barriers and problems exist

Legislation that is detrimental to good governance and existing levels of institutional rigidity and vested interests at all levels.

Recommendations for Action

- Define guidelines and enable universities to conduct self-assessment, understand their costs, and build up their mission and strategy.
- Enable universities to obtain the resources, including raising funds from new sources, that are required to take an integrated and well-managed approach to address this mission.
- Encourage Universities to take a leading role in regional and local development and use structural funds as incentives to this effect.
- Recognise universities as institutions in the EU Research Framework programme (FP7) and more than just a set of faculties and departments or even a set of researchers. Support the establishment of mechanisms in the next Research Framework Programme that should enable universities to improve their governance, by:
 - providing training on core governance competences
 - promoting accountability and Quality Assurance in Universities
 - facilitating the debate on full cost of research accounting and the adoption of accounting methods allowing identification of the full cost of research
 - encouraging networking and exchange of good-practice among different stakeholders
 - fostering the debate on governance, management and leadership, taking into account the different national contexts.
- Reinforce research on the socio-economic dimension of the knowledge and its implications, in particular on its actors as well as data collection on research-active Universities, including mapping of their activities.
- Encourage Member States to remove barriers to and promote leadership and management changes in Universities (less regulation regarding inner organization of universities; give universities autonomy in organisation and management decisions along principles of management by objectives and accountability; trust in the development of universities and their capacity to develop new leadership).



Introduction - Background

Introduction

The European Union wishes to be the most competitive and dynamic knowledge-based society and economy in the world^{1,2}. Although Universities³ are among the key actors in constructing this knowledge-based society and economy, the challenges that will be faced in the transition to a more knowledge based society require that Europe's Universities become more competitive in their research, and improve their interactions with the local society and industry.

Through the research they perform, Universities extend the horizons of knowledge; through their teaching, they disseminate knowledge and improve the stock of human capital; and by their other activities, they transfer knowledge to the rest of Society, work with established industry and create new companies, so setting the stage for using this human capital and knowledge to generate greater wealth and well-being. The contribution of universities to society goes beyond economic and technical advancement. They maintain a culture that fosters democracy and create an environment for well-rounded graduates. They also safeguard European cultural diversity. All these aspects of the university mission are fundamental in our efforts to achieve the Lisbon goals, and to maintain and strengthen the role of Universities in European Society.

This report describes some proposals for addressing the elements of Universities' role which are new. The lack of detail on aspects such as training, funding, and research per se does not mean that these issues are unimportant; simply that this report must focus on what the Forum sees as the key issues to be addressed in relation to the challenges now confronting Universities.

The new challenges faced include:

- The research landscape has become increasingly competitive at a global scale. Research that is carried out in European universities competes with, but also complements, work done in the USA and Japan and increasingly in other Asian countries such as China and India. How should these European institutes balance co-operation against competition? How shall they train and attract the best researchers and how many shall they seek to keep?
- The balance between education and research is changing. Where shall universities strike the balance? How shall they obtain sufficient funding to achieve this balance in the face of pressures to limit public expenditures? What is the right position to adopt with respect to the current debate on the promotion of elite universities? Can public and private universities be complementary or are they always in competition? Is greater university autonomy required and how can it best serve the enhancement of their capacities?
- There is also growing demand for universities to develop closer links with industry and other partners, including regional authorities, and to manage their research to ensure the exploitation and commercialisation. What is required for them to more successfully develop co-operations with these other partners? What is the right balance between meeting today's demands and ensuring a knowledge base that will support tomorrow's?
- Activities also become more interdisciplinary. How shall universities develop the necessary team-based and transdisciplinary approaches? What strategic choices shall they make to remain or become excellent? How shall university governance be used to support researchers and create more attractive workplaces.

¹ *Presidency Conclusions of the Lisbon European Council, 23 and 24 March 2000*

² *"More Research for Europe – Towards 3% of GDP", COM(2002)499 final, of 11.09.2002.*

³ *In this document the term "Universities" is taken to mean all higher education institutions, irrespective of their name and status in the Member States. Also, the term "Universities" is employed in order to be consistent with the language used in the Conference on "The Europe of Knowledge 2020: a vision for university-based research and innovation", organised by the European Commission in Liège in 2004.*

The debate on these issues was launched with the Commission's Communication on "*The role of universities in the Europe of knowledge*"⁴, the consultation of the stakeholders involved and the Conference on "*The Europe of Knowledge 2020: a vision for university-based research and innovation*"⁵ organised in Liège in April 2004.

The Liège Conference and the contributions of main stakeholders have highlighted the key issues and the need for action at all levels (European, national, regional, academic, business, etc.) to address these issues.

More recently, the important role to be played by universities in the creation, transfer and dissemination of knowledge throughout the Union and the crucial need to reinforce further this role has been recognised explicitly in the Commission Communication on the Lisbon mid-term review⁶.

Another important step undertaken at intergovernmental level and that deserves to be mentioned is the Bologna process and the reinforcement of the interdependence between the European Research Area (ERA) and the European Higher Education Area (EHEA).

It is very clear that competence for implementing any actions regarding universities lies primarily within the universities themselves and with authorities at the national/regional level. Nevertheless, the EU can play an important catalytic role in fostering the debate at European level and promoting the exchange of good practice amongst the key stakeholders.

Objective of the report

Former Commissioner Busquin established the Forum on University-based Research as a follow-up to the Liège Conference. The Forum's mandate is to help the Commission define an EU policy framework that supports universities in their efforts to face the challenges of the future and contribute to build the European Research Area (ERA) and achieve the Lisbon and Barcelona objectives.

The main aim of such a policy framework would be to facilitate reform as Universities adapt to their new context of increased competition and globalization and search for the right balance between education, research and knowledge transfer.

The objective of this report is to provide proposals for concrete actions that can be implemented at EU, national/regional or university level, and for actions that can be integrated in the next Framework Programme⁷.

Role of Universities in a knowledge-based society and economy

Universities have crucial roles to play in building a knowledge-based society and establishing a truly European Research Area. In both a historic and future sense, Universities are:

- At the centre of the research and teaching systems;
- The training institutions for our future researchers;
- A point where frontier knowledge meets practical applications;
- The school and library of the knowledge society.

⁴ "*The role of universities in the Europe of knowledge*", COM(2003)58 final, of 05.02.2003.

⁵ http://europa.eu.int/comm/research/conferences/2004/univ/index_en.html

⁶ "*Working together for growth and jobs – A new start for the Lisbon strategy*", COM(2005)24 final, of 02.02.2005.

⁷ "*Proposal for a decision of the European Parliament and of the Council concerning the seventh framework programme of the European Community for research, technological development and demonstration activities (2007 to 2013)*" COM(2005) 119 final of 06.04.2005.

There are important strengths within the existing, diverse European system:

- European Universities generally command great respect and are widely viewed as “castles” of knowledge creation, laboratories of democracy and critical thinking.
- Attending University is considered to be a “rite of passage” for a growing proportion of young people, a necessary part of their socialization and integral to the development of their personalities and capacity for critical thought. Especially in a campus environment, in addition to completing their own study programme, students are exposed to different scientific areas, views, lifestyles and modes of thinking and learning. It is worth recalling that these modes of thinking and learning are fundamentally different from the modes that are used in primary and secondary education and when being trained in later life, e.g., to upgrade or acquire new skills.
- Most research in the humanities and social sciences and a substantial part of research in the natural sciences is still conducted in the universities.
- With a general trend away from large corporate R&D facilities, many European universities have developed effective links with industry that support the generation, transfer and application of new knowledge within the marketplace.
- Diversity of nations and cultures provides its quality universities with a wealth of intellectual resources in which to tap into.

The Forum recognises the need to maintain these strengths while also improving a number of aspects.

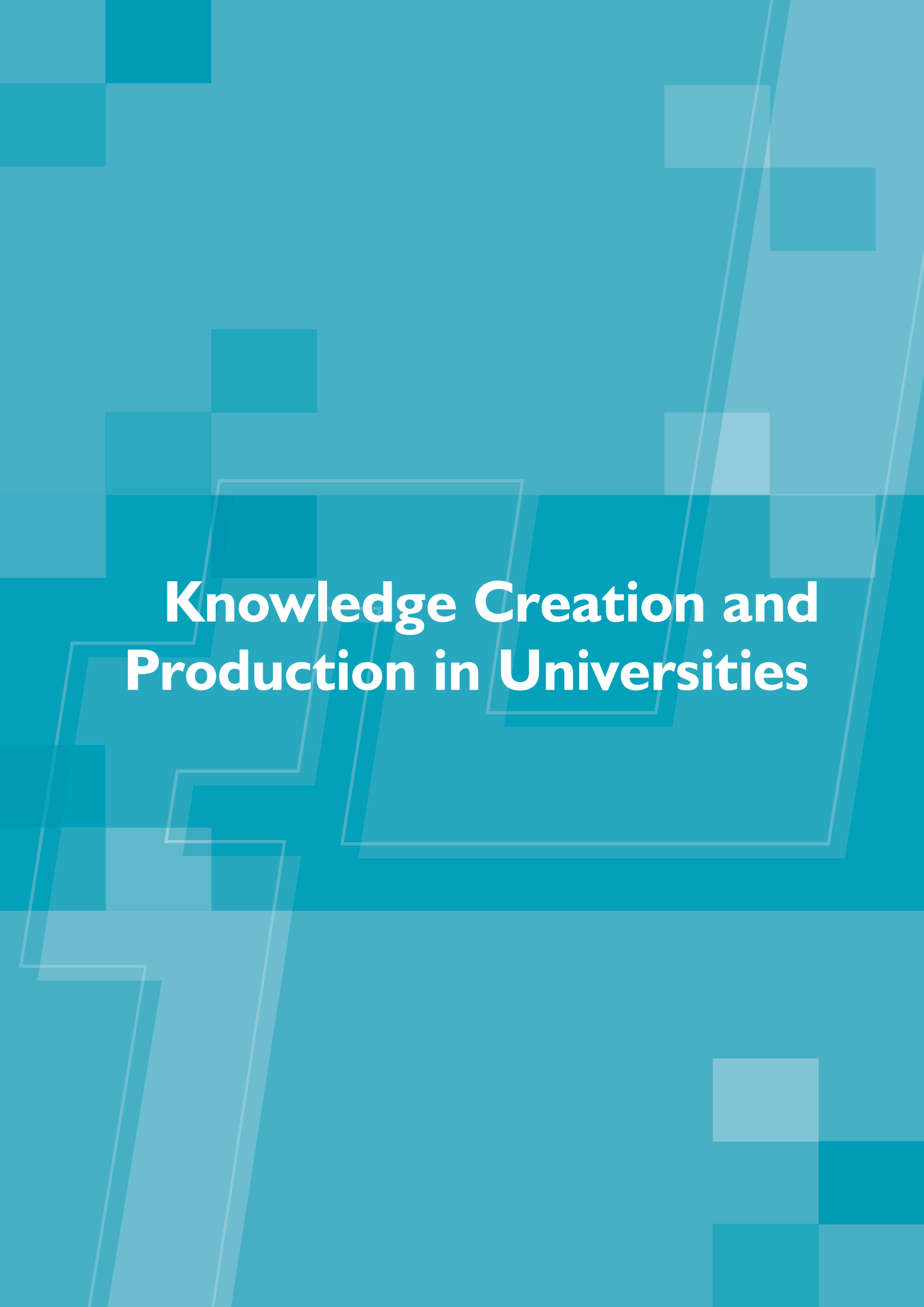
An alternative way to view the challenge is to recognize that there is an unprecedented rise in the demand for higher education, which cuts across regions and age groups. Lifelong learning is a worldwide demand of the labour force, and is fast becoming a growing global industry. All of these trends exert strong pressures on university resources, teaching models, etc.

It is clearly important to find solutions which address different ideological concerns and criticism, because these reflect the real difficulty of finding solutions to changing needs in the face of established requirements for accountability.

So Universities in Europe find themselves at a “critical juncture”. If social and economic forces are indeed to be mobilized in Europe to create the most competitive economy and knowledge-based society of the 21st century, European Universities have to play a central role. What are the necessary actions to strengthen European Universities in this effort?

For universities to contribute actively to this major European project, ways must be found to enable them to address the identified weaknesses without detriment to their key societal roles. These Universities can only take the necessary steps towards reform if they receive proper support at all levels.

This report provides some concrete proposals for action to create the conditions that will strengthen universities and support their efforts to improve their performance in the following areas: knowledge creation and production in universities, universities’ role in the exchange and transfer of knowledge with industry and society, trans-disciplinarity as an emerging principle and governance and the role of universities as institutions.



Knowledge Creation and Production in Universities

Introduction

European Universities have for centuries held a primordial role in producing knowledge. Today, the manner in which new knowledge is created and brought into use is changing. There is far closer and tighter interaction between actors including firms, public laboratories, think-tanks, foundations, consortia, and associations in the knowledge creation process. Universities need now to reflect on their interactions with these other actors and examine how to adapt to this new environment.

Forms of knowledge creation and production

Universities are engaged in different forms of knowledge production⁸:

1. Codified knowledge:

Codified knowledge is mainly composed of articles and publications produced by academics. The quality and importance of this production is determined by the scientific community through peer review.

2. Embodied knowledge

Embodied knowledge is the knowledge that each person has acquired and carries along his/her carrier. The importance of human capital embodied in society's human resources is ever more crucial in modern knowledge economies. Training enables knowledge and skills to be embodied in trainees or students, which is then available for application in the labour market. Universities play a very important role in this context.

3. Collective goods

Through their research, universities play a fundamental role in producing knowledge that constitutes a public good, available to the whole society. Universities also produce collective goods through non-research activities that expand knowledge, including cultural production. This knowledge supports public policy, including regional development, and promotes well being of Society at large.

4. Innovation

Knowledge production is an important component of the innovation process and Universities contribute actively to this innovation process. Indeed, there is a large range of relationships between universities and innovators.

⁸ This has been analysed in two reports prepared for the European Commission; "Measures to improve Higher Education/Research Relations in order to strengthen the strategic basis of the ERA", Report of a High Level Expert Group set up by the European Commission, November 2003 ftp://ftp.cordis.lu/pub/foresight/docs/foresight_hleg_v03_220104_en.pdf; "Higher Education and research for the ERA: Current trends and challenges for the near future", report by STRATA-ETAN expert group on foresight for the development of Higher Education/Research relations, October 2002 ftp://ftp.cordis.lu/pub/foresight/docs/hleg_final25102002_en.pdf.

The role of Universities on creation of knowledge

Universities, as a whole or parts of them, engage in a mixture of four modes of knowledge creation:

1) First is the *classic model of the University* as a place for long-term independent research without any immediate expectation of application. Here success is measured by the international scientific community. A firm base in long-term independent research ensures that universities will continue to be able to service the knowledge needs of future societies. A goal for policy makers is to ensure that fundamental problems can be tackled. One priority is to ensure that the “brightest and best” (at least) have access to the working conditions they require to make progress. This generally involves concentrating talent where peer pressure forces and encourages delivery. A difficulty is in identifying the best and brightest or, put in another way, in determining how widely to grant and resource this freedom in the face of pressure to become more immediately relevant.

The current strength of research in European universities has been called into question in two recent surveys, which – despite some cultural and methodological biases – came to conclusion that European universities are not performing strongly in global comparisons⁹.

2) Second is the model of *University departments or research groups as depositories of knowledge and know-how*. New knowledge can be created by applying existing knowledge and know-how to new circumstances. This is particularly implemented at the interaction between universities and industry. One policy challenge is making the University skills set – embedded in staff, technicians, research students, equipment, etc. – available to those in the local economy that would benefit from it. In this aspect, Universities play an important role as providers of continuing education to companies and individuals.

Example

The INFN's (Italian National Institute of Nuclear Physics) system, where institutes, embedded in Universities, provide ongoing upgrades to the technical knowledge and capabilities of local industrial staff.

A national Co-ordination Unit for Technology Transfer (CNTF), composed of representative members of INFN 19 Units, 8 linked groups (located within the most important Italian Universities) and 4 National Laboratories, has been founded in order to establish relations with local infrastructures. CNTF's task is to determine the companies' demand on staff training (training periods within the INFN Units) and the supply of technologies developed by the INFN to be transferred to industry. This potential supply is discussed with companies to estimate its real technological content and represents, more generally, a source of scientific and technological information.

The Technology Transfer mainly consists of: transfer of technologies, developed within scientific programmes, addressed to Italian and European enterprises; and training and re-qualification of SME staff by means of courses carried out within INFN Units. These goals can be achieved by closely collaborating with industrial confederations, in order to gear INFN's supply to the companies' demand.

⁹ Surveys by Shanghai Jiao Tong University, “Academic ranking of world universities – 2004”, (<http://ed.sjtu.edu.cn/ranking.htm>), February 2004, and by the Times Higher Education Supplement “The world's top 200 universities”, 5 November 2004.

3) Third is the *entrepreneurial role of Universities* as sources of spin-offs and start-up companies. These can be based on new knowledge or even just new applications of old knowledge, with universities maintaining a dynamic exchange of knowledge with the new companies. Addressing this role well is tremendously difficult, and is not solved merely by encouraging Universities to take out patents.

Example

Isis Innovation Ltd. is Oxford University's Technology Transfer Company. By investing at the interface between research and industry, Oxford has developed a successful model generating both economic and social benefit. Its approach works by combining world class research with strong IP policy; having a commercially-aware University Council, senior officers and academics, willing to make ongoing investments in research services; and by establishing systems that are integrated within the University and embedded into the local community. The University claims ownership of all rights resulting from University research activities and assists those researchers who wish to commercialise their research. Researchers share the benefits through royalty shares from licences, equity in spinout companies and income from personal consultancy. A central feature of Isis Innovation Ltd. is the professional skills of its employees, who understand that a great University is defined by great researchers, thinkers and teachers, and who know how to operate technology transfer in ways that will assist their success.

4) Finally, *Universities* and their staff play a role in *strategic mission driven projects*. Historically this is exemplified by the Second World War-driven initiatives such as the development of Radar in the UK and USA or the Manhattan Project, where manpower and technical resources of Universities and Industry were thrown at important problems.

A comparable variant is the *drive* of large companies such as Rolls Royce and GSK to ensure the vitality and strength of the University system by interacting systematically with them with a business driven agenda.

Example

Rolls Royce's position as a leading manufacturer of aeroengines and turbines depends on managing a wide range of research needs. These can only be satisfied through collaboration. Scientific and technical partnerships are needed to address a spectrum of fundamental and more applied scientific challenges. The company recognised that it should develop a strategic "Centres of Excellence" approach to concentrate its partnerships within fewer leading university groups and achieve greater critical mass.

Its approach supports skilled personnel in the selected institutions; ensures mutual understanding of business environments and also provides real problems for academic study by staff who have sufficient time to think about these problems. The interaction also facilitates training and recruitment. 5 year rolling contracts cover business and technical goals and this funding security enables the university to recruit high quality staff. IPR agreements meet the needs of both the company and the university, and close working enables effective technology transfer.

One of the key conclusions from this experience is that success is being achieved through long-term mutual commitment, which in turn depends on there being sufficient public as well as private sector funds.

Impact of the evolution of knowledge creation on University-Industry relations

Concerning *relations with industry*, a major shift resulting from these changes in knowledge creation would be widespread recognition and acceptance that Universities and Industry can co-operate successfully and of how this can be achieved while allowing these parties to address their different roles in society. In order for this to happen, the rules for such engagement must be clear, including but also going beyond being intellectually challenging and financially rewarding. This will be more deeply addressed in the next chapter.

It should be noted that there are now also firms producing intellectual property with manufacturing applications, whose activity is not manufacturing, but simply marketing of internally generated intellectual property rights. Such firms conduct research, file for patents and then sell license agreements or patents either to sister companies or on the open market. This type of highly specialized firm is often far in advance of other players in the industry and even universities, spearheading new developments, and for this reason plays a very important part in economic development.

This new type of knowledge-producer depends upon interchange with universities to recruit personnel, and this is usually the level at which contacts are created and developed.

One of the most important contacts that universities have with society is through the people that they train. In order to strengthen Universities, we need better information than is currently available concerning the fate of the people that universities train, in order that these universities can adapt their activities accordingly. Europe is generally weak in this area. In contrast with North America, only a few universities track the careers of their former students, and it is not clear that Universities are the correct actors to handle the task in any event.

Addressing all of the above issues will require strong management and decision making by European universities. Crucial to success will be the efficient use of finance. The globally competitive environment for students, staff, research funds and industrial engagement will require an effective governance and financial structure to enable European universities to compete. Such competition will require both agility and the ability to strategically grow long term alliances.



The background is a solid teal color with a pattern of semi-transparent, overlapping geometric shapes. These shapes include squares and rectangles of various sizes and orientations, some of which are slightly offset from each other, creating a layered, architectural effect. A large, semi-transparent white rectangular box is centered on the page, containing the main text.

**Universities' Role in the
Exchange and Transfer of
Knowledge with Industry
and Society**

Introduction

Knowledge and its exploitation through innovation are the key to economic growth and improving welfare and living conditions in a sustainable way for present and future generations¹⁰, thus enhancing the future of the "European way of life" and European values.

It is well recognized that European universities have three interconnected and indissociable missions in a Knowledge-based society: Teaching, Research and the Transfer and Exchange of Knowledge with other parts of Society. Furthermore innovation can no longer be usefully described in terms of a linear model involving separated roles for Universities and the rest of Society. A key challenge for Europe is to become better at using knowledge - the fruit of research- from the researcher to Industry and Society in general; in the words of Professor Soete¹¹, in activating knowledge.

The transition towards more knowledge-intensive economies changes the skills required to enjoy productive lives and also changes the ways in which knowledge comes into general use. These changes impact all aspects of the University's mission: education (for example, in supporting life-long learning and the acquisition of trans-disciplinary skills), research (balancing specialisation and leadership against flexibility and richness of culture), and valorisation of knowledge. The European research community has to look for ways to link the worlds of "Open Science" and "Open Innovation," that are sustainable and do not damage the long-term purpose of universities.

There are many types of barrier that hinder the valorisation of knowledge. Universities, industry and government share the responsibility for removing these barriers. Many of the required actions have already been identified, but there is continued reluctance to recognise the urgency of general reform. Such reforms will place emphasis on enabling new ways of disseminating knowledge to emerge, which will reinforce recognition of the importance of healthy and well-funded university systems.

A fundamental early part of the task for universities is to establish the strategic part that knowledge creation and transfer play within the institution's mission. Otherwise, there will always be a tendency for an institute to graft (e.g.) technology transfer departments, collaborative R&D projects with industry, and lifelong learning resources onto existing activities without identifying how these activities must work together. This requires adequate skills and resources, but also effective organisational forms and career progression schemes in order to achieve a coherent whole.

It is extremely important that universities are not encouraged to take on tasks that they are not resourced to handle. Value to society is created by combining knowledge from different players, and it is the tacit components and interfaces that are generally the most important. From a Societal perspective, more will be gained by letting our universities excel in knowledge creation while encouraging closer links with the rest of Society, than by forcing the belief that they should fund themselves through commercializing their knowledge.

This will require that universities can obtain the resources, including raising funds from new sources, that are required to take an integrated and well-managed approach to their chosen mission in respect of knowledge exchange and transfer.

¹⁰ *Communication to the Spring Council – Working together for growth and jobs – A new start for the Lisbon strategy – 02.02.2005 – COM(2005)24*

¹¹ *Investing in Research and Innovation, Realising the Potential of Public-Private Interaction, Dutch Presidency conference, 12-13 October 2004, Noordwijk, Dutch Ministry of Economic Affairs.*

Exchange of knowledge with industry and within society is not the responsibility of the universities alone. Companies, national, regional and local authorities, business promotion agencies, private and public joint venture investors and other stakeholders must be active in creating the infrastructure and surrounding environment (science parks, technology centres) to enhance this transfer.

If steps are not taken to enhance universities' role in transferring knowledge to the rest of society, there is risk that continued lack of urgency, disillusion with the value of the Lisbon agenda, and pressure on public finances will further fragment and weaken the university system, one of Europe's key assets, to our eventual but certain disadvantage.

Enhancing transfer of knowledge from Universities to Industry and Society

One of the elements in enhancing transfer of knowledge from Universities to Industry is that contracts for academic staff working within companies also recognise and integrate the expectations of the University. If co-operation is merely in the form of a service provided to companies, then the required resources and the financial consequences to the University, to staff members and to the companies need to be clear. If the co-operation goes beyond providing such services (and indeed this is where the greatest potential benefit exists), then it is also important to establish the balance of time, effort, intellectual challenge and industrial engagement expected of each partner.

If such effort of co-operation is to be encouraged, how should the University market itself? How open does it want to throw its doors? What are the rights and responsibilities of the institution and the individual? Although at first, an institution may want to offer financial inducements to companies at the expense of its own rewards, this may not be a sustainable strategy.

Furthermore, Industry also expects much more of the University than merely that it act as source of contract R&D. The long-term interests of Industry as well as the University are aligned in terms of supporting education and research. The debate is much more concerned with establishing the best mechanisms for ensuring that knowledge is transferred and valorised. This requires, as well a recognition that the university's commitment and obligation to serving the public interest need to be reconciled with Industry's commercial motivations.

A fully operational Community Patent is also one of the fundamental steps that can be taken to reduce costs and barriers to the "mobility" of the Intellectual Property (IP) codifying new knowledge created, both between actors in the innovation process and across borders.

Effective management of IP by Universities is an essential element in successfully transferring their knowledge to the rest of society. However, developing modalities for such management and exploitation of IP by each institution from scratch is extremely costly in time and money, and is a recognized barrier to implementing effective IP management¹², especially for universities with a smaller portfolio of research results and SMEs. Therefore, the effectiveness with which IP is managed and exploited can be greatly increased by initiatives producing templates that could be used by universities and companies as starting grounds for defining practices in this area.

¹² Lambert Review of Business-University Collaboration, December 2003. <http://www.lambertreview.org.uk>

Example

The “**Handbook on Responsible Partnering**”, developed by EIRMA, EARTO, EUA and ProTon¹³, is an important initiative to facilitate the management of collaborative R&D and the exploitation of IP generated through public-private partnerships. The guidelines set in this “Handbook” are intended to help Universities, companies and other public research institutions define, on a voluntary basis, the strategic principles that will guide their establishment of collaborative R&D programmes and ensure effective operational procedures for managing these collaborations, securing proper professional support for handling research results and the IP that results, sharing revenues, etc., thereby substantially improving the effectiveness of collaborative R&D and reducing barriers to the exploitation of IP that is created within public research organizations.

The Irish Code of Practices – It is also important that there are unambiguous policies concerning the handling and ownership of IP that is generated partly or wholly through public funding. These reduce risk and encourage Universities to work with partners and transfer knowledge in ways that will be effective and mutually beneficial. The approach taken by the Irish government illustrates how these can be established at national level and some of the hurdles that others are likely to encounter. Codes of Practice are being developed concerning IP that results from publicly funded research and the IP resulting from collaborative research with industry. The success of these Codes will derive from giving a clear signal that commercial exploitation is in the national interests and recognising that this requires professionally-staffed Technology Transfer Offices with missions aligned to the overall technology transfer strategy of their Universities. The Irish initiative has shown the importance of involving all interested stakeholders when developing the operational modalities, to take account of practical experience and to identify and address potential conflicts of interest.

An important component of transferring knowledge and experience between Universities and Industry is achieved through inter-institutional exchange of people. Indeed, “the best forms of knowledge transfer involve human interaction”¹⁴. This exchange promotes fundamental flow of information between the partners, increasing awareness of what each partner needs and can bring to the other. In this view there should be a reinforcement of programmes that promote placement of university students in companies (including SMEs) and life-long learning programmes in universities.

In order to increase transfer of knowledge to companies, the last 20 years have seen the establishment of Technology Transfer Offices at many European Universities. These are responsible for more effectively managing the transfer of knowledge from the researchers working within the University to those who will add value to this knowledge by putting it to commercial use. This is a fairly recent development in Universities' history, and the different dimensions of the task has often made it difficult to establish modes that are efficient and effective and benefit all involved. One has to avoid approaches that will prove to be naïve and take on tasks that others are better equipped to handle.

¹³ http://www.eua.be/eua/jsp/en/client/item_view.jsp?type_id=1&item_id=2171

¹⁴ Lambert Review of Business-University Collaboration, reference above.

Example

The Netherlands Genomics Initiative (NGI) is one of several substantive actions designed to establish world-class knowledge infrastructures in Holland to support pioneering and innovative research that will lead to a continuous flow of new business, while remaining embedded in society. Points that are pivotal to NGI's success include establishing a methodology to make choices and understand where to invest; treating research grants as investments rather than subsidies; being output-driven while also taking into account both commercial and societal interests in defining output and the valorisation process; and creating critical mass and the conditions that engage all parts of the innovation system in truly spearhead projects.

Many European Universities lack the resources and managerial skills needed to manage the valorisation of their research activities, and as a result the impact of their research activities remains far behind its potential. Furthermore, the extent and potential impact of research activities of European universities is very diverse, and (foreseeable lack of) economies of scale do not warrant fully dedicated research management staff in all institutions. This means that the wealth of human and other resources commanded by most European universities is not being fully tapped to promote growth and well-being in Europe. This constitutes a pressing gap in European University-based research that needs to be addressed, especially in view of increasing universities' contribution to the innovation process in a knowledge-based society.

The vitality of a knowledge-based society requires full and wide use of the products of scientific knowledge by society as a whole. Just as universities are the long-term guardians of society's knowledge, so too they must take steps to ensure access their critical, credible knowledge and teaching material. The web offers a powerful tool for achieving knowledge transfer and exchange.

Science Shops also constitute an existing, even if still not very well known, functioning model for transfer of knowledge to the non-commercial elements of our Societies. These provide independent, participatory research support in response to concerns expressed by civil society. In particular, they combine all three missions of Universities in a format that increases the roles of universities in local development, by making knowledge and research capacity available in the right place, in the right format and in a timely manner.

Example

University of Groningen Science Shops. The University of Groningen hosts 9 Science Shops in 5 faculties, covering fields from biology, chemistry to social science, economics and medicine. Their objective is to provide answers to questions related to environment, consumers, health, social issues, etc., arising from Society (Civil Society organizations, groups of citizens, etc). In The Netherlands and in a number of other European countries they have a 30 year history in matching civil society demands with scientific research support.

To give one typical example of their daily activities:

A citizen group in Steenwijk needed support to tackle the pollution caused by two carpet factories. They feared a cancer risk, noticed water pollution and suffered from nasty smells. The citizens did not trust the reports made by government agencies and company consultants. Once they had their own scientific back-up from two University of Groningen science shops (chemistry and medicine), they did agree to participate in the negotiation process. They accepted the Science Shops' conclusion that there was no cancer risk, and started to discuss the other two issues. After methodological discussions with company consultants a student re-calculated the odour profiles of both companies. The companies, due to a recent production change, were just below the legal limit. However, the scientific uncertainty in the findings relating to smells showed that the problem could not be underestimated. The local authorities recognised that there was a problem, but since legally they could not fine the company they allowed the creation of a round-the-clock call centre for complaints. This showed citizens that their issues were taken seriously. After many years, normal communication between citizens, companies and local authorities was restored thanks to this scientific back-up. The Chemistry Science Shop put the issues related to odours raised by the citizens on the agenda of the – usually more technical oriented- bi-annual Dutch Odour conference.

With the support of the European Commission, an international network – Living Knowledge (www.livingknowledge.org) – is now operating in order for science shops to meet, debate and share experiences, building partnerships for public access to research.



Trans-disciplinarity as an emerging principle

Introduction

There is inherent asymmetry between addressing relevant scientific and societal problems and the disciplinary structure upon which most universities are based. In this context the need for *inter-disciplinarity* is often mentioned. But inter-disciplinarity, i.e. co-operation between disciplines with a finite duration, is not enough. The development of the problems tackled by today's science implies that inter-disciplinarity is more a repair measure than a new instrument of science and research.

Trans-disciplinarity

What really matters is trans-disciplinarity, i.e. a new kind of co-operation that leads to an enduring and systematic scientific order that will change the outlook of subject matters and disciplines. Trans-disciplinarity is a form of scientific work which, again, arises in cases concerning the solution of non-scientific problems, for instance environmental, energy and health care policy problems, as well as an intra-scientific principle concerning the order of scientific knowledge and scientific research itself. In both cases, trans-disciplinarity is a *principle of research and science*, one which becomes operative wherever it is impossible to define or attempt to solve problems within the boundaries of subjects or disciplines, or where one goes beyond such definitions.

Besides, pure forms of trans-disciplinarity occur equally rarely as do pure forms of disciplinarity. These, too, mostly conceive and realise themselves in the context of neighbouring scientific forms, for instance with sociological elements in the work of the historian, chemical elements in the work of the biologist or biological elements in the work of the medical researcher. In this respect, disciplinarity and trans-disciplinarity are research-guiding principles or *ideal types* of scientific work, but mixed forms are the rule. What is important is that science and research be aware of this, and that productive research not be restricted by concerns that are obsolete (and mostly simply due to habit), and thereby focused on narrow areas. Such restrictions neither serve scientific progress, nor a world which, in light of its own problems, wants to use rather than admire science.

In other words, trans-disciplinarity overcomes the narrow areas of disciplines, but it does not lead to new disciplines. That is also why it cannot replace disciplines. Trans-disciplinarity, secondly, is a *scientific principle* of work and organisation which spans disciplines, driven by specific problems. The optics of trans-disciplinarity is scientific, and it is directed at a world that is more than ever a work of the scientific and technical mind, and which has a scientific and technical nature. Thirdly, trans-disciplinarity is a *principle of research* and not a theoretical principle. It guides the perception of problems, and their solution, but it does not solidify in theoretical forms.

This principle has already found its concrete form in scientific practice, and it is increasingly being fostered institutionally.

Competencies acquired in individual disciplines remain a fundamental precondition for tasks defined trans-disciplinarily, but they no longer suffice to successfully tackle research projects which extend beyond the established fields. This will, in the future, lead to new organisational forms, also beyond the establishment of centres such as those mentioned in the Example box, in which the boundaries between the individual fields and disciplines will fade away.

Example

The new scientific centres which have been formed in the USA, in Berkeley, Chicago, Harvard, Princeton and Stanford. Such Centres are also no longer organised according to the traditional pattern of faculties or schools of physics, chemistry, or biology, but rather according to a trans-disciplinary perspective, which follows the actual developments of science. One example from Harvard is the «Center for Imaging and Mesoscale Structures». It addresses a range of issues which could not sensibly be attributed to any particular discipline. That is also true in cases where single problems are being addressed, as for instance in the new «Bio-X» Centre in Stanford, or the «Center for Genomics and Proteomics» in Harvard. Biologists here use sophisticated methods from physics and chemistry to find out about the structure of biologically relevant macro-molecules, and physicists like the Nobel Prize winner Steven Chu, one of the initiators of the «Bio-X»- programme, investigate biological objects which may be manipulated with the most advanced methods from physics.

Need for change

To put it differently, *the system of science, including the university system, has to move when research is moving.* At the moment, it is often not the research needs that determine the institutional order, but rather the existing order -which is given in its subsystems and getting increasingly solidified- which is looking for suitable research. And this order is becoming counterproductive. However this should not be the future of research and of a system of science like the university system. As may be seen, the increasing trans-disciplinarity of scientific research will, or should, have far-reaching institutional consequences, also in the case of academic education. Many universities in Europe still have to learn that.

Therefore, to be fully applied, trans-disciplinarity clearly requires a change of culture that needs to be integrated at all levels of education and research activities. That is the reason why it is important that actions are taken and supported not only by the EU but also by governments and by universities themselves.





Governance and the role of Universities as institutions

In order to address the points raised in this report, it is also necessary to consider governance within Universities

Universities as institutions

Firstly, universities exist as *institutions* within the research landscape. More can be gained by recognising this institutional role than by simply concentrating on the input provided by individual teachers, researchers, students or even faculties. The mission and the strategic goals of universities are defined at the level of the institution as a whole.

Institutional leaders provide knowledge and experience, not linked to a discipline but to the goals, the needs and the processes of the University as a whole, and enable it to operate as an equal partner, for example within the local community as part of regional development.

Institutions can also act as catalysts for change top down as well as bottom up, in ways that the individual researcher can never achieve. Depending on their local environment, and their specific strategy and policies, universities are equipped, on the one hand, to transmit the result of the policy debate from the 'top' to their labs and researchers in a meaningful way, and on the other hand to put forward proposals coming from the bottom. These proposals are usually based upon broad internal discussion on priorities and depend upon organised links, mergers and arbitrage between different teams/labs and disciplines. It is the role of institutions to ensure that this process takes place and that the results are successfully fed into the policy process. This role is unique and can only be played by the institution as a whole.

Institutional governance in a competitive and global context

Institutional Governance is of the utmost importance in a competitive and global context, because it is the main factor in reinforcing leadership and accountability in European Universities.

It may be considered that other factors, namely the public financing of universities and research activities, are important for the future of European universities, but the choices made by universities concerning governing bodies and decision making processes are vital in their consolidation.

There is in Europe a wide variety of contexts and "social contracts" defining the political will and trust from major stakeholders regarding Governance of Universities. This contributes to the richness that stems from the diversity in the European University System. For this reason there is not a single model of Governance that is better applied to all European universities, and each institution should be the one choosing which model best suits it.

A more competitive University should have a *mission* (More or less emphasis on teaching versus research? Which sciences are served? What kinds of graduates are produced? Which populations are served?), a *strategy* that embodies that mission (including policies that enhance research excellence, the definition of core curricula, study programs and admissions policies, and the setting of well functioning academic and administrative structures), and a *plan* to execute that strategy.

Universities should also possess *procedures* to adopt its mission, its strategy and plans adaptable to changing circumstances. They also need *feedback mechanisms* to timely assess and evaluate their quality, sense and correct problems, as well as identify and aggressively pursue opportunities in new areas.

All elements of the mission of universities are public goods (or have such components) and universities are therefore a fundamental public responsibility. However, governments should not be in the business of running universities, but should rather be co-funding, supervising and evaluating them. On a par with reinforced leadership and increased accountability, governments should not attempt to regulate this by imposing a set structure by law, but on the contrary should remove obstacles and empower the universities by giving them the means for a more efficient leadership and management.

For these changes to occur, governments need to enable universities to act accordingly, and each need to take steps to remove external regulatory obstacles (for example, inappropriate restrictions on immigration, pension mobility, health and safety requirements, etc.).

In summary, Universities themselves should be able:

- to work in a decentralised system with financial autonomy, i.e. the capacity to take decisions on priorities and flexible redistribution of economic resources
- to have the freedom to decide their own organisation and decision making structure,
- to obtain the capacity or authority to decide on opening or closing areas of research and make related staffing decisions
- to set up more efficient and potent management in combination with respect for academic values, including the tradition of collegiality

and this will require taking steps to overcome some internal obstacles, for example concerning promotion, salaries, etc.

Improved University leadership and management

Only Universities with adequate models of governance will be able to deal with the new challenges that Research and European Higher Education are facing in the future.

The Forum's view is that these models should aim at reinforcing the leadership and the internal and external accountability of these institutions. This requires the development of a professional leadership, based on academic traditions which could be inspired by the structures and culture in the private sector.

There is no single best model of university Governance. Any well functioning advanced governance setup includes: 1) a "governing body" to set a mission, a (medium to long term) strategy embodying the mission, and yearly plans and budgets to implement the strategy, as well as review results of their execution; 2) a strong "executive body" to execute the policies derived from the strategy, as well as the annual plans and budgets, and 3) an external "quality assurance body" to assess and report to the others on the quality of the execution measured against the strategy and policies decided.

Aspects of this setup will vary from one University to another, and the need for interaction with National authorities responsible for Higher Education in defining the strategy, plans and budgets are diverse.

It is important that, when defining the University mission and strategy, the “governing body” is given the freedom, for example, to propose new Research Centres, endowed chairs and graduate schools (that is schools that only have a graduate studies curriculum). Excellence in research is fed by and feeds into excellence of a graduate school curriculum.

Example

New Danish principles for University governance. The new Danish University Law now being implemented defines a governing board that is self-renewing to safe-guard the autonomy of universities. The board appoints the rector, while the rector appoints the deans.

The collegiate influence is guaranteed by the Academic council elected by faculty. The division of power and influence between rector, governing board and academic council is defined by law.

A contract between government and the university is negotiated for a three-year period.

To achieve an efficient management structure, each institution should choose the setup that best suits its idiosyncrasies. It is fundamental to ensure a strong and accountable “executive body”, with reinforced leadership and internal and external accountability of the University.

A good management of university research activities requires better accounting systems, to enable the identification of the full costs and time involved in university-based research activities.

A stronger leadership is an important factor in increasing the level and upgrading the methods of fund-raising to be carried out by Universities, which is probably one of the most demanding duties of University Leaders.

European Research-active Universities must inevitably fund an increased percentage of their budgets from private financial resources obtained through their own fund-raising activities; this should not exclude Governments giving a high priority to the co-funding of these institutions.

Conclusions

Conclusions

The European University is one of the key strengths of this part of the world. There is tremendous opportunity to gain more benefit from this strength as we seek to develop successful Societies and Economies based on knowledge and technology.

Time for action has come and it is imperative that the European Union, Member states and Universities mobilize to contribute fully to the establishment of a knowledge based society.

Individual chapters of this report have developed several areas: knowledge creation, knowledge exchange, transdisciplinarity and governance. The cross-cutting questions that relate to Europeanisation are not treated in isolation, but reflect the overall spirit of the report.

Dealing positively within the process of globalisation requires that Universities can make greater contributions to the European Research Area. This depends upon the willingness to achieve sufficiently compatible national systems; the development of systems of evaluation that work effectively across national boundaries; the capacity to develop long-term partnerships that enable Universities to coordinate research strategies; and the promotion of flexible schemes (like the Marie Curie Action) that facilitate the exchange of researchers as an integral part of their research.

The members of the High Level Expert Group “Forum on University-based Research” would like the European Commission to reply to the recommendations made by the Forum, notably by:

- producing a strategic document that stresses the need to undertake concrete actions in order to strengthen and support Research-active Universities when they face their challenges;
- taking the necessary actions in order to integrate the recommendations made into main Community instruments, such as the EU Research Framework Programme and the Education Initiatives and the structural fund programmes, e.g. for regional development and inter-regional cooperation;
- widely disseminating the report to all concerned stakeholders;
- feeding the report into other discussions on similar and linked topics on-going at the Commission.

European Commission

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