

Knowledge transfer

Transfer znalostí

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Abstract: The paper deals with the issue of knowledge transfer from several angles (context, benefits, and channels) in order to specify roles the universities should play in order to enhance the competitiveness of the EU economy. Knowledge transfer encompasses a wide variety of activities that range from appearances in the media and at public forums to participation in bilateral projects, the commercial development of research, the application of expertise through partnerships and internships, and the inclusion of broader community influences in the curriculum to enhance the capabilities of graduates. The broader context to facilitate knowledge transfer activities is assessed, suitable channels identified and some hints to select the appropriate channels provided. As the benefits of knowledge transfer go beyond the simple financial return, factors supporting effective deployment of knowledge transfer function at universities include not only financial incentives, but also a combination of measures ranging from training knowledge transfer personnel, setting appropriate metrics to assess the performance of knowledge transfer processes, quality assurance schemes as well as barriers-removing policies to enhance mobility of staff and free exchange of knowledge.

Key words: knowledge transfer, knowledge economy, university, EU

Abstrakt: Téma transferu znalostí je v příspěvku pojednáno z různých úhlů (kontext, výhody, kanály) s cílem vymezit role, které by měly sehrát univerzity, aby přispěly ke zvýšení konkurenceschopnosti evropské ekonomiky. Transfer znalostí zahrnuje široké spektrum činností od přítomnosti v médiích a na veřejných akcích, přes participaci na bilaterálních projektech, komerčním výzkumu, využívání odbornosti v partnerských uskupeních nebo na stážích, až po přizvání širší veřejnosti k úpravám studijních programů v zájmu vyšší kvalifikace absolventů. Dále je v příspěvku předmětem hodnocení kontext, v němž se transfer znalostí odehrává a může přispět k zvýšení jeho efektivnosti. Jsou zde identifikovány i kanály využívané pro přenos znalostí včetně návrhu několika kritérií použitelných pro výběr vhodných kanálů v konkrétních podmínkách. Vzhledem k tomu, výhody transferu znalostí přesahují pouhé finanční výnosy, měly by faktory podporující efektivní zavádění transferu znalostí na univerzitách zahrnovat nejen finanční pobídky, ale také kombinaci opatření od výchovy a vzdělávání odborníků pro řízení transferu znalostí, přes stanovení vhodných způsobů měření výkonnosti v oblasti transferu znalostí, programy pro zajištění kvality a postupy odstraňující bariéry a umožňující mobilitu zaměstnanců a volnou výměnu znalostí.

Klíčová slova: transfer znalostí, znalostní ekonomika, univerzita, EU

Capitalism is undergoing an epochal transformation from a mass production system where the principal source of value was human labour to a new era of 'innovation-mediated production' where the principal component of value creation, productivity and economic growth is knowledge (Florida, Kenney 1991).

For the last two hundred years, the neo-classical economics has recognised only two factors of pro-

duction: labour and capital. This is now changing. Information and knowledge are replacing capital and energy as the primary wealth-creating assets, just as the latter two replaced land and labour 200 years ago. In addition, technological developments in the 20th century have transformed the majority of wealth-creating work from physically-based to "knowledge-based". Technology and knowledge are now the key factors of

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production. With increased mobility of information and the global work force, knowledge and expertise can be transported instantaneously around the world, and any advantage gained by one company can be eliminated by competitive improvements overnight. The only comparative advantage a company will enjoy will be its process of innovation – combining market and technology know-how with the creative talents of knowledge workers to solve a constant stream of competitive problems – and its ability to derive value from information and knowledge.

“A knowledge-driven economy is one in which the generation and exploitation of knowledge play the predominant part in the creation of wealth” (United Kingdom Department of Trade and Industry 1998). In other words: creating and sharing knowledge is essential to fostering innovation, and it is the key challenge of the knowledge-based economy.

An expanding environment for creating and managing knowledge recasts a wide range of policy issues, including public investment priorities, program design, dissemination of research results, technology transfer, and the form and scope of private controls on information and knowledge. Tension arises from the fact that governments, universities, and private companies operate in different ways and under different rules, yet there are compelling reasons to encourage a rapid movement of knowledge across the sector and institutional borders.

The role of universities goes beyond simply being an education or research provider: transferring knowledge to industry, the community and wider society is becoming the third cornerstone (“third stream”) of universities missions. Knowledge transfer encompasses a wide variety of activities that range from appearances in the media and at public forums to the participation in bilateral projects, the commercial development of research, the application of expertise through partnerships and internships, and the inclusion of broader community influences in the curriculum to enhance the capabilities of graduates. The most cited and accepted definition of activities encompassed in this area is those “*concerned with the generation, use, application and exploitation of knowledge and other university capabilities outside academic environments*” (Science and Technology Policy Research Unit Report to the Russell Group of Universities 2002).

OBJECTIVES AND METHODS

The paper is a contribution to the current debate over the knowledge transfer function of the univer-

sities. The objective of this paper is to highlight the role universities are expected to play in the process of knowledge transfer. In order to do so, several issues are assessed including the knowledge transfer context, benefits it is likely to bring about, and channels, which are listed in accordance to the characteristics of knowledge being transferred.

Methodologically the paper is based on comparative studies produced namely by the OECD and the AUTM, and reports and policy guidelines issued by the Allen Consulting Group, the PhilipsKPA and the European Commission.

RESULTS AND DISCUSSION

Knowledge transfer context

The increasing role of public sector science in industrial development can be readily illustrated. In the late 1990s, it has been estimated that over 75% of references to scientific publications in the US patent applications were to publicly funded science. Moreover the average number of the US scientific papers cited in the US patent applications rose more than six-fold between 1985 and 1998. The rise was particularly striking in biochemistry, organic chemistry, and medical and veterinary science (OECD 2002). Finally, in 2000 over 450 companies based upon a university-licensed scientific discovery were formed in the USA, with over 80% of these founded in the state/province of the academic institution that created the technology (OECD 2002; AUTM 2002).

The importance of knowledge transfer in boosting competitiveness and contributing to the effectiveness of public research is increasingly recognised also by the EU Member States. European universities and other research institutions are equally realising their changing role in the globalized economy and have undertaken interesting initiatives. They realise that they are no longer simply providing the local area with graduates but that they find themselves competing on a global scale for students, researchers and industrial partners. In turn, they realise that they will have to provide a world class research to attract said students and researchers in the future. In order to remain attractive, they will need to open up to business and international collaboration, which may also help to leverage new funds. Sharing knowledge in particular through R&D collaborations with businesses – while a potential source of income for research institutions – may well give an important boost to both quantity and quality of the research undertaken. In March 2006, the European University Association

published conclusions on good practices related to knowledge transfer function in research universities (Capart 2006). These conclusions include:

- active role of universities in the innovation process;
- incorporation of knowledge transfer in the university mission, its communication and endorsement by academic community;
- balancing basic, applied and experimental research;
- building on correlation between knowledge transfer and research excellence;
- quality assurance schemes in research with respect to knowledge transfer intensity;
- institutionalization of knowledge transfer with the inclusion of trained knowledge transfer professionals.

The European Commission in its recent communication (EC COM 2007) encouraged the EU member states to a co-ordinated set of actions to facilitate knowledge transfer especially through:

- creating conditions for successful knowledge transfer (by allowing for rich exchange of staff as well as by hiring of young graduates by industry; by enhancing skill and competencies of knowledge transfer personnel; by pooling resources among research institutions);
- promoting an entrepreneurial mindset (by professional management of intellectual property using suitable tools such as the CREST decision tree¹, model contracts such as the UK's Lambert agreements² or guidance such as the Danish document on *Contacts, contracts and codices*³; and by change of appraisal criteria in favour of activities such as patenting, licensing, mobility and collaboration with industry);
- promoting research institutions – SME interactions (see for example innovation voucher scheme adopted by the Netherlands);
- financial support (using state aid, the EU cohesion policy and the EC framework programmes).

¹ http://ec.europa.eu/invest-in-research/policy/crest_cross_en.htm

² <http://www.innovation.gov.uk/lambetsagreements>

³ <http://billed.di.dk/wimpfiles/lores/image.asp?objno=/68620.pdf>

⁴ Note that the UK Higher Education Innovation Fund uses three measures to drive the formula for allocation of funding:

- number of full-time equivalent academic staff, as a measure of potential and capacity building;
- external income from knowledge transfer activities, as a proxy for demand for the universities'
- knowledge;
- a group of indicators designed to model factors not best measured by income including start dedicated to 'third stream' activities; level of engagement with small to medium-sized enterprises; level of engagement with non-commercial organisations; number of university/industry staff exchanges; and number of student placements in industry or the community.

Financial support of knowledge transfer generates a majority of debate: a key barrier has been a view that universities should be able to secure revenue through their own commercial enterprise. Providing universities with sufficient resources to facilitate the process of knowledge transfer to businesses allows the market to ultimately deliver economic benefits. Resourcing activities to promote knowledge transfer has been recognised elsewhere as the most efficient and effective method of improving knowledge transfer and realising its benefits. It further clearly delineates the processes of knowledge acquisition in research and teaching and learning from the activity of translating it for use in industry and community. Some countries – the US and the UK⁴ in particular – have addressed this issue with specific funding schemes, while in other countries the debate is still ongoing. The Australian Vice-Chancellors' Committee for instance proposed in its Statement on Knowledge Transfer (AVCC 2006) a two-fold mechanism for knowledge transfer funding at the university level.

“Scheme A: A pro rata allocation to universities depending on the present knowledge transfer activities (based on measures of these activities such as industry support for research and infrastructure, commercial revenue, revenue from consulting activities, graduate full-time employment, etc.) and size (by staff full-time equivalence). Fifty percent of the knowledge transfer funds would be allocated in this way, and the university would be required to report on the outcome of the projects each year.

Scheme B: A competitive pool of funds would be created for 'demand-driven' projects. Submissions would be called for with a requirement that one or more of the partners is from outside the university sector (industry, government or non-government organisations), and one or more of the partners is a university. Such a project would require an explicit transfer of knowledge, relating directly to the needs of the partners. Fifty percent of the knowledge transfer funds would be allocated in this way.“

This proposition balances funding aiming at the long term strategic institutional planning with a more flexible scheme based on open competition and providing for a higher responsiveness and rapid adoption by the industry.

The ongoing debate over funding policies to facilitate knowledge transfer at the EU level is forced further by the following unfavourable comparison: the average university in Europe in comparison with North America generates far fewer inventions and patents. European institutions lag behind their North American counterparts regarding invention disclosures (by 25%), patent applications (by 53%) and patents grants (by 36%) (MEMO 2007) This is largely due to a less systematic and professional management of knowledge and intellectual property by European universities. Moreover, the efficient knowledge transfer in European research institutions is hindered by a range of factors, including: cultural differences between the business and science communities; lack of incentives; legal barriers; and fragmented markets for knowledge and technology (EC COM 2007).

Knowledge transfer benefits

The benefits of knowledge transfer go beyond the simple financial return. In fact, even in the US, where knowledge transfer is more developed than in the EU, only a fraction of such activities generate a net profit (MEMO 2007). The European University Association declares the following benefits of successfully deployed knowledge transfer function for universities (Capart 2006):

- recognition by the public authorities of the economic utility of the research function of universities, justifying a better funding;
- attracting more funding from foundations and private partners for collaborative research, which may in turn leverage more public funding;
- attracting good scientists for recognition and career opportunities;
- attracting more students.

The Sussex University⁵ lists the benefits of knowledge transfer in accordance to the various stakeholders:

For organisations:

- Strategic development of products, services and organisational development
- Financial support through grant funding
- Having a knowledgeable graduate to carry out the project work

- Access to university consultancy and facilities
- Outcomes which increase commercial success of a business

For graduates:

- Paid project work
- Application of specific knowledge and skills to real organisational situations
- Fast-track career development
- The opportunity for further post-graduate qualifications
- Building a portfolio of work experience, technical and business skills

For the university:

- The application of specific academic knowledge into industry
- Staff development opportunities in supervising and mentoring graduates
- The opportunity to work with business and build relevant relationships
- The student project could result in a postgraduate degree being awarded
- Publishing of academic papers
- Research opportunities and points towards departmental RAE ratings

Knowledge transfer channels

Effective knowledge transfer strategies rely on the capacity of universities to shape their knowledge transfer approaches and activities in partnership with their various communities, and to respond creatively to the distinctive needs of those communities. From this perspective, a healthy system of knowledge transfer should demonstrate considerable diversity in knowledge transfer approaches and activities, both within and across institutions and across disciplines and national research priorities. Given the diversity of knowledge as well as diversity of partners within knowledge transfer, it is not surprising that here is also a variety of potential channels through which knowledge is transferred. Brennenraedts, Bekkers and Verspagen (Brennenraedts et al. 2006) have built on previous work of Bongers et al. and derived the following typology of knowledge transfer channels:

- Publications
 - scientific publications, co-publications, consulting of publications
- Participation in conferences, professional network and boards
 - participation in conferences, participation in fairs, exchange in professional organizations,

⁵ <http://www.sussex.ac.uk/ktp/>

- participation in boards of knowledge institutions, participation in governmental organizations.
- Mobility of people
 - graduates, mobility from public knowledge institutions to industry, mobility from industry to public knowledge institutions, trainees, double appointments, temporarily exchange of personnel.
- Other informal contacts/networks
 - networks based on friendship
 - alumni societies
 - other boards
- Cooperation in R&D
 - joint R&D projects
 - presentation of research
 - supervision of a trainee or PhD student
 - financing of PhD research
 - sponsoring of research
- Sharing of facilities
 - shared laboratories
 - common use of machines
 - common location or building (science parks)
 - purchase of prototypes
- Cooperation in education
 - contract education or training, retraining of employees, working students, influencing curriculum of university programs, providing scholarships, sponsoring of education
- Contract research and advisement
 - contract-based research
 - contract-based consultancy
- Intellectual property rights
 - patent texts
 - co-patenting
 - licenses of university held patents
 - copyright and other forms of intellectual property
- Spin-offs and entrepreneurship
 - spin-offs
 - start-ups
 - incubators at universities
 - stimulating entrepreneurship

The above listed channels serve different rationales, as well as they facilitate transfer of all types of knowledge: explicit, implicit and tacit. The selection of channels and development of portfolio of the channels in use depends on sectoral differences in knowledge bases, factors related to the characteristics of knowledge being transferred (codification, tacitness, complexity), factors related to the characteristics of the recipient (motivation, absorptive capacity) and factors related to the context (trust, organizational distance, geographical distance).

Role of universities in knowledge transfer

Based on work published by the National Endowment for Science, Technology and the Arts (the organization devoted exclusively to supporting talent, innovation and creativity in the UK), the following roles of universities in knowledge transfer can be identified:

- *Driving forward the research frontier*: Universities generate knowledge needed for innovation. Basic scientific research primarily intended to advance knowledge lays the groundwork for many innovations, though it is normally conducted without a final application in mind. Universities also conduct applied research – the pursuit of knowledge to solve a practical problem.
- *Giving people the skills for innovation*: Giving graduates the skills they need. By 2014, the demand for science and technology professionals is estimated to increase by one-fifth, compared to an increase for all other occupations of four per cent. Universities can also do much more to give people the entrepreneurial skills they need. While most students and post-graduates have access to institutional facilities that support entrepreneurship education, such as enterprise and incubator units, the quality of provision varies widely.
- *Exchanging knowledge*: While universities appear to be improving their performance in some areas – both the number of spin-offs and licences granted have increased – progress is not uniform. Knowledge exchange is also important for the public and third sectors, although as yet this is poorly understood. Also faculty recruitment, reward and retention strategies focus heavily on pure research and neglect other activities essential to innovation, including external engagement and more applied research.
- *Acting as a hub in an international network of knowledge*: Globalisation enables business, people and knowledge to flow freely across the national boundaries. Universities are also moving beyond their original geographic origins, seeking out collaborations across the world. Through their links with other leading knowledge centres, universities not only facilitate the flow of ideas and people in and out of their country, they also strengthen the capacity for innovation of local businesses, the specialist knowledge of the local labour market and the attractiveness of their region to new investors
- *Providing regional leadership*: Universities are increasingly seen as partners in any regional strategy for economic development, and often form a major element of any innovation strategy. Closer links between universities and businesses should

also help to ensure that universities are educating their students with the skills most needed in the national economy (NESTA 2007).

CONCLUSION

Universities across Europe are under a growing pressure to engage in the knowledge transfer activities in order to increase the competitiveness of European economy. In some countries, schemes to facilitate knowledge transfer function of universities and other research institutions have been developed and serve the society, a vast majority of the EU member states, however, is yet to address this challenge and find the appropriate set of tools to initiate the process. Most studies dealing with the issue of knowledge transfer reveal that the knowledge transfer for commercial benefit represents only a sub-set of the broader concept of knowledge transfer which is directed towards enhancing material, human, social and environmental wellbeing. This by its nature multi-purpose function of the universities is difficult to implement. The implementation support scheme should include not only financial incentives (which tend to be naturally the most discussed issue) but also a combination of measures ranging from training knowledge transfer personnel, setting appropriate metrics to assess the performance of knowledge transfer processes, quality assurance schemes as well as barriers-removing policies to enhance mobility of staff and free exchange of knowledge.

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