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## **Knowledge spillovers to industry: Opportunities for universities of applied sciences**

### **Abstract**

The paper condenses recent empirical findings about the characteristics of those firms that utilize and appreciate knowledge spillovers from higher education organizations. We discuss these findings, sketch out how these empirical findings relate to the third mission of universities and how this can present opportunities for universities of applied sciences.

### **Keywords**

Mission of universities, knowledge spillovers, innovation, applied research.

## **Wissensspillover für die Industrie: Chancen für Fachhochschulen**

### **Zusammenfassung**

Dieser Beitrag fasst neuere empirische Erkenntnisse über die Charakteristika von Unternehmen zusammen, die Wissensspillover aus Hochschulen in den Innovationsaktivitäten nutzen. Wir diskutieren diese Ergebnisse vor dem Hintergrund der sog. dritten Aufgabe von Hochschulen. Insbesondere gehen wir darauf ein, welche Chancen sich daraus für die Positionierung von Fachhochschulen ergeben.

### **Schlüsselwörter**

Mission von Hochschulen, Wissensspillover, Innovation, angewandte Forschung

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## 1 University spillovers to contribute to the third mission of universities

Universities have always been changing. Ever since their inception at the end of the twelfth century, they have responded to changing societal, economic and political contexts. This evolution has gone hand in hand with changing definitions of mission and context, departing from the universities' medieval role as a storehouse of knowledge (YOUTIE & SHAPIRA, 2008) primarily responsible for teaching within the four main disciplines of theology, law, medicine and philosophy. The Humboldtian reforms expanded the role of universities into agents of active knowledge development (YOUTIE & SHAPIRA, 2008) and extended their portfolio of subjects. Natural sciences, humanities and arts eventually developed rather independent curricula, methods and approaches, while engineering sciences and social sciences evolved into distinct disciplines (BROCKLISS, 2000).

In addition to the two modes a third dimension has now been added: Universities are now to support economic and social development (e.g. ETZKOWITZ et al., 2000; ETZKOWITZ, 2003) on a broader basis. This mandate is highly appreciated and supported by policy makers, as it promises an expanding source of university financing (SLAUGHTER & LESLIE, 1997; CLARKE et al., 2006) and societal impact in other policy areas, notably in industrial and regional development. This new line of reasoning, which places universities in a central position within the knowledge based economy, is often described using the 'triple helix' metaphor to capture the three-fold interaction between universities, industry and government in a post industrial and knowledge driven economy (ETZKOWITZ & LEYDESDORFF, 1999).

The new roles assigned to the university system reflect radical changes in industrial demand for technology and knowledge, and thus in corporate innovation behavior. Over the last decades, firms have increasingly been shifting away from internally oriented innovation activities to open and interactive forms of development (CHESBROUGH, 2003; CHRISTENSEN, OLESEN & KJAER, 2005), because they recognize that they cannot themselves stay abreast of all relevant technological advances. Advances in scientific fields or industrial sectors far outside their own technological domains may represent highly valuable opportunities to expand product lines or improve production processes. Consequently, the success of individual firms increasingly depends on their ability to create and maintain interfaces, which transcend the corporate walls (NICHOLLS-NIXON & WOO, 2003). The growth of economies similarly depends on their ability to diffuse knowledge between different industrial actors and on their ability to foster and link advances in academic research to the needs and knowledge bases of industrial firms.

The university system is important in this context, but not only as providers of advanced technology to certain distinctively science-driven industries (MOWERY & SAMPAT, 2005). More importantly, in their function as innovation hubs (YOUTIE & SHAPIRA, 2008) universities may serve as knowledge brokers (HARGADON & SUTTON, 1997) which link academic research results to specialized, often tacit, knowledge developed by industry itself and contribute to its diffusion and use in

different contexts (ROTHAERMEL et al., 2007; COOKE, 2008). The latter particularly applies with respect to universities of applied sciences as they may interact intimately with different firms, accumulate valuable insights (e.g. HERSTAD & BREKKE, 2012) and use the resulting knowledge to support firms in new rounds of innovation.

Recent empirical research on regional development points to the importance of knowledge development and diffusion at the intersection between diverse industrial knowledge bases and scientific advances (e.g. FRENKEN et al. 2007; BOSCHMA & MARTIN, 2007). We are therefore tempted to agree with COHEN, NELSON and WALSH (2002): In spite of the Bayh-Dole Act<sup>2</sup>, the reform of employee invention regulations (e.g. in Germany, Austria and Norway) and substantial investment in the management of university intellectual property (IP), the transfer of such IP may very well be a rather insignificant channel for the diffusion of university knowledge into society to contribute to the third mission. By contrast, indirect diffusion of knowledge through education, researcher mobility and knowledge spillovers directly inspiring corporate innovation activities may play a more important role. Currently we observe that across Europe about 13% of innovative companies highly appreciate the universities as informal sources of inspiration for their innovation process (EBERSBERGER, HERSTAD & ALTMANN, 2012). In some countries this share is considerably higher (e.g. 18% in Norway).

## 2 Spillovers and the opportunities for universities of applied sciences

Although the empirical analyses of informal university knowledge spillovers in EBERSBERGER, HERSTAD and ALTMANN (2012), in LAURSEN and SALTER (2004), and in MOHEN and HOAREAU (2003) cannot distinguish between universities on the more basic side of the research spectrum and universities on the more applied side of the spectrum, they reveal a number of interesting facts. These might pose distinct challenges to universities as sources of industrial innovation in general. But these findings might as well present valuable opportunities for universities of applied sciences in particular.

*First*, firm size and R&D intensity determines the firms' usage and appreciation of universities as sources of innovation. The larger the firm and the more R&D intensive it is, the more it seems to use and appreciate spillovers from universities and higher education institutions. Essentially, firms have to comprehend, assimilate and integrate inspiration into their development work, and this absorptive capacity (COHEN & LEVINTHAL, 1989) appears to be more fully developed the larger and the more R&D intensive the firm is.

This suggests an opportunity particularly for universities of applied sciences to target smaller firms, SMEs in particular, with the provision of their research. Yet, the

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<sup>2</sup> The Bayh-Dole (in 1980) reformed the US legislation about with intellectual property generated by research funded through the federal government.

question of absorptive capacity of SMEs remains. The most important mechanism for the long-term build-up of absorptive capacity is the provision of educational programs which, through their content, link the worlds of academia to the world of industrial innovation and production. Reducing the dependence on strong absorptive capacities can be achieved through provision of low-threshold access to research results and findings, for instance by establishing science fairs particularly tailored for the needs and requirements of local and regional SMEs. Technical advisory infrastructure such as technology help desks, which are open for external consultation, may also increase the range of firms exposed to information generated within academic institutions on the applied side of the research spectrum. Supporting the researchers' publication effort in applied science journals in engineering, management and social sciences can furthermore increase the visibility of the applied research to corporate actors in the innovation system. This will increase their attention towards it.

*Second*, the openness of the innovation process is a strong determinant of the firms' use of university spillovers. It can be assumed that companies that already pursue an open innovation strategy have a higher receptiveness for external ideas and inspiration. Commonly it is argued that the largest challenge in implementing open innovation strategies is to overcome the not-invented-here-syndrome. Given that companies already use open innovation strategies it is plausible to assume that the syndrome is no strong obstacle for external ideas. The appreciation of inspiration is of course higher in these firms. To overcome the not-invented-here syndrome poses a real challenge, which – to the authors' perception – universities of applied sciences are better equipped to help overcome. Through frequent interaction with industry, universities of applied sciences may build a reputation as a reliable and sound source of relevant and applicable knowledge. This reputation and the frequent personal interactions between knowledge producing academics and knowledge users can support credibility and mitigate the adverse effects of the syndrome.

*Third*, internationality of the firm affects the use and appreciation of university spillovers. Foreign owned firms use university spillovers less. This can be caused by a branch plant syndrome, which reduces the embeddedness of the firm in its immediate environment, as its mandate does not comprise knowledge generation and innovation. Hence these firms will be less prone to absorb spillovers. Additionally, the international network of a foreign multinational company (MNC) can serve as a source of inspiration and knowledge spillovers. Even though their absorption requires less attention than the management of a collaborative project, attention is a scarce resource, which might be allocated to accessing intra-MNC spillovers and easily transferable knowledge assets where appropriability is less of an issue.

This suggests that the commonly perceived threat of regional knowledge leaking to global actors might not be all that relevant. Based on the findings we conjecture that it is indigenous firms, which benefit most from spillovers. This insight is crucial for the development of the research portfolio of universities of applied sciences. Their attention should be oriented towards regionally embedded firms, rather than towards attracting actors from abroad

*Forth*, the results also show that the technological frontier of the science system and the level of development of the economy have strong effects on the use and appreciation of university spillovers. Firms located in countries that are not at the technological and scientific frontier exert a lower likelihood to use university spillovers. University spillovers seem to be a valuable but rather economical source of inspiration.

This emphasizes the dependence of spillover impact on the absorptive capacity of the economy as a whole (e.g. MEYER & SINANI, 2009; BOSCHMA & IAMMARINO, 2009). Furthermore, it highlights the importance of university spillovers in small economies, thus indicating that the science system plays a particularly important role in linking such economies to knowledge development abroad (e.g. GRAF, 2010). By implication the spillovers play a particularly important role on the regional level and in contexts characterized by narrow competence bases and a high degree of specialization. For universities of applied sciences, this may present a valuable opportunity to develop as a knowledge hub in a region and to provide a regionally embedded platform of applied science and play a crucial role in supporting the development of regional economies by linking the endogenous industrial base to external academic inputs (TÖDTLING & TRIPPL, 2005).

### 3 A brief upshot

In general, the exchange of knowledge and inspiration across institutional boundaries requires the implementation of new methods of communication and tools focusing on mutual participation (GUSTON, 2001) and in a regional context the exchange of knowledge and inspiration has to build on trust developed by frequent face-to-face interaction of the relevant actors. This *visibility* must however be coupled with *relevance* to industrial applications and needs, and *sensitivity* towards problems and challenges specific to knowledge development and application in commercial contexts. Institutions with a strong emphasis on applied research should score far higher on visibility, relevance and sensitivity than other university sector actors. Furthermore, they should be better positioned to serve as knowledge brokers in regional innovation systems and able to overcome absorptive capacity constraints on the side of regional industry.

It is therefore our conjecture that universities of applied sciences are particularly suited to contribute to the economic and social development of their local and regional environment.

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