

## Components of Knowledge Commercialization in the Selected Universities of the World

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*This paper presents a qualitative research method that has been performed based on content analysis. In this study, in order to evaluate and identify the components of the commercialization of knowledge, factors affecting the expansion and development of academic projects in five of the world selected universities (Harvard, Stanford, Cambridge, Kyoto, and Singapore) have been focused on. These components have been extracted in these universities through analyzing more than 70 scientific research studies. The researcher has used an inductive approach for the analysis of information obtained from the conducted research in this area. Results have shown that the main themes, elements of infrastructure, policymaking and identification of potential customers have facilitated the commercialization of knowledge in the selected universities.*

*Key words: Commercialization of knowledge; Selected universities; Infrastructure; Policymaking; Identification of potential customers*

### Introduction

The commercialization of knowledge produced by the universities has created a major topic in today's public discussions and it generally causes the production of scientific results in universities. The role of academic institutions in society has been investigated in various academic disciplines. Since 1960 university has been introduced as an institution that specializes in creating and spreading knowledge for the public and it has entered into the society through research and education, and its results have helped the scientific and economic growth of the country.<sup>1</sup>

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<sup>1</sup> Clark, B. – Neave, G. (2006). *The encyclopaedia of higher education*. Pergamon Press, New York, NY.

Since competition increasingly depends on knowledge, all companies need to manage their internal knowledge. Nonetheless, companies need the ability to manage the acquisition and dissemination of knowledge to realize their inherent potential assets of knowledge. In fact, companies exploit external knowledge more i.e. they apply the commercialization of the knowledge assets of others.<sup>2</sup>

Nevertheless, changing technology into wealth has been considered to be a risky activity that might reduce the amount of success in projects or might affect the amount of investments in such projects due to the allocated fund to each limited project. Thus, the success of science commercialization would be a serious issue for universities and governments.<sup>3</sup>

The main reasons that industry does not benefit from university technology is that technology shows no commercial value and therefore it is stopped in the initial stages and does not enter into commercialization.<sup>4</sup> The other important point is that commercialization needs people to master the sources; therefore, part of the commercialization activities means transferring research from the universities to productive and commercial activities.

The competition for human capabilities takes place in a self-sorting process among the scientists and engineers who are about to migrate from academic research into the private sector. They can implement the commercial value of the knowledge they have acquired in academic research either by setting up their own entrepreneurial start-up venture or by becoming employees in someone else's entrepreneurial business. Accordingly, they either become the subject or the object of knowledge-based entrepreneurship. Yet, in either case, the peculiarities of scientific knowledge and its transfer mode imply constraints for exploiting knowledge which are changing systematically over time. As it will turn out, the – differing – responses to these constraints result in organizational arrangements which seem to be characteristic concomitants of the commercialization of new technologies.<sup>5</sup>

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<sup>2</sup> Hansen, M. T. (2002). Knowledge networks: explaining effective knowledge sharing in multiunit companies. *Organization Science* 13(1): 232–248.

<sup>3</sup> Aziz, K. A. – Harris, H. – Norhashim, M. (2011). University Research, Development & Commercialisation Management: A Malaysian Best Practice Case Study. *World Review of Business Research*, 1(2): pp.179–192.

<sup>4</sup> Weijters, B. – Cabooter, E. – Schillewaert, N. (2010). The effect of rating scale format on response styles: The number of response categories and response category labels. *International Journal of Research in Marketing*. 27(3), 236–247.

<sup>5</sup> Cohen, W. M. – Nelson, R. R. – Walsh, J. P. (2002). Links and Impacts: The Influence of Public Research on Industrial R&D. *Management Science*, Vol. 48, 1–23.

Selected universities are considered to be a great potential market for many industries. Universities are always looking for the opportunity to commercialize their research. It is a fact that companies need the scientific and technological achievements of various universities, but they cannot successfully do the commercialization of research in universities due to a variety of proposed scientific research projects by colleges and universities to meet the real needs of companies and markets as well. The issue, which was reported in 2009 by Swamidass and Vulasa, is that many university inventions have nothing to do with market needs, especially when industrial companies are reluctant to provide research funds for inventions. Also, many university inventions will always remain under the pressure of technology which is mostly considered a destructive factor in the market rather than market traction and it causes the market to continuously search for new inventions.<sup>6</sup>

To some extent, scientific and technological innovation in colleges and universities has often been imposed by the phenomenon of losing connection with the market. Only a few university researchers have stated a connection between university technology transfer and companies, but most of these transfers have not followed a correct understanding of markets. In addition, many colleges and universities have entered into this field with their research projects for the market needs regarding the limited knowledge in market research and understanding the technology related information. Levan et al (2010) have shown that technology and market needs are necessary to be considered by university researchers and for the commercialization of patents for effective technology transfer. In other words, a hybrid approach of research knowledge and demand in the industrial market for increasing the opportunities and achieving commercialization of research is required.<sup>7</sup>

### The Nature of Scientific Knowledge and its Transfer Conditions

The commercial performance of knowledge and long-term competitiveness of firms in high-commercial environments seems to hinge critically on their capacity to monitor and tap, in an anonymous

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<sup>6</sup> Creswell, J. W. (2007). *Qualitative Inquiry and Research Design: Choosing Among Five Approaches (2<sup>nd</sup> ed.)*. Thousand Oaks: Sage Publications.

<sup>7</sup> Luan, C. – Zhou, C. – Liu, A. (2010). Patent Strategy in Chinese universities: a comparative perspective. *Scientometrics*, 84(1): 53–63.

form, scientific and technological developments that have originated elsewhere.<sup>8</sup>

This means that new propositional knowledge emerging in academic research and more generally in the international innovation systems needs to be traced. Its usefulness, in terms of complementarities to the firm's own capabilities, needs to be assessed. A prerequisite for doing so is that the firm has sufficient cognitive "absorptive capacity", i.e. sufficient knowledge to understand the context and meaning of the information transmitted.<sup>9</sup>

The transmission of knowledge in encoded form is, however, not possible for all aspects of scientific research. Besides theoretical and empirical insights (whose publication in scientific journals constitutes the main objective of academic research), a variety of other forms of knowledge are essential to the scientific process. They are mainly differentiated from the former by their procedural characteristics and imply a substantial degree of tacitness.

The attraction of scientifically trained staff to business firms does not necessarily only serve the purpose of creating cognitive absorptive capacity in these firms. It also enables the firms to get a hold of tacit state-of-the-art knowledge from scientific research which cannot be transferred in other ways.<sup>10</sup>

However, by the very mode of transfer – the physical migration of the knowledge carriers into the commercial sphere – the knowledge carriers are cut off from the further development of that knowledge in the academic sphere. Even with considerable communication effort, it is, in most cases, not possible for a scientist who has left academic research to keep up with the rapid development of the tacit knowledge components there.<sup>11</sup>

Therefore, the problem of transferring tacit state-of-the-art knowledge can always only temporarily be solved. To retain the tacit knowledge transfer, ever new cohorts of scientists and engineers from academic

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<sup>8</sup> Cohen, W. M. – Levinthal, D. A. (1989). Innovation and Learning: The Two Faces of R&D. *The Economic Journal*, Vol. 99, 569–596.

<sup>9</sup> Szerlag, A. (2014). National diversity versus citizenship as social capital exemplified by Polish families living in the Vilnius Region. *Czech-Polish Historical and Pedagogical Journal*, 6/2, 3–13.

<sup>10</sup> Duchak, O. (2014). Visual literacy in educational practice. *Czech-Polish Historical and Pedagogical Journal*, 6/2, 41–48.

<sup>11</sup> Zellner, C. (2003). The Economic Effects of Basic Research: Evidence for Embodied Knowledge Transfer via Scientists' Migration. *Research Policy*, Vol. 32, No. 10, pp. 1881–1895.

research need to be attracted into the commercial sphere with a frequency that depends on the decay time of the tacit knowledge they embody.<sup>12</sup>

### Methodology

This study has been mostly conducted based on qualitative approach and an inductive method. It means that at first in the context and sentences (as units of analysis), repeatability of data was understood and the components related to knowledge commercialization were extracted from existing models and then the intended classification was done. Content analysis of qualitative data is mainly considered inductive and it attempts to reach a theoretical conclusion through direct reference to the data.

In this study, Harvard, Stanford, Cambridge, Kyoto and Singapore Universities were studied. The reason behind choosing these five universities was according to the Times rankings based on five criteria (education, research, citations, international image and relations with industry) that were evaluated to identify how universities succeed and why in the commercialization of knowledge and changing ideas into wealth. Therefore, based on the method of this study that was qualitative, the conducted studies on innovations and inventions and the way of connections of these centres with technology and the use of knowledge and research in universities were analyzed.

The research population included the conducted studies about commercialization of knowledge by researchers and teachers and students in and out of the selected universities in a thirty-year time period (from 1986 to 2016) on about 70 domestic and foreign articles.

### Research tools

In this study, the method of triangulation was used for data gathering. This method is essentially a way of qualitative evaluation and an attempt to achieve convergent data.<sup>13</sup> For data collection, the

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<sup>12</sup> Bowden, V. (2000). *Managing to Make a Difference – Making An Impact On the Careers of Men and Women Scientists*. Aldershot: Ashgate.

<sup>13</sup> Delavar, A. (2001). *Scientific and theoretical principles of a research in social and humanistic sciences*. Tehran: Roshd Publications.

researcher used the triangulation method of data gathering in three library ways (reading books, articles and related texts available on the Internet).

## Findings

According to the conducted studies, in the commercialization of knowledge in universities, the factors of science and technology, realistic analysis of the market, identifying opportunities, knowledge dissemination, privatization, university planning, financing, investment for research and information management were identified as pervasive themes in the commercialization of knowledge. Infrastructures, policymaking and recognition of potential customers were major themes in these studies. Table 1 presents a summary of these items along with the organizer themes based on research findings.

Table (1) the main, pervasive and organizer themes in the commercialization of knowledge<sup>14</sup>

<b>Organizer theme</b>	<b>Pervasive theme</b>	<b>Main theme</b>
Knowledge should have commercial value	Science and technology	Infrastructures and policy
Knowledge as a particular commodity		
Availability		
Technological thinking		
Technology parks		
Disclosure of potential knowledge in marketing	Dissemination of knowledge	
Dealing in the transfer of intellectual property		
Technology transfer services		
Transition from the stage of pure science		
Transaction to the transfer of intellectual assets		
Transferring concession for intellectual assets derived from research		
Technology transfer service	University Planning	
Creating structures and needed investment to support intellectual property		

Protection of research results through intellectual property rights	Financial resources	
Paying attention to the public interests as well as those of inventors and authors		
Identifying the university external commitments to the intellectual property despite the arrangement of financial support to other advocates for the development of intellectual property by agents outside the university		
Strong protection of intellectual assets in value creation for university or community		
Conflict management and encouraging synergies with the mission of the university		
Intellectual Asset Management		
Culturalization of university		
University-industry Linkage		
Services and financial support		
Helping the researchers in obtaining patent protection for technology	Funding for research	
Services funding for the formation of new companies and risky transactions		
Securing the technology		
Supporting the common rights of researchers in relation to their products and intellectual efforts	Funding for research	
Focusing on countries of technology commercialization		
Universities should play a strengthening role in knowledge production and innovation		
Provider of human resources		
Creating intrinsic motivation		

<sup>14</sup> Refer to the following resources and websites for accessing the main sources of the above Table [www.provost.harvard.edu](http://www.provost.harvard.edu)  
Intellectual property, patents and licences, UK  
Yal policy in inteklectual property patents and licensing agriments [www.enterprise.com.ac.uk](http://www.enterprise.com.ac.uk)  
[www.imperialinnovations.co.uk](http://www.imperialinnovations.co.uk)

development of new adventurous businesses associated with management technologies	Data management	Identifying potential customers	
Advising the university president on issues related to intellectual property management			
Protection of research results through intellectual property rights			
University professors should be supporters of non-local economic development Commercial capacity assessment			
Marketing for invention			
Focusing on the things that have most positive impacts on business			
Focusing on business incentives			
Registration of patent in due time			
Searching for business partners			A realistic analysis of the market
Identifying commercialization opportunities in the industry			
Dialogue on reasonable and fair conditions that reflect the role of transferred assets and expertise			
Market Analysis			
Negotiation of concession			
Assessing the social benefits of commercialization			
Business assessment of intellectual property	Identifying (internal) opportunities		
Identifying the research results that have potential commercial value			
Exploitation of foreign knowledge			
Training the managers for identifying commercialization opportunities			
Identification of practical programmes			

## Conclusion

This research study reviewed the effective factors in the commercialization of knowledge in the world in selected universities. Nowadays the commercialization of university research has changed into one of the important fields of state and university research. Universities and active research institutions intend to create financial resources in both research and commercial activities. According to the results of the study, policymaking, university infrastructure, identifying opportunities and potential customers are some of the most important factors in the commercialization of knowledge. In this era of globalization and fierce competition, the aim of commercializing and its direction has an important role in the expansion of research activities and development of the country. The results of the present study show that in the commercialization of university research only support and financial services are not sufficient and acculturation, focusing on policies, management infrastructure, and rapid recognition of the market demands are also required for the successful commercialization of university research.