

Researchers' Motivation And Expectation In Connection With Patenting And Technology Transfer Offices In Hungary

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Abstract

In the recent decades the role of universities has been changed towards commercialization of the academic knowledge. Owing to the Bayh-Dole Act and its consequences, technology transfer offices have emerged in order to promote commercial activities between academia and industry. There are concerns that engagement in commercialization may divert scientists from basic research, but recent studies concluded that engaging in business utilization along with the traditional functions yield more benefit. Technology transfer offices (TTO) could play a determinative role in encouraging scientists and creating a productive environment for successful knowledge transfer. Although the role of scientists in technology transfer process is crucial, there are only a few studies regarding researchers' motivation and their expectations for technology transfer offices. TTOs are expected to support academics in various fields of commercialization, but in contrast there are evidences that significant proportion of researchers is sceptical about the impact of university patenting. This brings up the question how to coordinate and establish effective technology transfer if the target audience do not believe in its prosperous impact. Without any doubt there are great concerns expressed by scientists which should be understood firstly in order to motivate them effectively. In this study we have conducted 14 in-depth interviews with scientists at scientifically respected high-level universities in Hungary to better understand their motivations and attitudes towards technology transfer. We found that scientists engaged in patenting are motivated mainly by scientific curiosity and the need of creating something applicable for the society. Reputational and financial incentives play less important role. We concluded that patenting and unsuccessful commercialization could make researchers disappointed leading to the loss of motivation towards technology transfer due to the negative experiences gained and the significant efforts spent on patenting. It has an important effect on the decision to be taken by academics whether to patent or not to patent. Our results show technology transfer offices playing an essential role in patenting, but scientists perceive it insufficient in commercialization. There are external and internal barriers which are either difficult to handle or cannot be overcome by the technology transfer offices whose role is more complementary than substitutionally at universities.

Keywords

technology transfer, researcher, motivation, expectation, patenting.

1 Introduction

The role of universities has been changed towards engaging in commercialization (Etzkowitz et al., 2000; Rasmussen et al., 2006) that was triggered by the Bayh-Dole Act. It has permitted universities to preserve the ownership rights of patents developed by scientists. On one hand this is a great opportunity for universities to gain financial resources through commercialization but on the other hand a new business model should have been developed for these public funded institutions.

Number of papers focus on the relationship between university and industry, while the importance of the individual researchers could be even higher owing to their essential role during the technology transfer process. The universities are inherently public institutions and this implies the question to what extent they can utilize the scientific results and how they can enforce their will against industrial actors who sometimes follow an opportunistic behaviour. There is no doubt that a supportive university policy should be introduced along with an effective technology transfer office to create a productive environment for successful commercialization of scientific results. To reach our objective we have to shift our focus on to the level of individual researchers who might be lack of motivation engaging in commercialization and who are affected by the organizational elements of the changing economy as well (Buzás, 2003).

The goal of this study is to better understand the scientists' motivation related to patenting scientific results and their involvement during the process. Furthermore we aim to determine their expectations for technology transfer offices at universities. These results can support policies of encouraging the involvement of scientists in patenting and we should also consider incentives tailored to individual researchers in order to enhance higher efficiency in commercialization. We reveal the main obstacles perceived by academics, which could have a negative impact on the university technology transfer process.

This paper begins with the review of previous studies dealing with scientists' motivation and expectation in connection with the technology transfer offices, thereafter our research design and empirical results of the in-depth interviews are introduced. Finally we draw the conclusions and give proposals for further development of research.

2 Researchers' Motivation Engaging in Commercialization

Knowledge transfer could happen through different channels e.g. publication, conference participation, consulting, etc. as well as patenting or entrepreneurial activities. The commercialization is referred to as a subcategory of knowledge transfer in the literature which could happen in the form of patenting, licencing or entrepreneurship. Recent studies assume participation in commercialization is mainly triggered by reputational

rewards (ribbon), scientific curiosity (puzzle) and financial incentives (gold) as Lam (2011) described.

Most of the scientists are motivated by reputation, which leads them to follow commercial endeavour (Lam, 2011) enhancing their prestige as well (Baldini et al., 2007). However these results highlight the importance of reputation perceived by peers, there are opposite results that have not showed significant relationship between entrepreneurial intentions and opinion of colleagues (Goethner et al., 2012).

While reputation is usually an extrinsic motivational factor, the puzzle-solving is an intrinsic driver which leads researchers to pursuit their scientific curiosity. Lam (2011) has found scientific curiosity as one of the main driver which was not approached earlier in details.

Some authors (Baldini et al., 2007; Lam, 2011) pointed out that financial factors play less important role in motivations than other rewards, however increased revenues shared with the inventors have a positive effect on university patenting activities (Lach and Schankerman, 2008; Nilsson et al., 2010). According to the results of recent studies policy makers should introduce other types of incentives instead of monetary rewards in order to foster knowledge commercialization (D'Este and Perkmann, 2011). Focusing on entrepreneurial behavior resulting in spin-off formation Renault (2006) found that revenues can affect the scientists' behaviour, but financial factors have only indirect effect on their entrepreneurial intentions (Goethner et al., 2012) through psychological determinants.

Another motivation to get involved in commercialization is to raise and secure funds for ongoing or further researches (Baldini et al., 2006; D'Este and Perkmann, 2011; Nilsson et al., 2010). This is somehow relating to the monetary rewards, but it is more research-focused instead of individual financial interest. The importance of this objective could be explained by the changed funding structure of universities which forces them to engage in commercialization and to intensify their interaction with industry (Rasmussen et al., 2006).

After a successful patent application, spin-off creation could be a useful channel for technology transfer between universities and the industry. Despite of the numerous advantages of this kind of transfer there are obstacles that pull back scientists from entrepreneurship, e.g. workload, research and teaching duties, obstacles in their personal circumstances, family duties or leisure opportunities (Goethner et al., 2012).

3 Researchers' Expectations in Connection with Technology Transfer

Technology transfer offices (TTO) could play a determinative role in encouraging scientists and creating a productive environment for successful knowledge transfer. There-

fore TTOs are expected to support academia in various fields of commercialization, but in contrast there are evidences that significant proportion of researchers is sceptical about the impact of university patenting (Davis et al. 2011). This brings up the question how to coordinate and establish effective technology transfer if the target audience do not believe in its prosperous impact. Without any doubt there are great concerns expressed by scientists that should be understood firstly in order to motivate them effectively.

Recent studies emphasize that engagement in commercialization may divert scientists from basic research (Geuna and Nesta, 2006) and may restrict communication between academics (Welsh et al., 2008) indicating the negative impact of patenting on the norms of open science (Davis et al., 2011). Nevertheless other authors concluded that engaging in commercialization along with the traditional functions of the university yield more benefit (Etzkowitz, 2003; Grimaldi et al., 2011; Godin and Gingras, 2000; Gulbrandsen and Smeby, 2005). In accordance with the protesters Welsh et al. (2008) also found that scientists believe university IP policies are aiming to increase revenues firstly instead of addressing public good issues. These studies highlight the different opinions and the complex nature of commercialization effecting academics which is supported by results, notably Renault (2006) stated that scientists have different attitudes toward commercialization regardless of the type of university, age of researcher or level of academic quality measured by publication.

Considering the time spent on teaching and research liabilities at academia it is not surprising scientists perceive patenting as a time-consuming process (Renault, 2006). Thus the availability of TTO and prompt administrative procedures are essential which affect scientists' engagement in commercialization positively (Baldini, 2010). In some cases researchers are not familiar even with the technology transfer process, e.g. they are not sure whether the scientific result is patentable or not (Renault, 2006), so in such situations TTO should offer assistance to them.

An important task of the TTO is to act as a contact facilitator between university and industry and to attract industrial partners, because some researchers are ignorant about the commercialization opportunities (Van Dierdonck et al., 1990). Such activities and the commitment of universities to exploit the inventions could also encourage scientists engaging in commercialization (Baldini, 2010). But there is no agreement on what level of mediation or coordination the TTO should follow during the technology transfer process. After bridging the scientists to the industrial partners, TTO should let them act without any further interference because structuring the technology transfer process overly probably fail the objectives, in addition interactions between universities and industry should grow in a spontaneous manner (Van Dierdonck et al. 1990). If we accept this argument we also should consider whether the scientists are able to manage the commercialization process alone.

In most countries the corresponding law and university policies oblige scientists to cooperate with TTO, but there are countries where the ownership rights of scientific results are granted to the researchers at universities (professors' privilege). Nilsson et al. (2010) suggest that such tenure system could encourage scientists more and reach higher benefit. The countries where academic inventors are granted for utilization of scientific results allow them to decide whether or not to collaborate with the TTO during the technology transfer process. The decision mainly depends on the competence of the TTO perceived by the scientist and the social capital of the individual researcher (Nilsson et al., 2010). But what can scientists do if they feel themselves more competent and are obliged to cooperate with TTO in other countries? Unfortunately there are evidences, which assume that in some cases scientists bypass the university regulation (Audretsch et al., 2006; Bercovitz and Reldmann, 2008) in order to exploit business benefits solely.

There are two ways of interpreting these results: either researchers value themselves being able to perform better than the experts of the TTO or some researchers believe that commercialization process is more effective with the TTO than without. While the former emphasizes less influence, the latter concludes the essential role of TTO. Following the last argument there are issues difficult to be managed by scientists themselves due to the complexity of technology transfer process. For instance legal protection is a task of TTOs which is typically recognised by academics, because the protection of intellectual assets from piracy and counterfeiting should be one of the main objectives of university IP policies (Welsh et al., 2008).

As we have seen, there are different motivational factors which have impact on scientists' behavior. According to the previous studies, reputation and problem-solving curiosity play determinative role, while the importance of financial factors is still open to dispute. Expectations for technology transfer offices differ and the perception of their impact on successful commercialization is questionable.

4 Method

This study focuses on the motivation and expectation of researchers in connection with patenting and technology transfer process. We approached the level of individual researchers, because they play crucial role during the technology transfer process.

14 in-depth interviews have been conducted with researchers at scientifically respected high-level universities in Hungary, at the University of Szeged, University of Pécs and Eötvös Loránd University. The researchers have mostly gained experiences in connection with patenting as inventors and have cooperated with technology transfer offices. They have been selected primarily based on these criterias and the colleagues of the corresponding technology transfer office got us them connected. Table 1 presents the list of the scientists regarding research field and research experiences.

	Research field	Research experiences (years)
1.	Biotechnology	40-45
2.	Tissue Engineering	30-35
3.	Biochemistry	10-15
4.	Medical Chemistry	45-50
5.	Nanotechnology	40-45
6.	Nanotechnology	15-20
7.	Dermatology	30-35
8.	Food Engineering	20-25
9.	Pharmaceutical Chemistry	35-40
10.	Pharmacology	20-25
11.	Biopharmacy	15-20
12.	Pharmaceutical Chemistry	15-20
13.	Biophysics	10-15
14.	Software Development	10-15

Table 1: List of interview partners

The prepared interview guideline consisted of 25 questions which focused on the general researcher's intentions, experiences and attitudes towards patenting and technology transfer offices. The interviews lasted around 45-70 minutes depending on the available time of the researchers. The interviews were semi-structured and tailored on the experiences and attitudes of the researchers which allowed us to acquire information outside the scope of the prepared interview questions.

In the next section the results will be discussed highlighting the main findings of the interviews compared to the results provided in the literature.

5 Empirical Results

In this section we show our empirical results gathered during the in-depth interviews which are structured as general motivational factors, patenting intentions and expectations for technology transfer offices.

5.1 What motivates scientists during their research?

Almost all of the researchers claimed that scientific curiosity is the main motivation of their research, which was triggered by mainly their experiences gathered during the basic education or university studies. According to their opinion, it is not worth to be engaged to academia and take part in research without any curiosity. As an interviewee said:

"... I have always wanted to be a scientist, I was not interested in industrial research ... or in the education, I wanted to get familiar with discoveries and to solve problems." (6.)

Most of the researchers earned several rewards that can gain reputation among academics. Some of them expressed their opinion that such scientific rewards do not motivate them during their research. A scientist stated that:

"Scientific rewards making me proud? To be honest, I have to say, I have never been interested in rewards." (7.)

A scientific reward cannot be a goal of a research, which might be perceived positively by professionals, but it is not an important factor. Researchers were asked to express their opinion whether patents signify any respect among academics or not. They agreed that it does not have any positive effect on their scientific recognition at university. Interestingly a few researchers stated that patenting could have even a negative effect, because the traditional academics at universities perceive patenting as a lower level activity which does not follow the norms of open science and academia. Two interviewees said:

"... I had a research fellow who have worked here, ... he wanted to patent with the university..., but he was fired from the university due to a conflict triggered by patenting" (3.)

"... Scientists those who want to reach more, than the others (through patenting), look suspicious." (7.)

Considering the financial incentives scientists were not motivated in general. A few researchers had some remarks which suggested that it could affect their behavior positively, but it is not a main driver. The researchers do not perceive patenting as a way of getting rich or earning significant revenues. According to their experiences gained during previous patenting the main disadvantages are the followings: successful commercialization is difficult and its profitability is questionable. Furthermore the significant proportion of the potential revenues will be gained by the industrial partner instead of the inventor or the university. The low importance of financial incentives is also supported by the fact that most of the scientists did not inquire about the proportion of revenue guaranteed to them as an inventor if the patent is successfully commercialized. In this case we cannot assume financial factors as an important driver if the scientists are

not aware of their approximate financial income from the research results. One researcher stated that:

“... I do not even have a basis of comparison how much financial proportion would I get from commercialization... I do not say that I reject this part, but I do not want to deal with it, I feel myself much more as a scientist,...” (3.)

If the research pursuit is triggered by mainly curiosity as an intrinsic driver, what motivate scientists to patent even if they cannot expect reputational and financial gain from patenting? Scientists expressed that conducting researches only for curiosity reasons does not meet their need to create something concrete and applicable. The final objective is always to adopt the scientific finding into the practice. It has two aspects on one hand to increase the welfare because one of the most important goals of universities is to serve the society and on the other hand to be perceived as an inventor and to own an invention. The latter was appeared just in a few cases.

5.2 Does it worth to patent?

Scientists were asked to evaluate patenting based on their experiences and insights. They all agreed that patenting their research finding is important, however they reported the disadvantages and limitations of the procedure as well.

Scientists stated that patenting is a time-consuming activity. They are familiar with the procedure of publishing research results in scientific articles, but patenting is quite different. An interviewee expressed:

“They (other researchers) have really naive thoughts (about patenting), researchers perceive it as a simple procedure because they are concentrating too much on the scientific part. ...they have gained experiences of publishing, convincing reviewers and they try to use the same way of thinking in patenting as well.” (11.)

This requires a different mindset from academics which is difficult to acquire. Furthermore occasionally additional experiments are needed during the patenting process in order to confirm successfully the novelty and the effects of the scientific result. But these experiments are usually not challenging for scientists and they do not motivate them at all.

Patents generally have to meet various requirements e.g. to be novelty, to be based on inventive activity and to be applicable by the industry, etc. Whereas scientists pointed out that these requirements do not include the necessity of the patentable scientific result to be based on real industrial needs. If the patent do not provide solution for any need in the industry it is simply needless. Therefore it is important to consider the industrial needs at the design of researcher agenda.

In the academic career ladder the quality of researchers is mainly measured by publications. If researchers engage in patenting they are not allowed to publish the scientific results until the patent application and have to take be careful in order to avoid novelty-destroying. An interviewee highlighted the main problem of publishing:

“If there is a scientific result which would enjoy public interest ... and the researcher publishes it, it will never be used. So the publication is contraproductive.” (11.)

Considering the duration of patenting, which might last many years, researchers are not allowed to publish important information about the results. It is obvious how these disadvantages could pull back scientists in their career path. There were academics who perceived patenting as an obstacle in his personal or in his research group development, but just a few scientists were aware of how publishing and patenting is managable in parallel.

Summarizing the different aspects listed above it is apparent researchers perceive patenting as a difficult process that do not necessarily meet the major objectives of conducting research at universities. It does not provide reputation, as mentioned previously and scientists with needless or unmarketable patent are perceived as unsuccessful by peers. Considering the efforts spent on patenting and its possible unintended negative effects on the inventor, it is questionable why some academics are willing to patent again while most of the researchers interviewed have not marketed successfully any patent yet. In some cases the researchers have expressed that if a patentable scientific result is found, they would use it rather for publication than commercial purposes due to the limitations of patents and previous experiences.

5.3 Expectations for technology transfer offices

Surprisingly, the majority of researchers were found to be not familiar with technology transfer office, e.g. what their basic tasks are, what they are responsible for and what services do they provide. Researchers reported that there was no seminar or workshop where they could be informed about the main functions of the offices but they would appreciate such events.

Scientists stated that the involvement of the technology transfer office in patenting is essential due to its complex procedure and time-consuming administration. But there was no agreement on how the tasks between scientists and technology transfer offices should be distributed during the commercialization. A few researchers feel themselves able to conduct negotiations with industrial partners while others do not. A researcher stated that:

“We do not have any experience in partnering and we are not even competent in it.” (3.)

In some cases the technology transfer office is expected to develop and recommend application opportunities of the patent for researcher, but some academics do not perceive the personnel in technology transfer offices competent to do it. They argue that only scientists are able to understand the scientific result in details due to its specific features therefore technology transfer offices should concentrate on other tasks.

During the interviews it turned out that most of the patents have not been marketed yet. Scientists were asked to evaluate the efficiency of the technology transfer office at their university. There was a consensus that the efficiency of the TTO could be higher because considering the revenues generated from technology transfer do not balance the efforts spent on commercialization. But the question how to increase efficiency at TTO splits the scientists who had different opinions and views about it. These opinions could be divided into different categories.

Firstly, external barriers like insufficient economic environment, lack of partners, geographic distance, etc. These obstacles cannot be handled by the TTO according to the scientists. In these cases they appreciate the effort taken by the personnel of TTO but scientists are sceptical about its efficiency.

Secondly, internal barriers within the TTO, like few personnel who cannot cover all the tasks. In addition some researchers perceive them incompetent either to understand the research in details or to perform own profession like partnering, market research, etc. An interviewee told the following:

"There is no marketing. They even do not know how to do it (marketing)...There is nobody to embrace certain ideas and to visit the whole country (for commercial purposes)" (5.)

Furthermore the fluctuation within TTO also negatively affects the technology transfer process. Researchers think TTO could develop more in these aspects but some of them noted that financial resources could be the main barrier of hiring more competent and well-experienced experts at TTOs. Nevertheless researchers have concerns that increased resources provided to TTO will not induce development in efficiency due to the external barriers.

Thirdly, internal barriers at the university also negatively affect the efficiency of TTO. For instance the research agendas do not focus on industrial needs and researchers perceive peers being not interested in patenting or any opportunity in commercializing scientific results.

Summarizing the experiences discussed above the role of technology transfer offices during the commercialization process is rather complementary than substitutionary. Although some tasks could be also managed by scientists, the assistance of TTO along with the commercialization process is necessary to enhance efficiency and meet the objectives of both the researcher and the university as well even if the general efficiency of the TTO could be higher. Without the TTO the researchers would not engage in com-

mercialization because they are not familiar with the process and they could not fund the patent application alone. These arguments also emphasize the importance of the TTOs at universities.

6 Discussion

In the literature review we have seen that researchers are motivated by different factors. In our study we have found reputation as a less important driver which is in contrast with results of previous studies (Baldini et al., 2007; Lam, 2011) while scientific curiosity was determined as an important motivational factor which is supported by Lam (2011) as well. Furthermore we have found that researchers who have gained experience in patenting are motivated to create something applicable which can affect commercialization potential positively. There was a difference of opinions in previous studies regarding financial incentives, some authors argued in favor of its importance (Lach and Schankerman, 2008; Nilsson et al., 2010, Renault, 2006) while others have not found significant impact on commercialization activities (Baldini et al., 2007; Lam, 2011). Our results support the latter opinion, because researchers do not consider financial opportunities during their research agenda and do not perceive patenting and commercialization as a way of getting rich. In accordance with the results provided by previous studies (Baldini et al. 2006; D'Este and Perkamann, 2011; Nilsson et al., 2010) researchers in Hungary were also motivated during their research to secure funds for further research projects but commercialization is not the way to do it. We assume that because of most of the patents owned by scientists and universities have not been successfully commercialized yet therefore they do not yield significant revenues for further researches. These researches are funded mainly by available public funds or industrial partners through contract researches.

Our findings highlight the disadvantages of patenting and commercialization that the researchers face. These experiences could discourage scientists from patenting and engagement in commercialization. It is important to preserve and maintain their motivation during the lifecycle of the technology transfer otherwise universities will lose their well performing scientists from the commercial point of view. Similarly to Renault (2006) the researchers perceive patenting as a time-consuming activity, therefore prompt administrative procedures could have positive effect (Baldini, 2010).

Davis et al. (2011) highlighted that researchers are sceptical about the impact of the technology transfer offices, which was determined by our study in Hungary as well. Researchers did not note that commercialization would have a negative effect on the science itself as some authors stated (Geuna and Nesta, 2006; Welsh et al., 2008), but a few scientists had difficulties in their career path due to the unintended disadvantages of patenting. Scientists agreed on that technology transfer offices have to provide assistance through patenting procedure, but regarding the commercialization process they had different opinions about the distribution of tasks between scientists and technology

transfer offices. As we have seen that there are different barriers perceived by scientists which could affect the technology transfer process significantly. Our study did not investigate that whether these obstacles exist only in Hungary or in other countries as well, but it would be worth to make a comparison between industrially more developed countries in Western Europe or in U.S. and Central and Eastern European countries. Such research could reveal the influences of different cultures and economic development between regions which might bring new aspects into the investigation of technology transfer process.

7 Conclusions and Recommendations

This study attempts to provide results about the motivations of scientists and their expectations regarding the technology transfer process. In some cases the results were in contrast with the findings of previous studies which emphasize the importance and the complexity of the topic.

The sample (14 in-depth interviews) of the researchers was small, but the results are indicative and comparable. In order to be precise, however, we also have to note that the interviewees have already gained experiences in patenting and they were selected by colleagues of corresponding technology transfer offices which could affect their attitude. Furthermore they might not reveal specific problems in order to avoid conflict with the technology transfer office at the university. Another limitation of the research is the small sample of the researchers who were unequally represented by research fields in this study.

Despite all these limitations our study has remarkable results. According to scientists patenting does not support reputational gain, so it cannot be triggered by motivations related to reputation or prestige. Scientific curiosity were determined as a main driver, but it should closely belong to the need of creating something applicable and patentable otherwise such research pursuits are useless from the technology transfer point of view. During the interviews we found that financial incentives do not have significant effect on researchers' behavior and they do not believe patenting could yield significant revenues from commercialization. Scientists perceive patenting as an important activity at the university but some researchers have been disappointed because patenting did not meet their previous expectations. Therefore a few of them shifted their focus towards concentrating on their scientific career instead of engagement in patenting which could accompany more disadvantages than benefits. In connection with the technology transfer offices it was determined that scientists are not really familiar with the technology transfer process. They agreed on that the participation of the TTO is necessary in patenting, because without its assistance they would never be able to manage the procedure. There was also consensus that the efficiency of TTO could be higher, but scientists experienced various barriers which affect negatively its success. These barriers partly derive from the external environment which cannot be managed by the TTO, while inter-

nal barriers were also determined within the university and within the TTO by academics. Finally the presence of TTOs at universities was perceived essential which play rather complementary role instead of substitutionary regarding the tasks of commercialization.

This study has further development opportunities. Firstly, extending the sample to other universities could provide information about differences between either universities or scientific fields. Secondly, asking the representatives of technology transfer offices how they satisfy the needs of researchers and how they motivate them, which could be an interesting analysis of the perception of both researchers and TTO. Thirdly, it would be advisable to make a research which accompanies scientists during the patenting and commercialization process in order to measure their motivation along the lifecycle and determine the main obstacles that scientists have to face. Such research would give more insights on researchers' motivation and potential threats affecting the commercialization.

References

- Audretsch, D. B., Aldridge, T. T., Oettl, A. (2006) 'The knowledge filter and economic growth: The role of scientist entrepreneurship.' Kauffman Foundation Large Research Projects Research, available from: <http://ssrn.com/abstract=1456458> [04 December 2014]
- Baldini, N. (2010) 'Do royalties really foster university patenting activity? An answer from Italy.' *Technovation*, 30 (2) 109-116
- Baldini, N., Grimaldi, R. and Sobrero, M. (2006) 'Institutional changes and the commercialization of academic knowledge: A study of Italian universities' patenting activities between 1965 and 2002.' *Research Policy*, 35 (4), 518-532
- Baldini, N., Grimaldi, R. and Sobrero, M. (2007) 'To patent or not to patent? A survey of Italian inventors on motivations, incentives, and obstacles to university patenting.' *Scientometrics*, 70, 2, 333-354
- Bercovitz, J. and Feldmann, M. (2008) 'Academic entrepreneurs: Organizational change at the individual level.' *Organization Science*, 19 (1) 69-89
- Buzás, N. (2003) 'Organizational elements of knowledge transfer in Hungary: Towards a functional system of innovation.' In: *Knowledge transfer, small and medium-sized enterprises, and regional development in Hungary*. ed. by Lengyel, I. Szeged: JATE Press: 32-46
- D'Este, P. and Perkmann, M. (2011) 'Why do Academics Engage with Industry? The Entrepreneurial University and Individual Motivations.' *Journal of Technology Transfer*, 36 (3) 316-339
- Davis, L., Larsen, M. T. and Lotz, P. (2011) 'Scientists' perspectives concerning the effects of university patenting on the conduct of academic research in the life sciences.' *Journal of Technology Transfer*, 36 (1) 14-37
- Etzkowitz, H. (2003) 'Research groups as 'quasi-firms': the invention of the entrepreneurial university.' *Research Policy*, 32 (1), 109-121
- Etzkowitz, H., Webster, A., Gebhardt, C. and Terra, B. R. C. (2000) 'The future of the university and the university of the future: evolution of ivory tower to entrepreneurial paradigm.' *Research Policy*, 29 (2), 313-330
- Geuna, A. and Nesta, L. J.J. (2006) 'University patenting and its effects on academic research: The emerging European evidence.' *Research Policy*, 35 (6), 790-807

- Godin, B. and Gingras, Y. (2000) 'The place of universities in the system of knowledge production.' *Research Policy*, 29 (2), 273-278
- Goethner, M., Obschonka, M., Silbereisen, R. K. and Cantner, U. (2012) 'Scientists' transition to academic entrepreneurship: Economic and psychological determinants.' *Journal of Economic Psychology*, 33 (3), 628-641
- Grimaldi, R., Kenney, M., Siegel, D. S. and Wright, M. (2011) '30 years after Bayh-Dole: Reassessing academic entrepreneurship.' *Research Policy*, 40 (8), 1045-1057
- Gulbrandsen, M. and Smeby, J-C. (2005) 'Industry funding and university professors' research performance.' *Research Policy*, 34 (6), 932-950
- Lach, S. and Schankerman, M. (2008) 'Incentives and invention in universities.' *RAND Journal of Economics*, 39 (2), 403-433
- Lam, A. (2011) 'What motivates academic scientists to engage in research commercialization: 'Gold', 'ribbon' or 'puzzle'?' *Research Policy*, 40 (10), 1354-1368
- Nilsson, A. S., Rickne, A. and Bengtsson, L. (2010) 'Transfer of academic research: uncovering the grey zone.' *Journal of Technology Transfer*, 35 (6), 617-636
- Rasmussen, E., Moen, Ø. and Gulbrandsen, M (2006) 'Initiatives to promote commercialization of university knowledge.' *Technovation*, 26 (4), 518-533
- Renault, C. S. (2006) 'Academic capitalism and university incentives for faculty entrepreneurship.' *Journal of Technology Transfer*, 31 (2), 227-239
- Van Dierdonck, R., Debackere, K. and Engelen, B. (1990) 'University-industry relationships: How does Belgian academic community feel about it?' *Research Policy*, 19 (6), 551-566
- Welsh, R., Glenna, L., Laey, W. and Biscotti, D. (2008) 'Close enough but not too far: Assessing the effects of university–industry research relationships and the rise of academic capitalism.' *Research Policy*, 37 (10), 1854-1864