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Student theses oriented on solving business problems as an effective factor of firms' innovativeness

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Abstract

This aim of this paper is to explore the role and usefulness of applied student theses dedicated to solve specified firms' problems from the perspective of firms manage. The additional value of such theses is connected with increase of interpersonal relations between universities and firms as well as decrease costs of recruitment in enterprises. The paper presents the results of research based on 50 interviews conducted in Krakow with representatives of firms for which such theses were prepared by students of five universities. Positive opinion about students engagement, high level of satisfaction of contacts with universities, usefulness and possibility of students theses implementation confirm that such kind of knowledge generated within this process is important for effective strategy of innovative development.

Keywords: Innovation, entrepreneurship

JEL codes: O31, L26

INTRODUCTION

Although the role of universities in regional development is relatively well recognised, most of research is concentrated on patents and expertise (Schoen & Buenstorf, 2013; Singh, Wong, & Ho, 2015). We try to analyse another way of innovative impact of univer-

sities through the process of preparing students' theses oriented to solving firms' problems. In section 1 we analyse the changing role of universities as part of an institutional system of innovative development. In section 2 direct interpersonal relations are analysed as a key value of firms' problem oriented student theses. In section 3 barriers of industry-university interactions are presented and followed by analysis of benefits generated during creation of applied students theses. In section 5 methodology of research is presented as well as results of research regarded usefulness of students' theses for enterprises (interviews were realised with 50 firms representatives).

UNIVERSITIES – PART OF INSTITUTIONAL SYSTEM OF INNOVATIVE DEVELOPMENT

Although universities were always centres of open discussion, exchange of ideas and education of elites, they were not seen as important actors in development, which was based mainly on government-industry interactions. In line with assumptions of a linear model of innovation common after the Second World War basic research was treated as an input for innovative development (Mowery & Sampat, 2005). The first attempts in the literature to include universities in this process were by Lowe (1982) and Sábato and Mackenzi (1982) but a more mature concept named the Triple Helix of university-industry-government relationships was developed in the 1990s by Etzkowitz (1993) and Etzkowitz and Leydesdorff (1995). In this concept not only the role of university in innovative development was stressed but also interactions among university, industry and government, which lead to new institutional and social forms for the knowledge production. Development of this concept in the (neo-) institutional perspective includes a statist configuration, where government plays the leading role, a laissez-faire configuration with limited role of the state and balanced configuration characterised by partnership relations among involved actors and even with a more active role for universities (Etzkowitz & Leydesdorff, 2000). This concept of the Triple Helix was later developed to the concept of Triple Helix Systems of Innovation (Ranga & Etzkowitz, 2013), which was a set of components, relationships and functions. These relationships among components were synthesized into five main types: technology transfer; collaboration and conflict moderation; collaborative leadership; substitution; and networking. The main function of a Triple Helix system goes beyond generating, diffusing and utilizing knowledge and innovation and is connected with the creation of special competences named 'Triple Helix Spaces' which cover the Knowledge, Innovation and Consensus Spaces and refer to entrepreneurial, societal, cultural and policy competencies (Ranga & Etzkowitz, 2013: 242).

The beginning of reorganization of universities in Europe in order to strengthen knowledge transfer to economy is connected with reforms introduced in Great Britain in early 1980s. This trend was stimulated also by wider processes of improving the efficiency of services in public administration which started in 1980 in UK and Australia named New Public Management (Hood, 1991). An approach treating citizens as customers to the public sector in administration was also developed in the system of higher education. The role of the state was slightly transferred from the supplier of public goods to market regulation (Mamica, 2018). This has had its consequences also at higher education system where mechanisms of competition were implemented (CHEPS, 1999; Salerno, 2004).

Mbah (2016) confirmed in his research that interconnections with wider community are an important determinant of universities' capacity to enhance local development.

Relations between universities and industry could be analysed as an important part of engaged scholarship concept, which is defined as “participative form of research for obtaining the different perspectives of key stakeholders (researchers, users, clients, sponsors, and practitioners) in studying complex problems” (Van de Ven: 2007: 9). The probability that solutions achieved by usage of this method will in a better way fulfil market expectations and take into account requirements of sustainable development, is much higher than in the case of innovations pushed by science or even driven by the market. The process of engaging both researchers and practitioners allows for more insightful results than in case of individual work (Simpson & Seibold, 2008). Boyer uses term the scholarship of discovery connected with intellectual climate of a university and stresses that it is “not just the outcomes, but the process, and especially the passion (1990: 17). This process is not just a transfer of knowledge from universities to firms but is characterised by interactions and lead to knowledge coproduction.

Not only research could be commercialized but also education as a part of university mission could be seen from this perspective as a product which could be sold and financed by systems of students fees. It means leaving the Humboldtian model of university as a community of scholars and students and increases the role of university managers concentrated on profit maximizing (Pinheiro, Karlsen, Kohoutek & Young, 2017). Laredo (2007) goes beyond only the expectation of production of new knowledge at universities, but he indicates its relations to economic and social targets. Such pressure on supporting of entrepreneurial ‘milieu’ was observed in UK as a response to consequences of the last global financial crisis (Charles, Kitagawa & Uyarra, 2014). Universities have to find equilibrium in a changing social environment and with reduced financing (Enders, 2013). Jessop (2017) underlines the growing tension between the public functions of universities (what gave them some autonomy from economic imperatives) and their profit-oriented role in the market economy. Looking for new methods of teaching is crucial not only in economic, utilitarian dimension but also “the identity of the modern, rational individual depends upon the direct teaching of abstract epistemically structured knowledge to successive generations” (Rata, 2017: 1003). Working on new application of already existed knowledge directed to solve real firms’ problems is a translation of this abstract knowledge into individual experience, verified by contact with practitioners. Innovations are not only limited to commercial units but are important as well for social dimension of development. McKelvey and Zaring (2017) stress different roles which universities can play in social innovation, despite strong pressure on their commercialisation via patents and start-ups. Students’ theses dedicated to solving social problems could be an effective method of the not-for-profit mission of universities and also help in development of much needed soft skills. Described in this paper is a model of applied student theses which could be an effective tool in broader actions of identification of students who have the capability to produce knowledge in non-standard innovative methods (Tierney & Holley, 2008).

DIRECT INTERPERSONAL RELATIONS AS A KEY VALUE OF FIRMS’ PROBLEM ORIENTED STUDENT THESES

Contacts of academics with firms during the process of thesis preparation by students support their networks of relations. Mosey and Wright (2007) show that those academics who developed commercial and social networks could be habitual entrepre-

neurs which can be an effective way to gain access to equity finance. Collaboration between firms and universities is determined by the development of cognitive and relational social capital (Steinmo, 2015). The first decade of 21st century saw an increased interest in the role of face-to-face communication and buzz in innovation development (Storper & Venables 2004; Bathelt, Malmberg & Maskell, 2004). Buzz is defined as a “key element of the socialisation that in turn allows people to be candidates for membership of ‘in-groups’ and to stay in such groups; and a direct source of psychological motivation” (Storper & Venables, 2004: 365). The role of such direct forms of communication was connected with development of the concept of interactive learning as a main source of innovation (Lundvall, 1992). Knowledge created and shared is known as a tacit knowledge (Polanyi, 1958: 1967).

Unintended knowledge spill-overs are treated as barriers in tacit knowledge diffusion and personal interaction (Boschma, 2005). The presence of students and sometimes thesis supervisors in firm, present an opportunity to perform actions indicated by von Krogh, Ichijo, and Nonaka (2000: 84) as crucial for transfer of tacit knowledge like mixture of “observation, imitation, narration, experimentation and join execution”. Students’ theses based on solving firms’ problems not only create an opportunity to share tacit knowledge of supervisor and firm staff, but also allow creation of both new tacit and codified knowledge. It supports such interactions as watching, listening, touching and discussing. Asheim, Coenen, and Vang (2007) point the role of buzz in the context of knowledge spillovers, which refers to rumours, impressions, recommendations, trade folklore and strategic information. They distinguish however between the importance of buzz and face-to-face communication in different industries, both equal in creative industries which are based on a symbolic knowledge base, and face-to-face communication as much more important for industries based on synthetic (engineering) or analytical (scientific) knowledge bases. Social ties established between students, their supervisors and colleagues play an important role in establishment of new interpersonal relations in innovation networks (Thune, 2006). They allow to maximise the trust among partners and support employment of the brightest students because of former contacts. Common working on finding non-standard solutions requires intensive interactions and fits into the context of pedagogy of conceptual progression which should, according to Rata (2015), develop relationships between the context-dependent knowledge of students’ experience and the context-independent knowledge of the academic subject.

The common work of student and faculty members in solving the real problem of the company/institution will in a natural way strengthen interactions and contact among them. The lack of interactions partly caused because of pressure of publishing has been described in one word as *impersonality* by Barzun who claims that as a consequence of limited relations “the university has lost its magic” ([1968] 1993, 208).

Although personal relations are crucial in problem-based learning there are some positive examples of this process done in virtual space (Gibbins & Brodie, 2008). Gibbins, Lidstone, and Bruce (2015) argue that most important for students engaged in problem-based learning is communication at a lower level, and at higher levels, complex educational issues associated with their own learning. The work done by Rajalo and Vadi (2017) confirmed that in university-industry collaboration relevant preconditions are individual rather than institutional levels of motivation and absorptive capacity. The

process of thesis knowledge transfer based on strong individual relations could lead to further university-industry collaboration.

Involvement of students in preparation of their thesis dedicated to selected firms within their chain of suppliers should be connected with special seminars at universities dedicated to these groups of students. This allows not only knowledge exchange among these firms but also increased levels of product and technology adjustment to the expectations of the goods' recipients. Additionally to the group of students from one university, young people from other universities increase the level of interdisciplinarity and can strengthen the innovativeness of proposed solutions. Besides engineers from technological universities, student teams could be supported by IT specialists, physicists, chemists, designers or economists. The structure of the student group should depend on the specifics of the industry. In the case of creative industries there could be also musicians and students from fine arts universities.

There is common agreement that spatial proximity supports industry-research relations (Fritsch & Slavtchev, 2007; D'Este & Iammarino, 2010; Musil & Eder, 2016). An important determinant of it is connected with fact that regional innovation systems vary because of different paths of knowledge and industrial accumulation (Asheim, 2012; Evangelista, Iammarino, Mastrostefano & Silvani, 2002). Applied student theses can use benefits of such spatial proximity and support the process of localised industrial accumulation.

BARRIERS OF INDUSTRY-UNIVERSITY INTERACTIONS

There are several factors which weaken the industry – university interactions. One of them is insufficient level of cognitive proximity, which does not allow industry to benefit from knowledge base of these institutions (Nesta & Saviotti, 2005). Among other factors are a lack of open and effective communication among stakeholders or lack of clarity among them (Muscio & Vallanti, 2014; Lawton & Leydesdorff, 2014). Research based on experiences of manufacturing firms located in the Emilia Romagna region in Italy showed that an R&D subsidy which supports their co-operation with universities and research institutes, but leaves some level of freedom in taking the decision to engage in this type of co-operation is an effective way stimulate co-operation (Marzucchi, Antonioli & Montresor, 2015). Link, Siegel, and Bozeman (2007) found that allocating by faculty members a relatively high percentage of their time to grants-related research increases the probability of their engagement in informal technology transfer. Implementation of university rules which regulates conflicts of interest between teaching responsibilities of academics and their external activities increases creation of R&D contracts and licenses (Caldera & Debande, 2010). Nowotny, Scott, and Gibbons (2003) connect decline in fundamental research at universities with increased commercialisation of research caused by lower public funds and increasing role of intellectual property rights. Strong pressure on universities to maximise their contribution to knowledge-based economy and intensification of relations with industry lead to a higher level of knowledge which is protected by law and privatised. This trend is with contradiction to the postulate of treating knowledge produced at the university as a public good with maximal positive impact on society and with free movement of ideas, which always stimulated growth (Jessop, 2007). There could be a conflict between private profits and positive externalities achieved when created knowledge is not commercialised and limited by intellectual

property law. This argument is used against the introduction of free capitalism market mechanisms in higher education (Marginson, 2013).

BENEFITS GENERATED BY PROCESS OF PREPARATION APPLIED STUDENTS THESES

Working by students during their theses preparation on real problem defined by firm representatives make this process more attractive for them and bring benefits for all engaged actors. Academics receive information about current industrial technological capacity and needs of firms. Students have higher chances for finding job connected with their interests. They also learn about interpersonal relations which take place in firms. Acquiring by students skills from the interaction with their supervisors increase the level of their satisfaction (Del Río, Díaz-Vázquez & Maside Sanfiz, 2017). Applied thesis support such kind of relations and increase engagement of employers in defining the course learning outcomes which in students' opinion is too narrow (Jorre & Oliver, 2018). The research among undergraduate students showed that those who reported having acquired skills from the interaction with their respective supervisors were significantly more satisfied (Del Río, Díaz-Vázquez & Maside Sanfiz, 2017). Even if the solutions proposed in students' theses are not implementable they receive a chance of deep negative case analysis so important in the process of action learning (Smith, 2017). Firms managers receive access to university laboratories and improve interpersonal relations with academics. Contacts with students during their theses preparation decrease costs of recruitment process and increase chances for finding appropriate employees. It is important because problems with staff recruitment are often treated as an major growth barrier (Coad & Reid, 2012). For firms cooperation with universities increase their brand name as a desired marketplace (Chandrasekaran, Littlefair & Stojcevski, 2015).

The amount of time and determination needed to prepare a Ph.D. thesis based on the development of a technological dilemma makes this process more valuable than in the case of bachelor and master students both for university and industry. There are several empirical researches that confirmed the importance of doctoral students in knowledge production at universities (Kyvik & Olsen, 2008; Slaughter, Campbell, Holleman & Morgan, 2002; Thune, 2009). Firms treat recruitment of graduate doctoral students as an important incentive for keeping relations with universities (Lam, 2001). The disproportion among number of Ph.D. students and positions at research institutions cause students to look for job offers by business. Many studies confirmed their important role in university-industry knowledge transfer (Graversen & Friis-Jensen, 2001; Herrera & Nieto, 2015). The empirical study on Ph.D. projects at Eindhoven University of Technology showed that collaborative projects outperform non-collaborative ones in the dimensions of both number of patents and patent citations and number of publications and their citation (Salimi, Bekkers & Frenken, 2015).

Knowledge generated during process of students theses creation could be seen as a step into minimising the substantive disconnect between universities and surrounding local entrepreneurial and innovation ecosystems which was analysed by Brown (2016) who suggested that entrepreneurial spill-overs from universities, especially in some peripheral regions like Scotland are exaggerated.

USEFULNESS OF STUDENTS' THESES FOR ENTERPRISES: RESULTS OF RESEARCH

Presented below opinions of firms representatives about different aspects of students theses dedicated to solve their problem were based on interviews with 50 of them. In April 2017, 400 emails were sent to students' thesis supervisors at 5 universities localised in Krakow (AGH University of Science and Technology, Cracow University of Economics, Cracow University of Technology, University of Agriculture in Krakow and The Academy of Fine Arts (only to Faculty of Industrial Design) in order to identify firms for which needs thesis were prepared. In effect 62 positive answers were received, while finally 50 interviews covered filling short questionnaires and open questions were conducted by the end of February 2018 (24 in field of technology, 16 at industrial design, 7 at economics and 3 at agriculture). Most of the interviews are available on-line at www.innowacyjnystart.pl (a regional platform dedicated to innovation policy). For statistical analysis was used the method of classification and regression trees (Breiman, Friedman, Olshen & Stone, 1984).

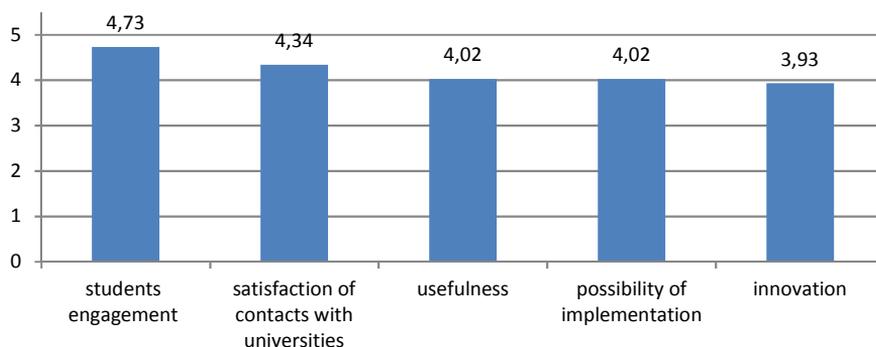


Figure 1. Opinions of managers about different aspects of applied students theses dedicated to firms' problems (in in 5 point scale, where 5 means very high usefulness and 1 very low).

Source: own elaboration.

The average score of usefulness of students' theses for enterprises as well as their possibility of implementation was relatively high: 4,02 (in 5 point scale, where 5 means very high and 1 very low). Firms managers appreciated especially students engagement in this process (average score 4,73). The level of innovation of these theses was estimated as satisfactory (average score 3,93). All of managers who declared previous experience in cooperation with universities (in 20 firms) except one declared that it was positive. The level of satisfaction of such contacts with universities was generally high (average score 4,34).

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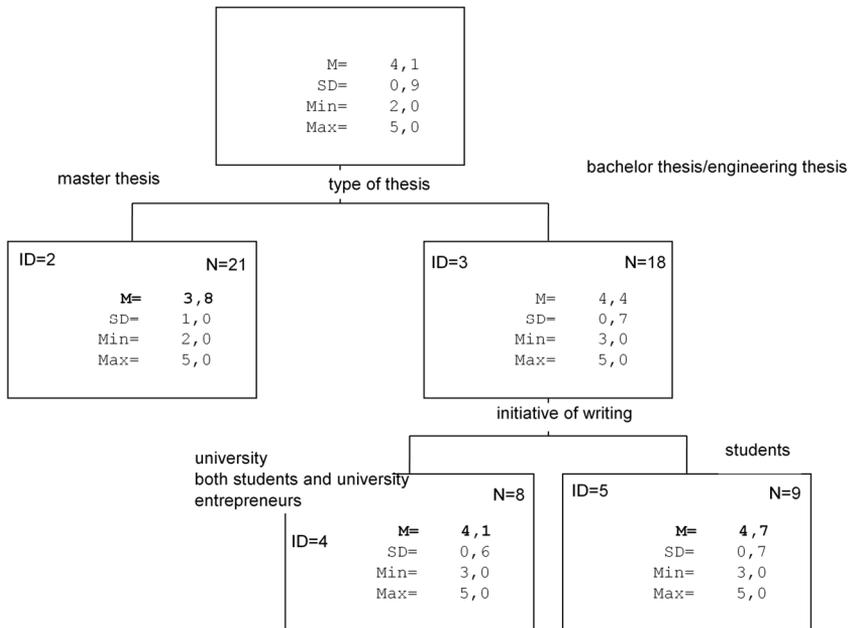


Figure 2. Chart regression tree model: usefulness of thesis for the enterprise (dependent variable)

Source: own elaboration.

SUMMARY

Universities do not use enough potential connected with process of students theses creation which are oriented on solving business problems. It increases interpersonal relations between universities and firms and allow to minimise costs of recruitment in enterprises. Applied student theses are possible because of spatial proximity and support the process of localised industrial accumulation. The research based on interviews with 50 firms managers who participated in the process of applied student thesis preparation confirmed high usefulness of such theses as well as possibility of implementation. It allows to formulate policy recommendation connected with implementation of incentives for academics connected with supervision of such kind of theses.

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