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INFLUENCING THE COMMERCIALIZATION OF INNOVATIVE RESEARCH RESULTS IN UNIVERSITIES OF ECONOMICS AND BUSINESS

Abstract

The majority of knowledge and technology transfer models relate to universities of technology and natural sciences whose commercialization potential allows them easily to adapt their outcomes to market demands. This, however, is not the case for universities of economics and business. Therefore, the aim of this paper relied on systematic literature studies performed with the use of a snowball sampling method. It was followed by an empirical study comprising nearly 60 in-depth interviews, 20 innovation audits and seven intellectual property valuations in Special Purpose Entity of Poznan University of Economics and Business. The study attempts to fulfil a research gap concerning the role of business schools in the commercialization of scientific research in Poland and other CEE countries.

Key words

knowledge management, knowledge commercialization, knowledge transfer, innovations

Introduction

The traditional Humboldt university model in which institutions of higher learning are focused predominantly on teaching and research is undergoing a revolution driven by the rapid advances of globalization, technology and today's economies. Universities are subject to far-reaching changes as they evolve from government-funded scholarly institutions into international know-how centers, frequently referred to as third-generation universities or 3Gus, as well as entrepreneurial universities [1]. According to Wissema [2], the new model of institutions of higher education aimed at commercializing research outcomes with the support of technology startups, technology-based companies and institutions which finance their operation, has become indispensable for scientific progress.

In recent years, growing interest in university-industry knowledge transfers has prompted a heated debate on the model that universities would be best advised to adopt and the activities they should pursue to promote effective engagement with industry and society at large [3]. Many scholars who studied university-industry connection mechanisms have argued that research collaborations are extremely important mechanisms for generating academic spillovers. Therefore, works by Etzkowitz and Leydesdorff [4, 5] on the Triple Helix Model (THM) followed by Quadruple and Quintuple Innovation Helices proposed by Carayannis and Cambell [6, 7] about interaction among university, industry, as well as government are the key to innovation and growth in a knowledge based economy.

Without a doubt, universities play an invaluable role in innovation systems. The importance of universities third mission support is included in the EU strategic documents, such as "Higher Education and Regions, Policy Brief" by OECD [8]. Korpysa [9] asserts that the spin-off companies he has studied are pursuing the Schumpeterian model of entrepreneurship, in which knowledge and business opportunities are employed to bring new solutions to market. However, universities' ability to create new knowledge and deploy it for economic benefit hinges on an array of economic, legal, social and political factors. Many additional internal influences arise within universities that determine the rates and directions of knowledge flow from that institution [10].

In view of the misgivings that have been identified, the article sets out to outline the factors that affect research outcome commercialization. The publication also attempts to respond to the problem presented by Wright and associates [11] regarding the role of business universities in the commercialization of research outcomes. Such commercialization was in the focus of nearly 60 in-depth interviews, 20 selected innovation

audits and seven intellectual property valuations at the Poznan University of Economics and Business conducted in the run-up to the establishment of a Special Purpose Entity.

The article also refers to observations by Gál and Ptaček [12], who relied on a study conducted in Hungary and the Czech Republic, to demonstrate the need for developing knowledge transfer models dedicated to universities in post-communist countries. Hence, in view of similarities in the economic and social environments, the examples quoted in this article may provide inspiration for other faculties of economics in Central and Eastern Europe.

Literature review

The literature on university-industry interaction usually displays patenting, licensing and formation of start-up companies as the main determinants of successful technology diffusion [13]. Shane [14] points out the importance of academic entrepreneurship, such as companies that form from university spin-offs in the commercialization process. According to Clarysse et al. [15], the number of academic spin-offs is accelerated by the ownership of intellectual property rights by technology transfer offices (TTOs), the pressure on universities to commercialize their research, as well as the support of public funds, as Fini et al. [16] confirmed. However, some authors suggest that publications, conferences, informal interactions and consulting [17], as well as formal arrangements such as contract research or joint research agreements [18] and personnel mobility, informal contacts or consulting relationships [19], are of greater importance. Perkmann and Walsh [20] summarize the university-industry links as research partnerships, research services, academic entrepreneurship, human resource transfer, informal interaction, commercialization of property rights and scientific publications.

Also, the latest publication on public policy measures designed to support knowledge transfer activities, which was based on a literature review [21], has identified a knowledge gap. As described earlier by Rasmussen and Rice, the reason the knowledge gap formed is that academic researchers and entrepreneurs lack the managerial skills and competences needed to advance their technologies or start-ups to a point at which successful negotiations with industrial partners or external investors may be conducted [22]. Carayannis and Dubina also point out the importance of intellectual capital and sustained investment in people as the main factors for the quality of innovation in smart, sustainable and inclusive growth [23].

Likewise, research by Boh, De-Haan and Strom [24] has shown the importance of business education in leveraging all potential university resources for technology transfer. According to the authors, entrepreneurship programs allow universities to leverage their own assets, bridging gaps between public funding of basic research, private funding of applied research, and research commercialization efforts. These programs are consistent with the universities' missions to educate, as well as to create and disseminate knowledge.

In view of the above observations, the main research question of this article is what role universities of economics and business are playing in the knowledge transfers that are believed to contribute to the development of a knowledge-based economy.

According to Suddaby and Greenwood [25], one of the functions of Business Schools should be to produce new managerial knowledge and circulate it by educating students and providing them with a common language, shared analytical tools and a unified set of assumptions. Starkey and Madan [26] argue that business schools can mainly develop academic entrepreneurship and entrepreneurial competencies in universities. Wright et al. [27] see the direct and indirect role of roles of business schools as providing tools, such as courses on entrepreneurship or doing research "on barriers at systematic level to the development of companies from universities" or directly by providing resources, such as by acting as directors on the boards of spin-off companies.

Wright and associates [11] have prepared a case study based on 42 in-depth interviews with representatives of technology transfer centers, deans of business schools and research and teaching faculty members at eight UK-based institutions of higher education. They examined the challenges to the role of Business Schools in promoting academic entrepreneurship. Their findings suggest that the institutional structures of universities restrict the role that Business Schools may play in addressing knowledge gaps in the development of academic

entrepreneurship. Institutional structures hinder interactions between the different stakeholders of academic entrepreneurship, and interactions with Business Schools in particular.

However, Khurana [28] emphasizes that university business schools have not been immune to the growing pressures to make scholarly knowledge more impactful and commercially relevant, nor have they been saved from sharp criticism about the intrusion of market imperatives in business and management education. Although management scholars seldom produce results that can be embodied in physical products as in the case of engineering or medical research, their research occasionally yields outputs in the forms of designs, methods, rules, tools and instruments that can be commercialized similar to any other technology. Such is the fundamental assumption underlying the importation of the technology transfer approach into the realm of administrative sciences [29].

The above recommendations are crucial for the development of the unique dynamics of Central and Eastern Europe (CEE). Since the enlargement of the European Union in 2004, the combined GDP (Gross Domestic Product) of CEE countries increased by nearly 80%, while the economic strength of the old EU countries rose by a mere one fifth. In 2013, Poland, which undoubtedly plays a leading role in Central and Eastern Europe, accounted for a 35% share in the total GDP of all Central and Eastern European countries. Although the growth rate declined somewhat in recent years, the CEE region holds a continued appeal to investors from all over the world [30].

According to the 2013 World Bank report, Poland ranks as the largest economy of all post-socialist EU member states and the sixth largest in the European Union in terms of purchasing power parity. Moreover, Poland has just experienced what appears to have been the two most prosperous consecutive decades in its history of more than a thousand years. Economic growth models tend to underestimate the unprecedented headway that has been made in improving the quality of education. As of today, nearly 60 percent of Poland's young adults (aged 18-24) are enrolled in tertiary education – this represents the second highest ratio among the OECD (*Organisation for Economic Co-operation and Development*) countries [31].

Given the current state of play, the challenge faced by Poland's universities is to create an ideal model of cooperation between science and business to fill the existing innovation gap in Poland's highly dynamic economy by fostering entrepreneurship education. Businesses and economic universities play a central role because according to Poland's Central Statistical Office (2013/2014), the country is currently home to over 70 higher schools of economics, including universities, and business and administration programs enroll more than 20% of the country's entire student population. Supplementary research questions are how and by what methods can we determinate the commercialization potential at business universities?

Research methods

The research methodology proceeded in two stages. Stage one incorporated a detailed literature review covering the available electronic databases such as Google Scholar, Scopus and the holdings of the library of the Poznan University of Economics and Business. Articles for the review were selected by a snowball sampling method that limits the percentage of articles collected at each level [32]. English and Polish-language writings were selected using the keywords "knowledge management", "knowledge commercializatio", "knowledge transfer" and "innovations". The inclusion criteria were studies that focused on business and economics schools and universities. The literature search generated 63 papers that were retrieved for more detailed evaluation and enabled the formulation of the research problem [33].

The second stage assessed the commercialization potential, skills and competencies of the Poznan University of Economics and Business research teams from 2010 to 2013. The assessment methodology was based on a thorough literature review comprising four phases consistent with the common schedule of technological audits, i.e.:

- 1) opening,
- 2) data collection,
- 3) result analysis and synthesis,
- 4) report drafting and handover [34].

Table 1. Data collected before innovation audits at Poznan University of Economics and Business

Faculty	Research grants and project in years 2010-2013		Doctorates in years 2010-2013		Habitations in years 2010-2013	
	total	analyzed	total	analyzed	total	analyzed
Faculty of Economics	2	2	51	0	13	3
Faculty of International Business and Economics	2	2	23	1	6	3
Faculty of Informatics and Electronic Economy	6	5	20	1	6	5
Faculty of Commodity Science	5	5	21	4	6	4
Faculty of Management	12	10	56	2	19	10
Total	27	24	178	8	50	25

Source: Author's research

Phase one involved a series of 57 individual and group interviews with the research teams of the Poznan University of Economics and Business, representing all faculties of the university. Note that the faculties vary widely in their profiles, ranging from the strictly economics-oriented Faculty of Economics, to the highly management-focused Faculty of International Business and Economics and Faculty of Management, to the Faculty of Informatics and Electronic Economy that specialize in economic IT, and the interdisciplinary Faculty of Commodity Science. The respondents were selected based on a study of the university's research grants and projects, as well as a list of first (doctoral) and second (habilitation) degree dissertations completed between 2010 and 2013. Table 1 summarizes data collected for each department.

The commercialization potential of current research was assessed and described based on 57 meetings in a document entitled "The Project's Commercialization Potential Identification Form". The document addresses the following four questions:

1. To what extent are the research outcomes likely to attract the interest of domestic businesses?
2. What advisory services may be offered based on the research findings?
3. What training may be offered based on the research findings?
4. To what extent is the project suited to encourage businesses to engage in research collaboration?

At this stage, the survey form and the scope of the report have been modified to fit the concerned report and to select and approve the auditors [35].

Preliminary analysis of the commercialization potential involved data gathering. On that basis, the authors selected 20 projects for an innovation audit. According to the university's profile, opinions on the commercialization potential were divided into two categories: opinions on solutions (9 audits) and opinions on technologies or products (11 audits). The technology reports briefly describe the technology focusing on its innovation and market potential, roughly analyze the target market, including its scope and growth prospects, and identify competition and barriers to entry, intellectual property protection status and research team profile. They also suggest ways to continue developing the technology, with an eye to furthering specific deployments and provide guidelines on how to formulate proposals.

The solution reports contain descriptions of individual solutions, including their nature and business value. They also describe the market in terms of the availability of comparable services/solutions, analyze the structure of service/solution proposals, outline consultant team profiles, offer recommendations on deployment stages, schedules and possible forms of intellectual property protection, name parts of the solution/service requiring protection and identify the university's activities designed to ensure the proposals are unique. The innovation audits were conducted by several internal and external auditors with experience working at an institution of higher education as well as in industry, including in the field of technology transfers [36]. Every meeting with the audited research organization was additionally attended by a member of the project team representing Poznan University of Economics and Business. For each meeting, the results were described in either a solution sheet or a technology sheet containing the most essential evaluation points.

The audit reports focused on areas in which commercialization opportunities were identified. For each area, existing and potential opportunities were defined and possible actions proposed [34].

The next step was to value any intellectual property (knowledge and technologies) in the possession of Poznan University of Economics and Business that has been in demand in the business community. The purpose of the exercise was to assess the knowledge and technologies held by the university. Such valuation was limited to the seven projects endorsed by experts during their preliminary analysis, which underwent innovation audits and were sought by industry practitioners, such as via the website. Most projects came from the interdisciplinary Faculty of Commodity Science.

One of the outcomes of this effort was a report on the valuation of the intellectual property of Poznan University of Economics and Business, which specified the purpose of the valuation and described the valuation method. The adopted method was income-based, in keeping with recommendations which, in the opinion of the Ministry of Science and Higher Education and the National Research and Development Center, may and should be used by State Research Institutions¹. The method was also market- and cost-based.

Other results included the formulation of precepts for and the adopted definitions of the discount rate, the rationale behind method selection, a description of the technology based on the technology potentials sheet, an interview with the authors, and a market description, including a basic SWOT analysis for the technology and for barriers to market entry, and descriptions of basic market players. Such players include a list and a short description of companies listed in market and patent databases, commercialization paths, and the recommended path for the technology in question. The recommendation/choice and an assessment of the technology by the selected method was made in keeping with the recommended commercialization path.

Results and discussion

The knowledge generated by universities, especially those oriented toward economics, may form an important launching pad for commercializing innovations [37]. However, the nature of university-industry collaboration has changed during the last decades, and it varies across countries and regions [38].

Therefore, this paper introduces the role of business schools in knowledge transfers, since only limited literature is available. Moreover, the commercialization of research outcomes in universities of business administration and economics requires a proper dedicated model. Universities in post-communist countries play a lesser role than those of more developed EU countries, as adaptations to new social and economic conditions in the former began substantially later than in Western Europe [12].

The literature emphasizes the importance of enlisting teaching and research faculty members to serve on the boards of newly established enterprises and, even more importantly, having them contribute in an advisory and consulting capacity. Hence, the research faculty of universities of economics should engage in the work of technology transfer centers and fill their knowledge gaps [11].

Locke [24] notes the potential to offer entrepreneurship courses for graduate and doctoral students taught by practitioners, as well as university teacher courses in marketing, law, economics and finance. These may prove to be of particular value for the establishment or continued development of startups. Universities of economics should assume the role of teaching managerial knowledge [25, 41].

Note that Arvanitis and associates [41] have found that institutions of education specializing in economics and natural sciences were the most dedicated to transferring knowledge and technologies. Therefore, the aim of the current research was to achieve a better understanding of the knowledge transfer process in those institutions based on 57 in depth interviews, followed by 20 innovation audits as well as seven selected project valuations at PUEB (Poznan University of Economics and Business).

¹ As presented in the guidebook entitled “Komerjalizacja B+R dla praktyków” (“R&D Commercialization for Practitioners”), Warsaw, 1st edition of 2010 and 2nd edition of 2013, p. 171 and p. 187, respectively.

According to Bell et al. [36], technological audits of universities are aimed at: 1. assessing the potential to boost the revenues of universities at large and their individual departments by utilizing the available technologies and equipment, as well as the knowledge contributed by research staff; 2. identifying the sources of strategy information to be used for management purposes at various levels; 3. incentivizing employees and enhancing their “industry awareness”.

Defined in such a way, the commercialization of research outcomes has become the centerpiece for assessing the commercialization potential of Poznan University of Economics and Business. The assessment relies in part on identifying research outcomes and, as a consequence, evaluating their attractiveness:

- based on research papers and abstracts (assessment of the potential value of specific topics and possible applications),
- based on patent databases (leading centers, growth objectives),
- against existing business offerings (market saturation, key advantages),
- in terms of application potential (declared interest).

Note that the proposed technology identification procedure, which complies with the “Rules governing the management of copyrights, related rights and industrial property rights and commercialization at the Poznan University of Economics and Business”, accounts for the university’s economic profile and clearly distinguishes between research on the commercialization potential of patentable or licensable technologies and research on solutions which hold no such promise. Applying such a procedure might help the long-term strategy of commercializing selected intellectual property generated at the PUEB and comprising either technologies or knowledge. The PUEB envisions the valuation and commercialization of successive future solutions.

However, the SPE (Special Purpose Entity) of the PUEB supports scholars in deploying their research outcomes and, contrary to technical and natural science universities, does not limit itself to assisting in the acquisition of patents or the conclusion of license agreements. Markiewicz [42] defined the commercialization of research outcomes as actions aimed at constructing a business model of technology, designing the sales process or bringing technologies to market. Generally, such commercialization is about ensuring that items of potential value and having the capacity to generate profit are sold, produced, made available or used for profit, to produce capital or create added value by means of the technology in question.

Based on 57 in-depth interviews at Poznan University of Economics and Business, highest commercial potential was observed at the Faculty of Commodity Science, followed by the Faculty of Informatics and Electronic Economy, as well as the Faculty of Management. Hence, out of 20 innovation audits, 45% (9 audits) were selected from the Faculty of Commodity Science, 25% (5 audits) from the Faculty of Management, 20% (4 audits) from the Faculty of Informatics and Electronic Economy, and only 1 audit (5%) from the Faculty of Economics and the Faculty of International Business and Economics.

Thus, assessments of the university’s innovation and overall potential are expected to generate tangible financial benefits through deployments [43]. Such assessments will also enhance the commercialization process achieved by assessing the commercialization potential of innovation, drafting commercialization business plans and acquiring external financing for the commercialization of innovations. In this field, the SPE relies on basic business theory and, as such, helps formulate the vision and mission, proposes values and designs the business model [44].

Founded on an analysis of project outcomes, 20 industry-targeted offerings of the PUEB were selected and posted on the <http://scuep.pl/> website. The website made it possible to search and commercially apply research outcomes, new concepts, ideas, and inventions, thereby making the PUEB more advanced and competitive. The website is particularly geared towards businesses and business support institutions, including research and development centers, deployment institutes, public authorities, as well as advisory, training and consulting organizations. The website was used to submit to Poznan University of Economics and Business more than twenty inquiries regarding joint research collaboration, consultations and training.

The research also helped delineate the new commercialization pathways of research at the economic university in the form cooperation on projects conducted by interdisciplinary research teams by identifying and assessing the commercial potential of the research teams of the PUEB and boosting their knowledge and skills. Such a multidisciplinary approach has led to the emergence of a thriving literature on technology transfers featuring

insights contributed by entrepreneurs, economists and managers [45]. These findings also complement previous observations by Olmos-Peñuela et al. [46], who investigated social and humanities research groups' engagement in knowledge transfer.

Furthermore, emphasis has been placed on engaging not only the university's research and teaching staff, but also its students in the commercialization process. The effort is in line with recommendations published by Grimaldi et al. [47] and Boh et al. [24], who stressed the key role of students (mainly of business majors) at early stages of spin-off development. Research on entrepreneurship among students also held Kopycińska et al. [48] compare Polish, Lithuanian, Latvian, Hungarian, Ukrainian and Russian experiences, as well as by Tho and Trang [49] who worked with business students in Vietnam.

According to Paton et al. [50], university business schools contribute best to the practitioner world, not by meekly acceding to the latter's pressing demands but by working alongside in a strategic partnership where each recognizes the strengths of the other for what they can really do. Once the business potential of universities of economics in the countries of Central and Eastern Europe to commercialize research outcomes has been tapped, further research opportunities are certain to emerge.

Presented findings suggest some recommendations and policy implications. First, the commercialization of research at business universities should be accompanied by continuous monitoring of the commercialization potential through innovation audits. Such research primarily highlights actual problems and needs, but also provides information that can be used in action plans for improving performance. Such audits also open opportunities for exploring alternative uses of university-based knowledge through consulting, combining interdisciplinary knowledge in different teams or engaging students in research projects. Second, literature studies pointed to the great potential of economic universities in teaching entrepreneurship and entrepreneurial competencies, as well as developing academic entrepreneurship.

Conclusion

The overall purpose of the article was to point to selected factors for the commercialization of research by using a snowball sampling literature studies method, as well as describing the case of Poland's universities of business and economics. The emerging science and industry collaboration model designed for universities of economics was the procedure – described extensively in the literature – of assessing innovation potential by conducting innovation audits and valuations. For the purposes of the study at hand, such audits and valuations were modified to fit the specific needs of universities of economics. Furthermore, the study helped set out further growth objectives for the newly-established Special Purpose Entity of Poznan University of Economics and Business.

The paper also attempts to fulfill the research gap concerning the role of business schools in the commercialization of scientific research in Poland and other CEE countries.

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