

Microfoundations of technology transfer in a leading Brazilian university

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Abstract

Intellectual property (IP) production has become a topic of interest for universities around the world due to its capacity of providing both an application of scientific knowledge to real world situations and as an alternative source of revenue. In this ongoing research we explore the micro dynamics of university generated IP commercialization from the perspective of academics from a leading Latin American institution. We take a step further into understanding how this process unfolds and what makes it effective. Thus, we present results from 23 in depth interviews with inventors which have commercialized their inventions via the universities Technology Transfer Office. Our preliminary conclusions show that the form of university-industry interaction varies across fields of research and laboratories. However, there seems to be more commercialization effectiveness when academics demonstrate stronger entrepreneurial characteristics, thus being less reliable on the Technology Transfer Office, even though this is a necessary player on this process. We also comment on the specific case of a blockbuster patent and how the deep university-industry connection made possible for the IP to be commercialized and generate a significant value stream for the university.

Introduction

Innovation and economic growth have come to benefit considerably from knowledge transfer between the industry and universities (Guerrero et al., 2016). Active engagement of scientists with intellectual property (IP) commercialization is critical for success, especially for public universities in developing economies, which play a pivotal role in strengthening innovation capabilities in industrial agents (Fischer et al., 2019). However, although indicators reveal a growing number in university generated IP across the globe, not all of it is successfully commercialized. In this ongoing research we take a step forward from IP production indicators and dedicate attention to advance our understanding about the micro foundations of university-industry interactions regarding the production and commercialization of academic inventions, i.e., the complex individual-level aspects that are involved with the formation of an entrepreneurial orientation in academics (Hayter et al., 2021).

Objective and method

Within the context of universities in emerging economies, this research seeks an in-depth knowledge of how processes of IP creation and commercialization unfold from the perspective of academics. Our objective is to relate these processes to certain factors such as field and type of research carried out in the university and patterns of interaction with industry. To this end, we are conducting interviews with inventors from the University of Campinas (Unicamp) – Brazil – in order to explore cases of IP commercialization spanning several fields of research and individual trajectories. Unicamp is one of the largest universities in Brazil, answering for over 6% of the country's total scholarly output citations – according to SciVal. It is a public organization and one of the leading patenting institutions in the country, holding 8.5% of all national patent citations.

So far, we've produced data from 23 interviews (Table 1). Individuals were selected from a list of IP commercialization cases made available by the university's Technology Transfer Office (TTO).

Table 1. Sample aspect

ID #	Field of research	Year of PhD	Patent	Software	PPVP*	ID #	Field of research	Year of PhD	Patent	Software	PPVP*
9	Agronomics	2011	0	0	3	6	Electric Eng.	2003	10	1	0
12		1992	16	0	0	7		2006	1	0	0
19		1995	11	0	0	13		1991	4	0	0
23		1996	1	0	0	14		2005	8	2	0
2	Chem./Food Eng.	2006	6	0	0	1	Food Eng.	2009	8	0	0
4		1984	16	0	0	16		2005	6	0	0
10		1995	3	0	0	17		2016	8	0	0
11		1995	18	3	0	18		1982	9	0	0
21	Chemistry	1999	18	1	0	20	Medicine	2001	2	0	0
3		2009	11	1	0	22		2004	12	0	0
8		2008	3	0	0	5		2010	7	2	0
15		1987	6	3	0						

*plant and plant variety protection

Interviews followed a structured protocol comprised of 6 inductive questions (Table 2), each followed by specific sub-questions to be addressed as needed.

Table 2. Interview protocol – lead questions

I.	How would you define yourself professionally?
II.	Could you tell us the story behind your first patent?
III.	Has your patent been commercialized in any way? How did this process take place?
IV.	Was the IP born out of a market/industry opportunities you recognized or out of research?
V.	How has your engagement with developing new technologies with market potential changed your research and teaching activities?
VI.	How do you evaluate the role of the university in the process of creating and commercializing your patent(s)?

Preliminary results and discussion

With the aid of the MaxQDA Analytics Pro 2022 software, interviews were transcribed and resulted in almost 1,000 data entries divided into 6 main coding groups: (i) university (ecosystem, support structure & overall relation with IP development and commercialization); (ii) entrepreneurial characteristics & intention; (iii) IP commercialization; (iv) IP development; (v) profession/career; (iv) individual opinions/viewpoints. In this section we highlight a few key findings.

Interactions with industry

The profile of industry interaction among Unicamp's inventors varies across the different fields in our sample. Academics from the Engineering field mentioned keeping a close contact with

market partners. This leads to the creation of new research projects and targeted IP production. However, the extent to which such linkages are triggered by market demands seems to vary across specific sub-fields. While in some cases companies seek researchers to co-produce knowledge, the majority of interviewees report a typical technology transfer process in which IP is generated and then pushed to commercialization. Illustratively, one interviewee mentions that in his field of research, “naturally focused on application” (I-7), it is common to develop IP without a specific demand in mind. On two instances researchers claimed to develop an invention based on the observation of a specific sector’s regulatory environment (I-2 and I-8). In both cases, the IP was developed first and prospective licensors were approached later. Beyond scientific particularities, such timing of approximation with industrial partners emerged as an outcome of academics’ proclivity towards being involved in networks comprehending agents outside of the university.

Commercialization

The majority of interviews underscored marginal success in IP commercialization. Although cases were sampled from the TTOs listing of commercialization activities, negotiations with an industrial partner were either inconclusive or did not render a marketable product. Reasons for this include:

- *Incompatibility with the industrial partner:* In some instances, objectives and expectation misalignments impacted the decision to not move forward with negotiations. For a specific case (I-10), the company wanted to apply the technology as soon as possible and asked for complete transfer of ownership over the IP with no financial compensation, only the promise of access to facilities for development and testing. The technology, however, was still in early stages of development and had yet to become application worthy. Another concern in this respect is timing issues of both scientific undertakings and negotiation processes with the university. This emerged as a particularly sensitive issue when projects involved co-creation of knowledge with companies.
- *Lack of funding:* For some researchers, IP commercialization or co-development with an industrial partner is a means to accrue funding for research projects. Therefore, the inventor himself does not necessarily seek out IP commercialization as a source of income, but as a way of assuring the continuation of research. In this case, technology transfer itself is not a legitimate goal for the researcher, a situation that created barriers for the translation of scientific results into technologies with minimum market viability.
- *Heavy reliance on the TTO:* All interviewees attribute a fundamental role to the TTO as a connector between them and industrial partners. By concentrating several time and resource consuming activities, such as patent filing, prospecting and negotiating with potential investors, the TTO leaves room for researchers to focus on their core activities. However, the majority does not rigorously follow up on the TTO and the negotiation of their IP, usually waiting to be contacted on occasion. By doing so, many researchers are unaware of the exact outcomes of commercialization. Such conditions indicate a feeble entrepreneurial identity in most analyzed cases. Only in one occasion (I-13) the researcher took an active role in the commercialization process.

Entrepreneurial profile & personal characteristics

The cases allowed us to identify certain characteristics amongst individuals which may have influenced the success of IP commercialization. *A priori*, all interviewees identify themselves as academics. Therefore, problem solving, persistency and innovation are found all across the board. On the same note, the majority seemed to be well aware of the specific regulations and

dynamics of the markets to which their field of research contributed to and could clearly identify applications for their inventions. However, when it comes to engagement with the industry and their involvement with IP negotiation, differences became apparent. As mentioned before, some relied heavily on the TTO for handling negotiations with prospective buyers. However, the most successful cases revealed individuals with a more active, hands-on approach to negotiation. One of these individuals even mentioned never letting the TTO talk to the prospect alone (I-3).

Blockbuster patents

Our sample included one blockbuster patent, applied to the food industry, responsible for the university's most profitable commercial licensing currently active (I-13). In this specific case, we found that the university-industry interaction occurs at a much deeper level for a number of reasons. First, the technology meets a pressing demand from the industry. Second, the inventor sees his research as part of a cycle that "must end with application" (I-13), highlighting an entrepreneurial identity that perceives scientific knowledge as a means to generate economic and societal impact. Third, and as a result of these identity traits, is actively involved in seeking new opportunities to improve his solutions, participating on both academic and industry conferences in order to "be aware of what is out there" (I-13). Fourth, although the TTO is engaged in negotiating the technology, the researcher is personally involved with the industrial partner. To illustrate, he mentions that, although his invention did not fit standard industrial quality tests, his team provided training for the industrial partner, perfecting the implementation of the technology to allow its commercial application. All of these elements work together in order for the prospective company to not just take the university generated IP at face value and increase the chances of successful commercialization, while also allowing the university to accrue better financial compensation.

Preliminary remarks

The dynamics of IP production and commercialization, as well as the level of university-industry interaction, varies across fields of research and personal characteristics. Researchers from Engineering keep close contact with industrial partners, since companies usually come to these professionals, leading to targeted solutions. Other areas, such as Chemistry, Biology and Agronomics are less frequently sought out but have their own means of producing IP. However, inventions are not necessarily tailored to one specific industry.

The blockbuster case allowed us to identify key personal characteristics influencing the university-industry interaction. I-13 is a self-declared academic entrepreneur. He is actively engaged with industry and constantly seeks new opportunities for generating new technologies. His approach to research is problem-driven with application as the final goal. Given this close proximity to the industrial partner, trust between parties, as well as the chances for a successful IP commercialization, are increased. Following these examinations, we provide some initial insights on the micro foundations of technology transfer processes, highlighting not only the relevance of knowledge domains, but also the key role played by individual-level motivations and identity issues.

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