RELISE

THE DILEMMA OF INDUSTRY-UNIVERSITY COOPERATION PROCESSES WITHIN TECHNOLOGY TRANSFER OFFICES: EVIDENCES FROM THREE BRAZILIAN CASE STUDIES[1]

Marcos Ferasso[2]

Eduardo De-Carli[3]

Andréa Paula Segatto[4]

Fernanda Salvador Alves[5]

ABSTRACT

This research aimed to identify facilitators and restrictive factors on Technological Transfer by comparing case studies of the Brazilian Technology Transfer Offices (TTO). The research was carried by a comparative case studies based on interviews with Directors and selected documentation. The three case studies' results revealed, regarding the restrictive factors, that the federal universities showed an initial cooperation process through their TTO, whereas the state university presented facilitator factors about better-structured cooperative processes and generated returns to the institution. Federal universities showed restrictive factors from a legal framework and changeable professors' profile and personal interests more dedicated to research and lectures in graduate courses than I-U partnerships. This research evidences the importance of national policies towards technology transfer via industry-university in developing countries.

Keywords: Technology transfer; Industry-University cooperation; Technological development; Technology Transfer Office.

RESUMO

Esta pesquisa teve como objetivo identificar facilitadores e fatores restritivos à Transferência Tecnológica, comparando estudos de caso dos Escritórios de Transferência de Tecnologia (ETT) brasileiros. A pesquisa foi realizada por meio de um estudo de caso comparativo baseado em entrevistas com Diretores e documentação selecionada. Os resultados dos três estudos de caso

[1] Recebido em 17/04/2018.
[2] Universidade Federal do Paraná. mferasso@hotmail.com
[3] Universidade Federal do Paraná. eduardodecarli@ufpr.br
[4] Universidade Federal do Paraná. aps@ufpr.br
[5] Universidade Federal do Paraná. fsa@ufpr.br

revelaram, em relação aos fatores restritivos, que as universidades federais apresentavam um processo inicial de cooperação através do TTO, enquanto a universidade estadual apresentava fatores facilitadores sobre processos cooperativos melhor estruturados e gerou retornos para a instituição. As universidades federais mostraram fatores restritivos de uma estrutura legal e perfil de professores mutáveis e interesses pessoais mais dedicados à pesquisa e aulas em cursos de pós-graduação do que as parcerias I-U. Esta pesquisa evidencia a importância das políticas nacionais para a transferência de tecnologia via indústria-universidade nos países em desenvolvimento.

Palavras-chave: Transferência de tecnologia; Cooperação Indústria-Universidade; Desenvolvimento tecnológico, Escritório de Transferência de Tecnologia.

INTRODUCTION

The country's development measures are linked to processes such as the industry and universities (I-U) cooperation, which allows the expansion and exchange of knowledge and results in the companies' development. Perkmann *et al.*(2013) argue that universities, simultaneously, have a significant role in people's training and knowledge development. The authors also claim that, increasingly, universities have sought to facilitate the technology transfer to the business sector through Technology Transfer Offices (TTO).

In Brazil, the Innovation Law (BRASIL, 2004) explains that the Brazilian science and technology institutions must have TTOs that, according to the second article, are conceptualized as a "[...] structure consisting of one or more STIs [Scientific and Technology Institution], with or without legal personality and whose purpose is institutional policy management innovation [...] ". In item V of the same article, the Science and Technology Institution (STIs) is defined as an "[...] agency or entity of public administration whose institutional mission includes performing basic or applied scientific or technological research activities". Among them, it is possible to mention the universities.

In addition to the Brazilian Innovation Law, it was formed the new law of innovation, called 'Novo Marco da Inovação' (BRASIL, 2016) in order to

encourage partnerships between universities and industry from stimulus and reduction of barriers in this kind of interaction. Within the TTOs, as well as incubators and technology parks, an alternative link between industry and university for practical application of knowledge can be the Innovation Agencies (IA) (Oliveira & Telles, 2011).

The Technology Transfer (TT) from the academic environment to the private sector is one of the levers for a country's technological development. A university increases the attractiveness of a region for business investment, which is interested in improving their systemic competitiveness (Plonski, 1999). Some Brazilian examples of these studies are Segatto (1996), Segatto-Mendes & Sbragia (2002), Porto (2000, 2007), Póvoa (2008), Dalmarco, Dewes, Zawislak & Padula(2011), Closs & Ferreira (2012). On the international scene, publications about the I-U cooperation include Bonaccorsi & Piccaluga (1994), Rahm (1994), Santoro & Gopalakrishnan(2001), Meseri & Maital (2001), Friedman & Silberman(2003), Lockett, Wright & Franklin (2003), Anderson, Daim & Lavoie(2007) and Bröchner(2013).

According to Mowery & Sampat(2005), the technological development of the American universities came from the Bayh-Dole Act, which provided subsidies and significant incentives for TT between the I-U, in collaborative research. Also noteworthy is that the universities have benefited from 'technological opportunities' from the source of scientific knowledge and its application in the private sector, depositing patents in their names (Feldman & Desrochers, 2004; Póvoa, 2008).

The scientific research conducted by the University and its cooperation with the productive sector lead to technology development and improvements in the relationship between science-technology-productive systems, which promote financial and scientific gains (Rosenberg, 1982). Axis countries like the US-Europe-Asia have achieved significant gains from these relationships.

Countries with emerging economies such as Brazil are seeking to modernize their industrial parks with a) buying foreign technology, b) research capacity development and domestic development (R&D) or c) establishing partnerships with universities for a medium term, achieving their ability for R&D (Lopéz-Martinéz, Medellín, Scanlon, & Solleiro, 1994; Segatto, 1996).

Therefore, the paper aims to identify facilitators and restrictive factors of technology transfer, in the TTOs of universities. The study was conducted at the IAs of three institutions: The Federal University of Technology of Parana (UTFPR), the Federal University of Paraná (UFPR) and the State University of Campinas (Unicamp). The paper is structured in a theoretical review of industry-university cooperation, methodological procedures, presentation and discussion of data and conclusions.

INDUSTRY-UNIVERSITY (I-U) COOPERATION

I-U cooperation processes enable different participants of the National Innovation System (NIS) to interact and create conducive environments for national technological development. These relationships, according to Segatto (1996, p. 28), "[...] include a process of products and services' transfer and processing, and aim to the growth of both participants knowledge."

To analyse the universities' role through their TTOs, it is possible to present some factors found in the literature and considered, here, as crucial to the achievement of such cooperation processes, beyond those posted previously. Next, the authors are going to identify them and demonstrate, in the practice, if they occur or not.

A NIS is made up of public and private institutions that are related to design, develop, disseminate and utilize technological innovations and improve the technological performance (Albuquerque, 1996; OECD, 1997; Plonski, 2005; Stal, 2006). That performance stems from the completion of the parties

(Póvoa, 2008), and when there is cooperation, it builds up skills and abilities for growth (Garcez & Sbragia, 2013) and improve the national technological performance.

For Sábato and Botana (1968), the scientific and technological infrastructure, and the productive structure could relate to continuous knowledge 'exchanges' of the triple helix of relations (university, industry and government). However, for the use of 'available intelligence' it will be necessary that the government promotes the relationship between universities and industry. That mobilization could result in knowledge exchange and development of the real needs of the country (Sábato & Botana, 1968), and it can allow technological activities from the academic knowledge (Cecere, Corrocher, Gossart, & Ozman, 2014).

According to Porto (2000, 2007), cooperation is a way of meeting potentialities and opportunities. Therefore, Marcovich(1999) points out that the scientific research focus on the long term, and it complements the one made by the industry. Nevertheless, cooperation depends on management, and it is aligned with different perceptions. For the universities, the process motivations are support for long-term research and interaction between scientists and industrial engineers. They are the following for industries: the emergence of new ideas, knowledge and technologies; cost reduction; approach with scientists and connection of research to the firms demands (Segatto-Mendes & Sbragia, 2002). Plonski (1999) highlights the need for a clear perception of different missions.

It indicates that even with different objectives, "[...] university-industry relationship is essential for technological development" (Tigre, 2006, p. 95). Thus, companies can evolve (Penrose, 1959), develop technology (Rosenberg, 1982), and universities can take a practical 'destination' to developed knowledge.

An efficient I-U cooperation process and TT must be linked to the definition of the university institutional policies, internal resources and processes aimed at the TT (Porto, 2007; Wright, Birley, & Mosey, 2004). Therefore, the university should encourage the TT to become a regional technology spill over (Chapple, Lockett, Siegel & Wright, 2005). In the end, it can commercialize its academic research, provide advice to private industries (Lee, 1996) and carry out joint R&D projects (Lee & Win, 2004).

To do that, the IAs require different skills, such as agents' training who interact with entrepreneurs (Siegel & Phan, 2005), managers' training (Chapple *et al.*, 2005) and resources and expertise to find innovations with potential and commercial value (Owen-Smith & Powell, 2001).

Other reasons that increase the I-U collaboration are the results of research, business-oriented agency's management and the university responsiveness forward to the services provided in the IA (Muscio, 2010). Relations or network of this locus enable the exchange of formal and informal ideas (Grimpe & Fier, 2010; Harmon *et al.*, 1997; Lindelöf & Löfsten, 2004), and they increase the demand for universities to solve the organizations' problems (Rahm, 1994).

The government also has a role in I-U cooperation to promote research centers through funding and necessary resources for the subsequent technology transfer to the industry (Lee & Win, 2004). It can occur through the national legislation for universities (such as the Bayh-Dole as presented by Mowery and Sampat (2005), the Brazilian Innovation Law (BRASIL, 2004) and the new law of innovation (BRASIL, 2016).

Note that several factors are enabling and encouraging the I-U cooperation occurrence, and they are generated by many benefits, and therefore, there are better technological production institutions. These conceptual elements are presented below.

The IAs universities with successful history and experience in cooperating and with institutional policies, adequate management, structure, expertise and interest areas will tend to expand these processes (Anderson et al., 2007; Arvanitis, Kubli, & Woerter, 2008; Chapple et al., 2005; Friedman & Silberman, 2003; Lockett et al., 2003; Markman, Phan, Balkin, & Gianiodis, 2005; Muscio, 2010; O'Shea, Allen, Chevalier, & Roche, 2005; Owen-Smith & Powell, 2001; Rahm, 1994; Siegel & Phan, 2005; Siegel, Waldman, & Link, 2003).

It is in line with the philosophy and institutional interests. If there is a thought focused on the development of activities, initiatives for patenting, forms of protection and use of TT benefits, educational opportunities and research lined up with industry demands, policies and accessibility to the TT, the interests will prevail, and the expansion of activities will occur (Decter, Bennett, & Leseure, 2007; Friedman & Silberman, 2003; Lockett et al., 2003; Owen-Smith & Powell, 2001; Rahm, 1994; Wright et al., 2004).

Another aspect consists of the IA and University's administrative procedures. When they are well designed and structured (via technology transferred for joint R&D projects or formal TT mechanisms, for example), they can provide further support for the expansion of these activities (Lee & Win, 2004; Link *et al.*, 2007; Siegel *et al.*, 2007).

Likewise, renowned professors and researchers attract industries to partnerships. The involvement and interest of researchers, in the process of TT/I-U, could be a process facilitator. Instead, the non-involvement of researchers in I-U cooperation, because the focus is restricted to the academic pursuits, may impair future partnerships for TT (Grimpe & Fier, 2010; O'Shea *et al.*, 2005; Rahm, 1994).

The university's impact on the ambience is another point to consider. With renowned and transparent processes and institutional contributions,

university attracts industries, becoming technological regional spill overs. The R&D university activities provide the basis for regions' economic growth, which becomes a facilitator to find solutions for partner companies (Chapple *et al.*, 2005; Friedman & Silberman, 2003; Harmon *et al.*, 1997; Lee, 1996; Mowery & Shane, 2002; Pérez & Sánchez, 2003; Rogers *et al.*, 2001; Santoro & Gopalakrishnan, 2001).

Then, it is worth mentioning the research results that allow the universities knowledge to have a broad public access. However, if knowledge is purely academic, it can be limiting the partnerships and reducing the institutional capabilities (Dalmarco *et al.*, 2011; Muscio, 2010; Rahm, 1994).

Another influential factor is the social relationships developed through meetings, interactions with industry associations, networking, informal contacts for TT, industrial consulting, training and people's transfer. All the actions can give visibility to the universities knowledge and facilitate the access to collaborative processes (Grimpe & Fier, 2010; Harmon *et al.*, 1997; Lindelöf & Löfsten, 2004; Link *et al.*, 2007; Lockett *et al.*, 2003; Pérez & Sánchez, 2003; Samsom & Gurdon, 1993; Santoro & Gopalakrishnan, 2001; Siegel & Phan, 2005).

Finally, there is the legislation and government levels that guide what can be carried out via national policies for universities, aimed at technological development. Nonetheless, the government as a supporter of research centers through funding and other necessary resources may restrict and prevent cooperative activities and procedures (Feldman & Desrochers, 2004; Lee & Win, 2004; Mowery & Sampat, 2005).

There are key elements about stimulating or limiting TT. The factors listed above were analysed in this study, in three Brazilian universities TTOs: UTFPR, UFPR and Unicamp to verify their ability to facilitate and/or restrict the technology transfer.

RESEARCH DESIGN

The paper aimed to identify academic facilitators and restrictive factors of TT in the TTOs. Then, a deductive and exploratory methodology (Collis & Hussey, 2005), from a post-positivist approach and multiple cases studies was delineate.

The cases were chosen because of their peculiar characteristics. UTFPR: the first technological university in Brazil, UFPR: the oldest federal university in Brazil (founded in 1913), and Unicamp, as Amadei and Torkomian (2009), for its historical emphasis on technological development, mainly, through patent applications.

It is also used to support the universities' choice the results presented by De-Carli (2015) and De-Carli, Segatto, Frega and Alves (2015) about universities patent deposits, which is an indication of the technological development. Therefore, from 2004 to 2013, the university with more patents was Unicamp, most of them without partnerships (771 and 477, respectively); UFPR was in tenth, with almost all the deposits held without partnerships (138 and 125, respectively) and UTFPR was not mentioned in the study.

As data collection instrument, it was possible to opt for a semi-structured interview, which was sent by e-mail to the Directors or Managers of the selected IA. Documentary sources were consulted to perform data triangulation, mainly, in aspects of technological development and institutional policies. Data were analysed and synthesized for subsequent categorization as cited by Collis e Hussey (2005).

The interviews were structured as the identified categories in the literature, which formed the basis of a framework for subsequent data analysis. It was held, initially, an individual analysis, followed by a comparison, and then, a discussion of the results.

PRESENTATION OF CASES AND CHARACTERIZATION OF THE SUMMARY TABLE

Federal University of Technology of Parana (UTFPR)

UTFPR began its activities with the creation of the School of Apprentices and Craftsmen, in 1909, and devoting to the underprivileged classes of teenagers. In 1942, there was an industrial training organization in Brazil and, after that, the UTFPR started offering technical courses in buildings, construction machinery and engines. After 1974, the first short courses were implemented in Operation Engineering – with emphasis on Civil and Electrical Engineering (UTFPR, 2009).

Currently, the UTFPR works with applied research and entrepreneurial culture (near to the business sector) and develops extension courses for the community. The UTFPR mission is to "promote educational excellence through teaching, research and extension, interacting ethically and productively with the community to social and technological development", and its vision is "to be an educational model of social development and a reference in the technological area" (UTFPR, 2013, p. 24).

The UTFPR's IA, established in 2007, seeks to develop collaborative research with national and multinational companies. For IA activities development, it has a staff of seven employees and one director.

The activities performed by the Agency consist of the university intellectual property management, and they can be exemplified by identifying opportunities, encouraging innovation, technology transfer and stimulating patenting (DIRAGI - Diretoria da Agência de Inovação, 2016).

Federal University of Parana (UFPR)

Federal University of Paraná (UFPR), initially called as the University of Paraná, started the activities in 1913 as a private institution. The federalization occurred in 1950, and its base relates to the tripod teaching, research and extension to reach the community development.

The UFPR's mission is "to contribute to sustainable development, prioritizing the continued professional training of citizens and producing, socializing and appropriating knowledge in coordination with other society segments and acting as a reference in Brazil." It is worth mentioning the following values: "construction of a free, public, quality and committed university with social and sustainable development" (UFPR, 2012, p. 4).

Therefore, the Institutional Development Plan (IDP) provides, among various interests, the partnerships' increasing rates with productive sectors. The creation of its IA, in 2008, was a boundary for consolidation and strengthening of the technological innovation system by the institution (UFPR, 2012)

Currently, the IA has five employees who work in production management of scientific and technological knowledge of the institution. The protection of generated knowledge and support for its implementation in society makes up the primary objective of the IA (Agência de Inovação UFPR, 2016).

State University of Campinas (Unicamp)

Unicamp has a more recent history than other universities in question. It was founded in 1966, and self-entitled as a "young institution that has won strong tradition in teaching, research and relations with society" (UNICAMP, 2015a) since it fulfils the function to enable the skilled person for developmental activities.

The highlight of the institution is to "combine teaching and research" since much of the professors (86%) work with total dedication. Also, with

research and related activities, the students can create new knowledge, and "15% of the Brazilian university's research" originates in this university (UNICAMP, 2015a).

Inova Unicamp (its IA) aims to "[...] establish a network of Unicamp relationships with society to increase research activities, education and advancement of knowledge [...]" and its mission is to "[...] identify opportunities and promote activities to stimulate innovation and entrepreneurship, increasing the impact of teaching, research and extension in favour of sustainable and socio-economic development [...] " (UNICAMP, 2015b).

The agency focuses on providing support to researchers, assisting in innovations licenses, intellectual property management, partnerships among public and private sectors and development support (UNICAMP, 2015b). Besides, it has the role of facilitating partnerships and cooperation. It attempts to expand aspects of teaching, research and extension through partnerships and ways to stimulate innovation and entrepreneurship (Agência de Inovação Inova Unicamp, 2014), and it has 45 employees to do that.

Summary of crossed cases

The literature review allowed the identification of critical issues concerning the TT that supported categories analysis (following table lines). The empirical research allowed the identification of collected, analysed and categorized data, characterizing aspects of each TTO studied. Thus, Table 1 below shows data's syntheses.

Categorization of elements	UTFPR	UFPR	Unicamp
History and Experience	IDP provides technological development to the institution, search for technologies production, patent applications and TTOs establishment at all campuses.	IDP provides technological development to the institution. Therefore, there is a quest to develop and structure TTO such as supporting tools, more employees experience and training, as well as search for more staff.	IA accumulates enough experience in the I-U because its introduction intends to achieve a continuum of improvement. It has a structured TTO and a precise role of IA as a partnership facilitator.
Philosophy and institutional interests	Aims to increase the TTOs performance from the market demands to technology transfer. Encourages researchers to work with consulting (support industries and firms), continuing education for companies and generate royalties for the university.	Seeks to raise partnerships' rates with productive sectors and create environments approach of partnerships. Also, it establishes ways for firms to access new technologies developed. The focus is on giving a practical destination to knowledge produced and generating royalties for the university.	Seeks to identify opportunities, stimulate innovation and entrepreneurship. Generates technological development from R&D agreements; expand the market approach; it generates royalties for the university.
IA administrative procedures	IA manages bureaucratic procedures for patenting, but partnership routing is a responsibility of DIREC and centered in PROREC	IA prospects partnerships, but partnerships formalizing is centered externally by departments and legal prosecution of the university.	Administrative procedures aligned to the Public Prosecutor and the State Court of Auditors; IA prospects and negotiates partnerships; Partnerships formalization is quickly made by departments and legal prosecution
Researchers	It was not mentioned the presence of renowned scientists working in partnerships. The demand for publications and scientific papers have	The university has renowned scientists, but with incipient participation in the institution's partnership processes. Therefore, IA seeks	It has renowned scientists, with active participation in partnership process, which enables the development of internal skills demanded by the society. IA seeks to

	directed researchers to projects without a focus on technology transfer	to develop means and/or mechanisms to approach researchers, and industry	establish a strong relationship with researchers
University's impact on ambience	Aims to contribute to the economic and technological development of society, supporting the TT in the I-U cooperation	Seeks academic excellence, contributes to the economic, technological and social development of society	Aims to contribute to the economic, technological and social development of society, generating wealth and solutions to social challenges
Solutions sought by companies	Main demand is for troubleshooting and pursuit of knowledge in engineering	The demand is for new technologies or partnerships for R&D to solve specific problems and/or obtain competitive advantages, technical cooperation and services provision	Demand for process improvement and challenges related to disruptive issues, with a focus on Information Technology
Research results	Develop collaborative research with spin-offs, national and multinational firms. Seek to establish and deposit patents both individually and in partnerships	Develop collaborative research with private companies and industries federation. The goal is to develop technological innovations, make TT processes and deposit patents. The results are still preliminary for generating financial resources for IA	Develop partnerships with national and multinational firms, with different sizes and purposes. The results are continual deposits of patents, licensing agreements and a source of financial resources for IA
Social relationships	Maintains contact with companies and industry associations; Perform network, informal contacts and formal lectures on different campuses to spread the IA and intellectual property	Forms partnerships with industry associations and public and private institutions to identify market needs; Conducts workshops, events, meetings with companies and researchers that can give knowledge and expand their activities	Develops partnerships with public and private, domestic and foreign institutions. Provides education and training programs. Conducts workshops, events, creates environments in stimulus university and support entrepreneurship
Legislation and government levels	Follow legal requirements (such as the Innovation Law (BRASIL, 2004),	Follow legal requirements (such as the Innovation Law (BRASIL, 2004),	Follow legal requirements (such as the Innovation Law (BRASIL, 2004), the

	the Well Law (BRASIL, 2005) and other associated legislation to achieve the activities	the Well Law (BRASIL, 2005) and other associated legislation to achieve the activities. Seeks to use these requirements to expand investments, foster culture innovation and attract research centers	Well Law (BRASIL, 2005) and other associated legislation to achieve the activities. Seeks to use these requirements to expand investments, foster culture innovation and attract research centers
Barriers	Historical/cultural influence as a barrier (conflicts between institutional and researcher's interests). Lack of financial resources and skilled technical employees. Staff turnover. A gap between the percentage of Intellectual Property (IP) between universities and industry. Little skill and/or disinterest of the agents. Lengthy internal procedures to formalize the contractual relationship. Need for IA's consolidation, legislation and the 'taboo' perception of profit by the university	Lack of precise definition of processes, financial resources and employees. Constant changes in the coordination of IA and time-consuming internal procedures to formalize the contractual relationship for the partnership. Need for IA's internal and external consolidation. Need the creation of interest by researchers and better support them. University skills unknown	Barriers are more linked to external aspects (high tax burden, lack of flexibility in the granting of patents, handle violations and difficulty of application and interpretation of laws, which cause legal uncertainty and disinterest)
Factors that stimulate the TT	Location and commercial applicability of development research stimulate the TT. Training and qualification programs are essential to TT	Location, IA's structure, professionals' qualification and reputation of the university to stimulate TT	Location, university mapping skills, quick and clear bureaucratic procedures, qualified personnel for partnerships' management, structured TTO and training programs to stimulate TT

TABLE 1 - TABLE SUMMARY AND ANALYSIS OF COOPERATION PROCESSES I-U.

DISCUSSION

Among the investigated IAs, there is some uniformity about innovation as registrable knowledge (intellectual property or patent) and the understanding that TT relates the university to industries primarily located next to the university environment. No wonder the impact they have in the locality where they are.

In this sense, the partnerships approach, maintenance and range of knowledge to the society depend on interaction. In the UTFPR, the demand for association starts with industries seeking the university to solve problems because the professors research for projects of their interests, which are not necessarily linked to the commercial interests. At the UFPR, the search is generally from industries that also seek how to solve their problems. In the Unicamp, the I-U cooperation process comes simultaneously from the university and industry.

In all three institutions, the solutions sought by the industries relate to insufficient knowledge, R&D need or problems solved in connection with engineering and technology areas. Furthermore, the partners access universities resources such as research laboratories and qualified personnel.

The partnerships and technologies' development require knowing about university skills such as Unicamp and UTFPR, which are recognized powers in the engineering area. The situation is still incipient in the UFPR, which works with its research coordination to resolve that difficulty and develop an online platform such as UNICAMP.

Moreover, there is capability to provide human resources for development activities. Thus, the partnerships' performance becomes considerably significant and one of the facts to raise activities and partnerships held by the institutions.

The casual approach of the UFPR with productive sector stems relates to the short number of employees in its IA. Therefore, the difficulty faced to

establish and continue partnerships prevents from activities' improvement and expansion. The UTFPR presents the same difficulties; however, it has a distributed performance at different campuses and emphases in engineering.

The Unicamp IA, in contrast, has enough trained personnel in well-specified positions. There is a delineation of activities and people along with close ties with the researchers, making it possible to expand activities and remain in continuous development.

Another important point, in the UFPR, is that the partners not always know the partnership course and becomes an obstacle to developing activities. In the UTFPR, bureaucratic proceedings and administrative fees charged by the managing partnership foundation (FUNTEF) are well defined and publicly reported on its website. However, this may slow down and endear the association, leading some firms to seek private institutions for solutions.

Although the partnership development processes were known, the main problem at the UTFPR seems to be negotiating the ownership percentage of the intellectual property. The university parts of an equal division of potential revenues between the parties, which is not always accepted to formalize the partnership by the firm. Contrary in Unicamp and UFPR, the percentage negotiation process is not an obstacle, but a consensus between the parties.

The prior difference between cases is the partnership processes management. It was noticeable that UFPR and UTFPR IAs rely heavily on other internal organs of the institutions to go forward with the process. Then, it may cause delays, excessive bureaucracy and, consequently, lack of interest in the firms.

On the other hand, Unicamp has a particular organ that conducts the cooperative processes, and there is an online tool for companies to look for the university expertise and expedite the partnership formalization. The restrictive

factors of cooperation are more linked to external aspects such as laws and government bureaucracy for the approval of research results.

Therefore, it is worth suggesting for the UTFPR to have a better structuring of TTOs for a more efficient operation. In the case of the UFPR, it could be positive to add an internal restructuring with support to researchers, a better IA management structure with well-defined processes and a large amount of staff to carry out and expand activities. Unicamp needs more infrastructure and resources for technology testing (something common in other countries like the US) and more qualified human resources. It is also necessary a regulatory standard and tax burden review. External improvements such these may increase the demand and development of activities by the IA.

CONCLUDING REMARKS

The central idea of developing research that may show TTOs performance in the public universities of Brazil needs to evidence the importance of such centers in intra-institutional and extra-institutional ways. From the literature on the subject, it was possible to lift features facilitating or barring the development of TTOs activities: History and experience, Philosophy and institutional interests, Administrative procedures, Research, Impact on the ambience, Research results, Social relationships and Legislation and government levels.

Although the UTFPR focus on the relationship with the external community, it is necessary to observe the market's demands and pay attention to the unresolved industry problems, increase the researchers' involvement in R&D projects without breaking the current legal framework.

Similarly, the UFPR presents difficulties in the TTO maintenance process, mainly, by having few, available and qualified specialists to expand the activities. It is also necessary to integrate the researcher to the activities and

develop partnership processes. Moreover, the lack of institutional perspective to get closer to the market leads to the underutilization of the institution potential. The ability obtained from the institutional trajectory could be better demanded and the partnerships' counterpart can be an efficient use for developing knowledge and a funding source for the institution.

The Unicamp IA has a better structure for partnership processes and TT. It has got specialized personnel and supply resources facilitating the expansion and service improvements. Besides, the institutional philosophy proves to be relevant to perform activities and use the resources to light up with the market's needs. That better structure contributes to the expansion of activities and the development of the institution, researchers and partners.

Among all these aspects, it is clear that each institution has perspectives for institutional technology, development processes and partnerships. Unicamp stands out due to its closer relationship with the productive sector, making it possible to obtain financial returns and a growing source of funds for the institution. These aspects need to be considered by the federal universities TTOs.

As the main challenges in the TT are to contribute to society’s economic and technological development, institutions rely on both internal and government incentives, greater availability of resources, reduction of barriers to cooperative processes and acceleration of I-U partnership processes. These features tend to increase I-U cooperation, giving usefulness to the IA and enabling improvements in various aspects.

Future research can identify, at the universities with structured TTOs, why researchers will engage or not in future I-U partnerships. Besides, it is worth understanding the university management models of IAs, innovation and technology’s management to suggest the best management practices from successful cases.

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