

University entrepreneurship in Brazil

University
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in Brazil

Panorama of the technological innovation centers of universities

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Abstract

Purpose – Universities, as providers of knowledge and technology, have a key role in society based on knowledge. The purpose of this paper is to identify and describe the technological innovation centers (TICs) of the federal universities of Minas Gerais, Brazil, verifying if federal institutions of higher education in the state are meeting the attributions outlined in the Innovation Act.

Design/methodology/approach – In order to achieve the proposed objective, each one of the public and federal universities in the state of Minas Gerais, Brazil, was outlined as analysis units. The data sources used for this study are intrinsically secondary and were collected from the websites and TICs of each university.

Findings – As a result, it was found that all universities have TICs, and are inserted into the State Intellectual Property Network. Those aspects show that the universities have been searching for structure themselves by the new entrepreneurial mission of today's educational institutions.

Originality/value – As noted in the literature, more research is needed to examine the efficiency and professionalism of TICs in the entrepreneurial activity of universities because the institutionalization of TICs is still recent and many TICs are currently in an improvement phase of their activities.

Keywords Innovation, Brazil, Entrepreneurial university, Technological innovation centres, Minas Gerais state

Paper type Research paper

1. Introduction

The constant changes occurring in the global socio-economic system confirmed that organizations have been seeking for new institutional forms as a way to stay active and competitive (Morschel *et al.*, 2013). This new context started interfering with a variety of actors, such as governments, regulators, private companies, investors and other stakeholders such as universities (Paloma Sánchez and Elena, 2006). Therefore, an important agent capable of transforming the scientific capital produced by their research in technological innovation was identified in universities, since these institutions have key elements of this process, such as trained personnel, specialized laboratories and partnerships with public and private organizations.

Therefore, the university has begun to contribute to industrial progress, so that the dissemination of knowledge generated in universities to society can occur in several ways, including the hiring of professors and students by industries, providing consulting, publications and presentations of academic papers, the development of technology-based companies, licensing of patents, among others (Grimaldi *et al.*, 2011; Berbegal-Mirabent *et al.*, 2015).

Therefore, in the literature of entrepreneurial university or academic entrepreneurship, the objective is the commercialization of new technologies developed by academic researchers (Grimaldi *et al.*, 2011). The main premise involving this new context of the universities is that the large amount of scientific literature produced by educational institutions may have commercial applications that are able to generate returns for the universities (Wood, 2011).



Furthermore, the universities are implementing institutional bodies to support technological innovation in their research, a factor that has reduced the barriers for researchers seeking to develop entrepreneurial activities (Suzuki, 2012; Walsh and Huang, 2014), as the technological innovation centers (TICs) or technology transfer offices (TTOs) as known in the literature (Bercovitz and Feldman, 2008). Thereby, the TICs have important goals of promoting the dissemination of potentially marketable inventions, managing the intellectual property of the university, providing the resources for the development of research and mediating the relationship between researchers, companies and university administrators (Weckowska, 2015).

However, despite the existing progress of the strengthening of TICs, the institutionalization of TICs is still recent, and many TICs are currently in an improvement phase of their activities (Dias and Porto, 2013). Thus, as noted in the literature on academic entrepreneurship, more research is needed to examine the efficiency and professionalism of TICs as a way to explain the changes in the entrepreneurial activity of universities (Clarysse *et al.*, 2011).

Given this scenario, the question raised is: How is the structure of TICs by federal universities of Brazil? Therefore, in order to guide the actions that will lead to a better clarification of the research question, the general objective of the research is to identify and describe the TICs relating to federal universities of Minas Gerais state, in Brazil, making sure that these institutions are in accordance with the outlined tasks in the act innovation of the country, which states that universities should have TICs.

Besides this introduction, this paper is structured into six sections. Section 2 contains a literature review that supports this study. Section 3 presents the methodological procedures used to achieve the purpose of the study. Sections 4 and 5 present, respectively, the results and discussion of the collected data. Finally, Section 6 shows the conclusions of the work.

2. The role of entrepreneurial university and the tics

The current scenario establishes innovation as an essential factor for the development and economic growth in many countries, making it essential to develop measures to corroborate to the research and development of new technologies (Etzkowitz, 2003). For this purpose, one of the main analytical frameworks for innovation is the triple helix model, proposed by Leydesdorff and Etzkowitz (1996), which emphasizes that innovation does not originate from individual action, but rather from the interaction of three main actors as a way to promote innovation in a given context, these being the university, industry and government.

Thus, in the triple helix model, universities, together with business and government, play a central role in promoting innovation (Etzkowitz and Leydesdorff, 2000), where, in this model, the focus is on the production and dissemination of knowledge (Ivanova and Leydesdorff, 2014). In this approach, the university can play an important role in the development of innovation in increasingly knowledge-based societies (Etzkowitz, 2009), mainly through scientific research and other academic papers (Grimaldi *et al.*, 2011).

To do so, over time, universities have passed through two academic revolutions. The first one was the need to enter along the teaching of academic research practices, while in the second, there was a need to capitalize this knowledge generated by the academy, providing a new mission to higher education institutions with more entrepreneurial vision (Etzkowitz, 1998; Suzuki, 2012). In this context, “the entrepreneurial university plays an important role as both a knowledge-producer and a disseminating institution” (Guerrero and Urbano, 2012, p. 44).

In this way, “use of knowledge for commercial purpose has been questioned in terms of university entrepreneurial mission together with teaching and research” (Ozgul and Kunday, 2015, p. 882). Despite the development of academic research, activity practiced by professors are substantial, especially on ways to expand the frontiers of knowledge;

recently, scientists are being encouraged to develop research of technological nature (Cowan and Zinovyeva, 2013), where, for Etzkowitz (2003), the entrepreneurial university encompasses and extends the research university.

Furthermore, after the development of applied research by universities, the protection of the invention by means of intellectual property is essential (Wood, 2011). The intellectual property guarantees legal rights of results derived from literary, artistic, scientific pursuits and industrial holders, ensuring certain rights with limited time to enjoy such productions as well as the misappropriation of third parties (World Intellectual Property Organization, 2004; Fujino *et al.*, 1999).

Furthermore, it appears that only recently, educational institutions have developed formal steps to invest in internal organizational structures and support mechanisms in order to optimize the process and encourage the marketing of their knowledge (Grimaldi *et al.*, 2011). In Brazil, as a way to regulate the actions of universities, the management of innovation, and, consecutively, the intellectual property, the Innovation Act was created, with the Law 10973 approved in December 2004. One of the aspects of this law is to focus on encouraging the participation of science and technology institutes in innovation process, which enables the transfer of technology and TIC's patent licensing, the development of consulting processes with the industry and the encouragement of innovation by its employees (Brazil, 2004).

According to the Innovation Law in art. 16, the STIs should have TIC in order to manage their innovation policy (Brazil, 2004). Thus, the TICs are now able to manage and protect their knowledge and develop skills to transfer the invention to the market, such as literary works, industrial designs, computer programs, among many others (Lucena and Sproesser, 2015). Thus, among the various instruments that higher education institutions have to enhance their activities, the role of TICs is essential (Muscio, 2010; Pereira *et al.*, 2015).

3. Methods

In order to achieve the proposed objective, each one of the public and federal universities in the state of Minas Gerais, in Brazil, was outlined as analysis units: Federal University of Alfenas (UNIFAL); Federal University of Itajubá (UNIFED); Federal University of Juiz de Fora (UFJF); Federal University of Lavras (UFLA); Federal University of Minas Gerais (UFMG); Federal University of Ouro Preto (UFOP); Federal University of São João del Rei (UFSJ); Federal University of Triângulo Mineiro (UFTM); Federal University of Uberlândia (UFU); Federal University of Viçosa (UFV); and Federal University of Vales do Jequitinhonha and Mucuri (UFVJM). Therefore, an object to study the structure of the TICs of each of the above universities was defined, seeking to verify whether universities are structured on a more entrepreneurial action, as they are aligned with government regulations, such as the 2004 Innovation Act.

Data sources used for this study are intrinsically secondary and were collected from the websites and TICs of each university. Therefore, for the collection of data, documental research was used, which, according to STUMPF (2005), is a method that can be considered a set of steps that allow the researcher to obtain bibliographic information, documents and notes of relevant references to the topic as a way to analyze the information, using in the writing of an academic research.

Furthermore, the information was collected on the websites of each of the analyzed TICs, which allowed the characterization and verification of the structure related to the actions that corroborate for the management of innovation from universities to which they belong. Data were analyzed based on relevant information to characterize the TICs, as year of creation, the ordinances they were instituted, the organs to which they were linked, the developed activities and other information that was available on websites. In the following section, the analysis of these data is presented by means of a description of the main information found in each TIC.

4. Results

According to the data collected in the institutional sites of each TIC, it was found that the Higher Education Federal Institutions of the State of Minas Gerais are looking for ways to structure the management of innovation, especially with the creation of TICs, which are the main actors within the higher education institutions that support the formation of an environment conducive to academic entrepreneurship, which contributes to the management of a more entrepreneurial university.

Since all 11 Federal Universities have TICs, a distribution of creations of TICs was proposed, in Figure 1, referring to the studied higher education institutions, regarding the evolution of the regulations on the main protections of intellectual property, since the government operates in innovation system primarily through regulations concerning innovation.

The Regional Center for Innovation and Technology Transfer (RCITT), created in April 1995, is the TTO of the Federal University of Juiz de Fora (UFJF), and it is linked to the Office of Graduate Studies, Research and Innovation of the university. The RCITT was created through Resolution 16/1995 and qualified as TTO by Resolution 31/2005. Among its responsibilities are the management of innovation policy of UFJF, coordination of the technology-based incubator and the responsibility for ensuring the maintenance of the institutional policy of fostering the protection of creations, licensing, innovation and other forms of technology transfer related to UFJF.

The Federal University of Minas Gerais (UFMG) in its duties has the Coordination of Technological Transfer and Innovation (CTTI), which was working since 1996, and was established only in 1997, through Ordinance 02/212. The CTTI acts in the management of scientific and technological knowledge; performing, among others, activities related to technological exploration; orientation and technological dissemination related to UFMG; creation of an entrepreneurial culture for teachers and students of the UFMG; protection and technology transfer; raising of funding for internal research at UFMG; and training of the university related to IP management.

The Standing Committee on Intellectual Property of the Federal University of Viçosa (UFV), established by Decree no. 0769 of 15/10/99, is responsible for the management of intellectual property, with the mission to organize, guide, monitor and implement the procedures provided in the legislation on intellectual property, which involve deposits and records of rights relating to intellectual property, as well as evaluate and advise the agreements, research contracts and contracts for services on issues involving confidentiality and intellectual property, technology transfer agreements and licensing within UFV and support the establishment institutional intellectual property and technology transfer policies.

The Center for Technological Innovation and Entrepreneurship (CTIE) was formed in 2001 in order to promote the formation of a cooperative environment that combines interests of Federal University of Ouro Preto (UFOP) to promote innovative activities and technology

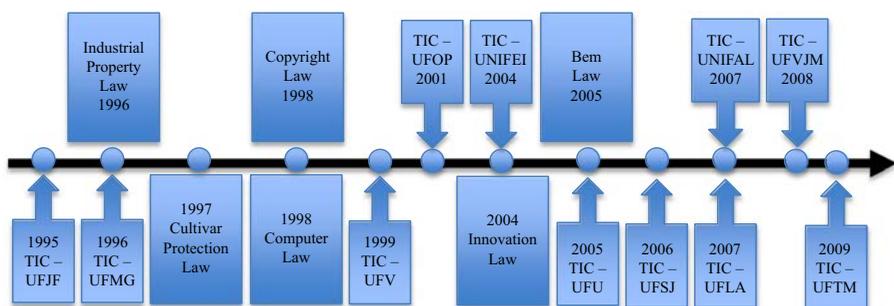


Figure 1.
Evolution of the creation of TICs and legislation on innovation

transfer, aiming to contribute to the social and economic development. The CTIE has as main objectives the acquisition and protection of intellectual property assets generated in UFOP in order to transfer those assets to market and for public use as well as for economic development, implementing the entrepreneurial culture in the academic environment.

The Innovation Center, the TIC of the Federal University of Itajubá (UNIFEL), was created by Decree 565 on December 17, 2004. The Innovation Center is part of the Technological Park of Itajubá project and aims to disseminate the culture of intellectual property and innovation; to stimulate research projects and development of new products; to process material in accordance to market demand; to perform the mapping of technological innovations; to perform the identification of internal and external demands of technological innovation; and, finally, to support entrepreneurial culture by pre-incubation and incubation processes in line with the market.

The Federal University of Uberlândia (UFU) created the Patent and Innovation Support Center in February 2005. The Center was institutionalized in August 2006 under Resolution 08/2006 on December 2, 2006. After such approval, it was called Intellect Agency, a body linked to the Office of Research and Graduate Studies, and it aims to promote and take care of the legal protection of knowledge generated in UFU, and encourages and guides the transfer of this technology protected service to the productive sector. Therefore, the public served by the Agency is the research community of UFU and companies interested in partnering with the University.

The Innovation Center is an administrative unit of the Federal University of São João Del Rey (UFSJ), linked to the Office of Research and Graduate Studies. Such skills were carried out by the Commission on Intellectual Property – COPIN in the period October 2, 2006–February 25, 2013, when COPIN was formally transformed into the Center for Technological Innovation, through Resolutions 10/2013 and 11/2013. The Center provides services such as guidance on intellectual property; assessment of patentability requirements; technological predicting; technological monitoring; production patent applications, software registration, trademark and industrial design; development of geographical indication projects; technical, administrative and legal advice to agreements; and contracts involving intellectual property and technology transfer.

The I9, Agency of Innovation and Entrepreneurship at the Federal University of Alfenas (UNIFAL), is a supplementary body directly linked to the Dean office. It was created through the Innovation Center of Restructuring and Intellectual Property (ICRIP/UNIFAL-MG), present at the University since 2007. It aims to expand the activities and skills of the TTOs, making the integration of all the initiatives for the innovation and protection of intellectual property. The I9 Agency is responsible for the management of innovation policy in UNIFAL-MG, through the protection of intellectual property and technology transfer, actively working to strengthen, support and coordinate entrepreneurial activities, as well as the establishment of partnerships between Entities and TICs.

The Innovation Center of UFLA, NINTEC/UFLA, was created on July 4, 2007 through Resolution No. 026/07 and is responsible for the management of technological innovation policy and protection of the knowledge generated at the university. It is linked to the Office of Research, and its main activities important to mention are the dissemination of the importance of intellectual property protection at the university and guidance in preparing the documentation for patent application, trademark registrations, computer programs, industrial designs, copyright and others; to help in the process of transfer of technologies generated in UFLA; to encourage the development of creations with potential for innovation; and to encourage agreements with other institutions and companies.

The TIC (NITEC) of the Federal University of Vales do Jequitinhonha and Mucuri (UFVJM) is the body responsible for the management of the technological innovation policy and protection of the knowledge generated at UFVJM. It was created by

Resolution No. 23-CONSU on 18 August 2008, altering the basic structure of the Office of Graduate Studies and Research at the University. It is linked to the TIC and has the mission of management actions and innovation processes; the dissemination of the importance of intellectual property protection at the university; to help in the process of transfer of technologies generated at UFVJM; encouraging the development of creations with potential for innovation; and, finally, encouraging the conclusion of agreements and arrangements with institutions and partner companies.

The TIC of the Federal University of Triangulo Mineiro (UFTM) was instituted and regulated on March 3, 2009 by resolutions 001 and 002 and is linked to the Office of Research and Graduate Studies. The primary function of the TIC-UFTM is to help researchers, professors, students and technicians of the institution and private sector that are interested in establishing partnership with UFTM, searching to increase awareness about the need to protect the generated knowledge and the transfer of technology. Its main responsibilities are: to manage intellectual property, technology cooperation and technology transfer.

5. Discussion

The technological potential observed in higher education institutions comes from efforts still in basic research, and possesses a more scientific nature. In this scenario, it appears that Brazil has gained worldwide evidence with regard to academic research, since it is responsible for about 53 percent of the scientific production in Latin America, which confirms that the country occupies the 15th place in the volume of global scientific production (UFV-PPG, 2012). In this sense, since the potential of higher education institutions in Brazil in the production of world basic research, it appears that they also excel in technology production. As demonstrated by Thomson Reuters (2013), among the ten largest holders of patents in Brazil from 2003 to 2012, five are public universities, which hold 27 percent of patents filed in the country. This result emerges from a process in which universities, besides maintaining their basic premise of teaching, research and extension, also began to produce applied research.

Brazil, therefore, as a developing country has moved to solidify a political and institutional framework for the formulation of policies, laws and regulations aimed at the area of innovation, both in the executive and the legislative power (Pereira *et al.*, 2015). The executive, the Ministry of Science, Technology and Innovation and the Development Ministry of Industry and Foreign Trade and in the legislative, the Computer law (Law 8248/1991), Intellectual Property (Law 9279/1996), Cultivar Protection (Law No. 9456/1997), Copyright (Law No. 9610/1998), computer programs (Law No. 9609/1998), the Federal Innovation (Law No. 10973/2004) and Bem (Law No. 11196/2005) can be cited (Suzuki, 2012; INPI, 2017).

The Law of Innovation, established by Law No. 10973 in 2004, has emerged as an attempt to explore the role of universities in the innovation scenario, in order to direct the research for the development of the country (Lucena and Sproesser, 2015). This law was structured in three parts, and the second part aims to encourage the participation of science and technology institutes in the innovation process and to establish the law requirements for the creation of TICs and for the management of innovation within the TIC or a set of TICs (Ministério da Ciência Tecnologia e Inovação, 2015). However, as can be seen, some universities have sought to introduce TICs even before the enactment of the law that regulates such activity, e.g. UFJF, UFMG, UFV and UFOP. As stressed by Arbx and Consoni (2011), several Brazilian universities have already held similar structures to TICs, even before the requirement was set by the Innovation Law, and the novelty is that the law, when institutionalizing and regulating these activities, structured an incentive system for the research to turn to the productive environment and the economy, and expanded the scope of operation of these institutions.

However, currently, all Federal Universities herein analyzed instituted TICs in order to manage innovation in the university context, which shows that the federal universities are in accordance with the determined law. Ishikawa *et al.* (2013) identified in their studies that despite the formation of some TICs being recent, these innovation agencies promote fundamental actions and activities for the development of the region in which they operate, as actions and activities related to entrepreneurship and dissemination of innovative culture, mainly through the protection and transfer of technology and intellectual property.

Finally, it is noteworthy that the federal universities of Minas Gerais are seeking for a greater structure for the development of innovation, since all the TICs from the analyzed universities are part of the Intellectual Property Network of Minas Gerais. This Network is a non-profit association that supports the scientific and technological institutions in the State of Minas Gerais in the area of intellectual property and innovation management, strengthening the development of the protection of scientific and technological knowledge in the State. It was established on July 16, 2003 and April 17, 2007, and joined the accredited networks promoted by the Foundation for Research of the State of Minas Gerais (FAPEMIG) through the "Program to Support Networks," showing its constant search for increasing the number of its activities in order to assist in the promotion and practice of consolidation of intellectual property in Minas Gerais and, consequently, in Brazil. Comprising 32 members, the current coordination of the network occurs through the Federal University of Minas Gerais (UFMG) and the Federal University of Viçosa (UFV). The coordinators who are in charge, respectively, are Pedro Vidigal and Rodrigo Gava (professors), leaving it to the UFV, the overall coordination of the Network.

6. Conclusion

Faced with the new demands of a society increasingly based on knowledge, the universities are an important agent for technological development, since academic research has great depth of knowledge that is capable of generating new technology. Therefore, universities, throughout their history, have undergone modifications that have attributed to them a more entrepreneurial mission. These universities have sought ways to structure themselves by the new context in which they entered. Several strategies are developed, such as the creation of TICs that are responsible for developing an environment to technological development, constituting one of the main elements of entrepreneurial universities.

Furthermore, verifying the importance that universities take in technological development, the creation of TICs designed to manage innovative skills and entrepreneurial universities is necessary so that these institutions can better manage innovation. Given the above, this study sought to identify and describe the TICs of the federal universities of Minas Gerais state, checking whether they are in accordance to the Innovation Act of 2004 that assigned the creation of TICs by universities.

As a result, it was found that all universities had created TICs over time, and some institutions made the institutionalization of these agencies even before the government regulation. The 2004 Innovation Law defines that the Science Institutions Technology should have TICs or any partnership with other institutions. Still, all the analyzed educational institutions are part of the Intellectual Network Property of Minas Gerais, an institution that supports the scientific and technological institutions in the State of Minas Gerais in the area of intellectual property and innovation management. Universities have been looking for a more entrepreneurial culture entering this new context. However, there is still the need for more support and effective actions.

It is noteworthy that the research has some limitations, especially with regard to the use of only of secondary data, as well as the difficulty in finding some specific data on the institutional websites of each TIC. However, despite these difficulties, the analysis of the

collected data allowed the authors to achieve the proposed objective, verifying that universities are seeking further improvement by the new context.

For future research, analyzing other agents that corroborate to university entrepreneurship in Brazil, such as technology parks and incubators of technology-based companies, is suggested. Also, the analysis focused only on the Federal Universities of the State of Minas Gerais; therefore, other studies can analyze the context of other universities in Brazil or in other country.

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