9th Research Workshop on Institutions and Organizations – RWIO

Center for Organization Studies – CORS

INTELLECTUAL PROPERTY & TECHNOLOGY TRANSFER PRACTICES OF PUBLIC BRAZILIAN SCIENCE AND TECHNOLOGY INSTITUTES: MULTIPLE CASE STUDIES

MARTHA DELPHINO BAMBINI
MA in Science & Technology Policy at University of Campinas (Unicamp)
Technology Transfer Supervisor at Embrapa Agricultural Informatics,
Av. André Tosello, 209 - Mailbox 6041- 13083-886, Campinas (SP), Brazil .
Email: martha.bambini@embrapa.br

ANA MARIA NUNES GIMENEZ
PhD Candidate at Department of Science & Technology Policy (DPCT), Institute of Geosciences (IG),
University of Campinas (Unicamp). Mailbox 6152 - 13083-970- Campinas (SP), Brazil.
Email: anamarianunesgimenez@gmail.com

MARIA BEATRIZ MACHADO BONACELLI
Professsor at Department of Science & Technology Policy (DPCT), Institute of Geosciences (IG),
University of Campinas (Unicamp) - Campinas (SP), Brazil.
Mailox 6152 - 13083-970 Email: bia@ige.unicamp.br

ANA LUCIA VITALE TORKOMIAN
Professor at Industrial Engineering Department at Federal University of São Carlos (UFSCar)
Rod. Washington Luís - Km 235 - 13565-905 - São Carlos, São Paulo, Brasil
Email: torkomia@ufscar.br

Abstract

The "Technological Innovation Act", promulgated in Brazil in 2004, represents the main legal framework implemented to promote technological innovation and to delineate a favorable scenario for scientific development in Brazil. It regulates specially the relationship between Scientific and Technological Institutions (STI) – such as universities and public research institutes - and private companies in Brazil. Among other things, the law determines that each STI should compose a Technological Innovation Center (NIT, as its acronym in Portuguese) to act as an interface of the STI and its markets. These centers are equivalent to what is internationally called Technology Transfer Office and have as main responsibility to transfer the knowledge and inventions generated at Public Research Institutes (PRI) to private

9th Research Workshop on Institutions and Organizations – RWIO

Center for Organization Studies – CORS

sector.This paper describes and provides some reflections upon the experience of three NIT, located in the State of São Paulo (Brazil): Innovation Agency of University of Campinas (Inova/ Unicamp); Innovation Agency of Federal University of São Carlos (UFSCar) and Embrapa Informatics of Agriculture. The analysis was focused on the following issues: history, legal structure and organizational model, mission and activities, relationships and results.

Key words: *Technology Transfer, Innovation, Science and Technology Institutions, TTOffices*

INTELLECTUAL PROPERTY & TECHNOLOGY TRANSFER PRACTICES OF PUBLIC BRAZILIAN SCIENCE AND TECHNOLOGY INSTITUTES: MULTIPLE CASE STUDIES

1. Introduction

A National System of Innovation can be described as a network of institutions and organizations in public and private sectors that interact in order to develop, diffuse and use innovations (Edquist, 2005). It offers a holistic and interdisciplinary perspective, considering several factors such as: economical, social, political, organizational and institutional. This approach stress that the innovation capability of a country depends not only on the individual power of the players, but also on the relationships established among them.

Regarding Brazilian Innovation setting, institutional framework was implemented from the 1990s on with the Intellectual Property Law enacted in 1996 (with some additions in 1998). In 2004, the "Technological Innovation Act" was promulgated in Brazil, representing the main legal framework to promote technological innovation and to contribute to the delineation of a favorable scenario for scientific development in Brazil. It regulates specially the relationship between Scientific and Technological Institutions (STI) – such as universities and public research institutes - and private companies in Brazil.

Among other things, the law determines that each STI should compose a Technological Innovation Center (NIT, as its acronym in Portuguese) to act as an interface of the STI and its markets. These centers are equivalent to international Technology Transfer Offices and have as their main responsibility to transfer the knowledge and inventions generated at Public Research Institutes (PRI) to private sector. The literature pinpoints three main profiles for the NIT' activities: legal, administrative and business (Lotufo, 2009). With

respect to the NIT' mission, they can vary: seeking for royalties as a source of revenue; maximization of regional and country development by transferring technologies to the market (based on spin-offs or licensing) and maximization of benefits to the society as a whole by freely disseminating the research results.

The main motivation for this paper is to understand the organizational practices of Brazilian NITs and their impacts on the results they obtain also considering the environment and the institutional innovation setting. This study aims to evaluate some aspects of three NITs: legal structure, mission, activities, organizational model, personnel and responsibilities. Based on that and on the literature, some considerations will be made regarding the organizational practices and the results obtained by each STI.

Three NITs, located in the State of São Paulo, have been selected for the analysis: Innovation Agency of University of Campinas (Inova/ Unicamp); Innovation Agency of Federal University of São Carlos (UFSCar) and Embrapa Informatics of Agriculture, a Research Center of Embrapa, the main federal company of agricultural research in Brazil.

This paper describes how these three specific Brazilian Science and Technology Institutes (STI) have structured their NIT in order to promote and execute the various activities assigned to them by the Technological Innovation Act, such as: research partnerships, technology transfer contracts, intellectual property protection and licensing, specialized consulting services and insertion in Research, Development and Innovation projects.

This article is structured in five sections, beginning with this introduction. Section 2 presents an overview of the state of art of the literature and section 3 describes the methodology employed in this study. Following are described the results and discussions, through the presentation and analysis of the selected cases. The conclusions are described at the end of the paper.

2. Literature overview

2.1 The role of Public Research Institutes in National Systems of Innovation

The theory of systemic innovation was created in the 1980's and considers that a innovation is a result of the interaction of several actors that establish several relationships in order to produce, diffuse and appropriate new and economically useful knowledge in within a country (Lundvall, 1992; Nelson, 1993).

The National System of Innovation (NSI) is a conceptual construct characterized by the reunion of several elements and relationships which interact in the production, diffusion and use of new and economically useful knowledge. Its core activity is learning, a dynamic social activity characterized by interactions between individuals, combinations of existing knowledge and both by feedback and by reproduction (Lundvall, 1992)

The NSI construct allows the conduction of several kinds of analysis regarding Innovation and a country level, such as: the group of institutions that influence the technological capabilities of a nation; the processes by which they are developed through education and training; the business culture of the country; the financing agents and their mechanisms; the managerial decisions and working practices of the firms and their relations with public research institutes; the interfaces of universities and markets, and so forth. The Systemic approach stresses that the innovation capability of a country depends not only on the individual power of the players, but also on the relationships established among them (Lundvall,1992; Nelson, 1993).

According to these authors, the systemic innovation approach is characterized by intensive formation of networks of organizations, permeated by institutions and policies that affect their behavior and their innovative performance regarding the generation of new products and processes that are socially and economically appropriate. The elements of an innovation system either reinforce each other to promote the learning processes and innovation or, conversely, combine into constellations to prevent these processes. Cumulative causation, virtuous and vicious cycles are characteristic of systems and sub-systems of innovation.

Edquist (2005) describes the NSI as a network of institutions and organizations in public and private sectors that interact in order to develop, diffuse and use innovations. It offers an holistic and interdisciplinary perspective, considering several factors such as: economical, social, political, organizational and institutional.

Lundvall (1992) pin points the important role of the institutional framework to NSIs in order to promote direction and directives either the actors and their collectives. Institutions can be described as routines that guide everyday actions of production, distribution and consumption; they can also be directives to guide change processes, enabling economic systems to act and survive in an uncertain world. In this context, one should consider the technological trajectories and paradigms that drive the innovative activities of scientists, engineers and technicians as a special type of institution. Examples of institutions are rules and norms regulating relations between the organizations of the system and intellectual property legislation.

Scerri and Lastres (2013), when addressing the relationship between the State and the NSI, highlight the need to consider the specificity of each context in analyzing each country´s NSI. They argue that there have been several definitions of NSI, more and less comprehensive, but the central role of the state in the formation of the NSI is always prominent in most of them. The authors adopt a broader definition of NSI considering several dimensions such as: historical and national trajectories and several contexts such as productive, financial, social, institutional and political, as well as micro, meso and macro spheres.

According to the authors, the broader approach regarding innovation systems assumes the influence of a large number of types of actors in the innovation process, not just the organizations that perform activities in the field of Science and Technology. Considering that the innovative activities and practices occurring in a given country are immersed in a broader economic system, several elements have to converge to complete the innovation cycle, with the effective use of new knowledge of technologies. Some of these elements are: adapted productive systems and infrastructure, institutional setting (regarding regulations, public policies, laws, norms and practices), capital availability and adapted organization models of the involved actors.

Scerri and Lastres (2013, p.8) stress that "the analysis of the NSI with focus on the institutions, formal and informal, provides the broader context within which development economics should properly be based". Considering this view, the role of the policies is not to create but to shape the evolution of the NSI along a directed path.

According to Edquist (2005) the main components of a NSI are organizations and institutions and the relations established among them. Generally speaking, Public Universities and Government Laboratories are important organizational actors at NSIs, sources of new knowledge, know how and technologies. Some important outputs of university research, that apply to Government Laboratories, are: scientific and technological information; equipment and instrumentation; skills and human capital; networks of scientific capabilities and prototypes for new products and processes (Sampat, 2006).

Both types of organizations share important features and characteristics between them (Bozeman, 2000). The similarity between them regards the academic background and reward system of research personnel (generally based on academic publications and to a certain extent patenting and commercialization of innovation assets). The comparative advantages among them reveals that government laboratories have more skills to perform interdisciplinary research that universities, generally with departments organized by scientific fields. Other advantage of laboratories is the facility to build scientific laboratories and share equipment time with partners. On the other hand, Universities have a vital asset: students,

which make virtual difference in the outputs of research and in organizational culture. Additionally, the students formation are an important source of technology transfer to other research centers of to the industry, enhancing university-industry relations through personal contacts.

Bozeman (2000) considers that the nature of the technology transfer agents, such as universities and government laboratories, is affected by its culture and norms. Governmental laboratories are more likely to be involved in technology transfer activities, according to the author, since they have institutional missions directed to applied research, multiple and diversified. Other aspects that influence technology transfer processes are geographic location, budgetary and managerial flexibility of projects, commitment and interaction of the collaborating parties, the researchers' familiarity with the firm's needs.

2.2 Institutional framework to enhance University-Industry relations at Brazilian NSI

Several countries have implemented directives to increase relationships of public research institutes and universities with firms and other actors of NSI. These directives were implemented mainly through legislation and credit offer.

In United States, the Bayh-Dole Patent and Trademark Amendment was enacted in 1980, permitting publicly funded research institutes and universities to file for patents on results of their research as well as to grant licenses for these patents. Considering the specificity of this NSI public universities were active in patenting and licensing long before this legal framework (Mowery et al, 2001). The legislation was implemented in order to encourage linkages between public research institutes and universities and private firms and enhance technology transfer from publicly funded research centers to firms, converting knowledge into innovation.

Other policies were implemented in the U.S. in the period such as the reduction of public funding for Research and Development (R&D) activities and the creation of industry-university research as the National Science Foundation Centers (Bozeman, 2000). Mowery et al (2001) emphasize that the Act did facilitated university patenting and licensing as it promoted a shift to stronger intellectual property rights and stimulated commercialization. Sampat (2006) pin points that based on the belief that the Bayh-Dole Act enhanced technology transfer and public research institute´s contribution to innovation in the U.S., other developed and developing nations considered implementing a similar policy.

Regarding Brazilian Innovation setting, some authors emphasize that there was a delay in implementing a strong Brazilian Innovation institutional framework what happened from the 1990s on (Gouvea and Kassicieh, 2012).

Legislation regarding intellectual property was enacted in 1996, with some additions in 1998. The main legal framework implemented in Brazil to promote technological innovation and contribute to the design of a favorable environment for scientific development scenario is the Law No. 10.973, of December 2, 2004, regulated by Decree No. 5563 of 11 October 2005, also known as the "Technological Innovation Act" (MCTI, 2014).

This legislation regulates specially the relationship between Scientific and Technological Institutions (STI) – such as universities and public research institutes - and private companies in Brazil (Lotufo, 2009). This legislation is a major landmark in the process of increasing the linkages amongst government, universities and firms in order to promote an innovative environment and to convert knowledge in wealth (Santos & Torkomian, 2013).

This initiative reflects the need to provide efficient legal mechanisms to support the challenge of establishing a culture of innovation in the country. In this context, the Ministry of Science, Technology and Innovation (MCTI) considers knowledge as the central element of the new economic structures that arise and innovation as the vehicle of transforming knowledge into wealth and improving quality of life societies (MCTI, 2014).

Within the scope of the "Innovation Act", Science and Technological Institutes (STI) are considered governmental entities whose institutional mission includes performing basic or applied research activities of a scientific or technological nature. This legal framework deals with the relationship between STIs and private companies (Lotufo, 2009) and involves three main areas: the creation of propitious environments to strategic partnerships between universities, public research institutes and companies; encouraging the participation of STI in innovation processes and promote innovation in the company.

The Innovation Act was accompanied by other instruments of innovation policy. Innovative companies can apply for a range of possibilities of obtaining financial and human resources (Torkomian, 2011). Some examples are the Program Human Resources in Strategic Areas (RHAE), operated by the National Council for Scientific and Technological Development (CNPq); the funding offered by the Financier of Studies and Projects (FINEP) and by the National Bank for Economic and Social Development (BNDES) and tax incentives provided by the Good Law (Law No. 11.196 / 2005). Some of these supports are provided by the existence of R&D projects developed collaboratively by companies and STIs.

Since the enactment of the Innovation Law, STI assumed several new activities such as: protecting the intellectual property of inventions; entering in contracts of technology transfer and licensing of intellectual property assets; providing expert consulting services and encouraging the participation of its researchers in projects of Research, Development and Innovation.

In order to provide an organizational structure to implement these new activities, the law requires that each STI constitutes a Technological Innovation Center (NIT, as its acronym in Portuguese) to act as an interface of the STI and its markets and manage its innovation initiatives. The duties of the NIT, stipulated by the law, are: (I) the maintenance of an institutional policy of fostering the protection of creations, licensing, innovation and other forms of technology transfer; (ii) to evaluate and rank the results arising from activities and research projects to meet the provisions of the Technological Innovation Act; (iii) evaluate independent inventor requests; (iv) opine by convenience of promoting the protection of creations developed in the institution; (v) opine as to the advisability of disclosing the creations developed at the institution, subject to intellectual property protection; (vi) track the processing of applications and the maintenance of intellectual property rights of the institution.

2.3 Brazilian SNI performance and the role of TTOs

The Innovation Act was enacted almost ten years ago and it still persists in Brazil, a significant disconnection between the activities of public research and the generation of technological innovations (Lotufo, 2009). There is a need for strengthening of ST&I (Science, Tecnology & Innovation) policies in Brazil, which can be achieved through synergistic interactions with the industrial policy and the stimulation of the protection of intellectual property assets in order to incorporate them into the productive process in order to encourage cooperation actions between STI and private companies. The government can also act in the promotion of tax incentives and grant resources to support initiatives to promote technological innovation.

Even with a significant improvement obtained after the implementation of the Innovation regulatory framework, regarding the qualification of human resources and the amount of publications and intellectual property assets generated in the country, Brazil has had lower statistics than the other BRICS countries (Brazil, Russia, India, China and South Africa) (Lotufo, 2009; Dutta et al, 2014).

The study Global Innovation Index (GII) evaluated 143 economies in 2014 (Dutta et al, 2014). It was constructed considering 81 indicators divided in 7 dimensions: institutions; human capital & research; infrastructure; market sophistication; business sophistication; knowledge and technology outputs and creative outputs. This model reflects the fact that innovation is a multi-faceted phenomenon with several input drivers and different output results.

According to this study (Dutta et al, 2014) the top ten countries in innovation are: Sweden, Finland, Switzerland, United Kingdom, Netherlands, United States of America, Singapore, Denmark, Luxembourg, Hong Kong (China). At first sight, one could say that high income would be a common factor to explain their leadership in Innovation. However, several other high income countries did not reach these positions, what shows that other factors have important influence to strengthen National Systems of Innovation. Another common characteristic of these leader countries is that they are consistent in having high ranks on most of the seven dimensions of the study.

Brazil ranked 61 in the GII study. Analysing its position in the 7 dimensions (mencioned above), the highest score Brazil obtained was related to its institutions, although it ranked 96 in comparison with the other economies under study. Even though Brazil has a strong regulatory framework, other countries have institutional characteristics more favorable to innovation, especially with regard to the business environment, assessed the ease of starting a business, resolving insolvency and paying taxes.

The GII presents Brazil at the second place regarding "quality of innovation" of medium income countries, aspect evaluated by quality of universities, families of patentes covered and citable documents. Worth noting that China was ranked first place and India was third.

Brazil was better ranked at some indicators of the seven dimensions, assuming places from 25 to 42, such as: knowledge-absorption (25), research and development (34), information and communication technologies (41), education (43), online creativity (47) and knowledge workers (52).

Innovation linkages ranked 57 and comprehend the following indicators: university/ industry research collaboration, state of cluster development, percentage of gross expenditure on R&D financed by abroad, joint ventures/strategic alliances, patent family filed in 3 or more offices. The complete results of the study are described by Dutta et al (2014).

Considering that NIT have been created as an instrument to facilitate interactions of STI and the markets, with emphasis on the private companies, they have an important role in improve the innovation linkages build by an economy. According to Lotufo (2009), the performance of NTI favors the creation of a favorable environment for technology transfer and for the protection of knowledge generated in STI, configuring it as the main interlocutor of the institution with the market.

In relation to mission and directives, the NIT can have multiple focuses, such as seeking royalties as a source of revenue, and maximizing the regional development of the country with the transfer of technologies to the market (based on spin-offs) and generation benefits to society as a whole, from the dissemination of the results of academic research. Santos (2009) highlights that in developed countries reported in the literature models, NITs concentrate their activities in asset management intellectual property, considered a central component of the process of technology transfer.

2.4 Technology Transfer Offices (TTOs): processes and activities

"Technology Transfer" can be defined as a process that involves the acquisition and provision of operations and involves the transmission or exchange of knowledge and/or technology between two or more parties (Assafim, 2010). The concept of transfer takes the existence of a possessor of the technology and another actor who needs it.

Manimala and Thomas (2013) identified six essential elements of the process of international technology transfer, which can also be applied to transfer processes in general:

(1) a **transferor**: the entity that owns the knowledge assets and wants to transfer it to another entity;

(2) a **transferee** (that receives the technology): the entity that wants this asset in order to use it and convert it to benefits;

(3) the **content**: the nature of the knowledge asset to be transferred;

(4) the **mechanism** by which the asset will be transferred in order to allow the transferee to use it appropriately and effectively;

(5) the **purpose** of transferring, for the transferor and the transferee (which may have different agendas);

(6) **channels and transfer modes** such as licensing, cooperation agreements, joint ventures, start-ups, etc.

Establishing a Technology Transfer Office (TTO) is not a trivial matter (Young, 2007) and must be a result of a planning process at the STI with a long term commitment of the institute with the TTO activities. An **executive-summary plan** should be defined describing its mission and objectives. The STI has to establish an Intellectual Property policy according to its norms and the country´s legislation as well as a funding model.

Brazilian NITs are equivalent to international Technology Transfer Offices, in terms of purpose of existence and activities and have as their main responsibility to transfer the knowledge and inventions generated at Science and Technology Institutions to private sector.

The literature pinpoints three main profiles for the NITs' activities: legal, administrative and business (Lotufo, 2009).

Bennet et al (2012) observe that the implementation of a Technology Transfer Office requires: (i) selecting as adequate business model; (ii) establishing an institutional policy framework in accordance with national legal scene clarifying the responsibilities of the institution and its employees; (iii) building the capacity to protect the intellectual property and negotiate innovation assets through legal agreements; (iv) acquire experience in developing business strategies to effectively disseminate technologies and work with private companies; (v) building an innovation culture at the institution and communicate it externally.

The authors emphasize that technology transfer activities may be addressed in different manners, always considering local need, resources and legislation.

Regarding TTO´s Business Models, Bennet et al (2012) describe several types: independent department in within a public research institute; a networked based TTO (sharing the office with others institutes); a subsidiary company to the STI and outsourcing.

Considering the complexity of these processes, various skills need to be applied to accomplish technology transfer related tasks (Mom et al, 2012). Individual skills mentioned by the authors are: marketing and negotiation; team work; innovation; business development; knowledge management; entrepreneurship, communication, and intellectual property. Bennett

et al (2012) describe the core activities and skills of TTO personnel: evaluate invention disclosures and decide about intellectual property strategies; manage and monitor patents prosecution; define commercialization strategies; negotiate and execute several types of transfer agreements; and, once the agreement in concluded, monitor technology developments and compliance with license terms.

Considering that activities are so diverse, TTOs need multi-disciplinary personnel, with specific skills, as well as an adequate business model and organizational structure in order to facilitate interaction with researchers and the potential market.

3. Methods

A qualitative research was conducted focusing on three cases of study (Yin, 2010) aiming to answer the following question, considering the context of a Brazilian National System of Innovation (NSI): what organizational practices can be implemented by Brazilian NIT so that they can effectively promote the diffusion and exploit new knowledge and technologies? Data was collected through: interviews, documentary research and literature review.

Three NIT, located in the State of São Paulo, have been selected for the analysis: Innovation Agency of University of Campinas (Inova/ Unicamp); Innovation Agency of Federal University of São Carlos (UFSCar) and Embrapa Informatics for Agriculture, a Research Center of Embrapa, the main federal institute of agricultural research in Brazil.

The cases were selected in order to present NITs linked to different types of STIs. The first two cases refer to two public universities, one linked to the State Government of São Paulo and another to the Federal Government. Both have prominence in higher education and graduate studies and are located around major technology centers (in Campinas and São Carlos, respectively). Additionally, the case of Embrapa presents the experience of an important public research institute in the field of agriculture and information technology, also near to the high technology pole of Campinas.

4. Results and Discussions

4.1 First Case: Technology Transfer at University of Campinas (Unicamp)

4.1.1 Characteristics of Unicamp

The University of Campinas (Unicamp) is a public institution established in 1966, with autonomy regarding its educational policy, but subordinated to the state government of São Paulo, with respect to the financial resources for its operations.

Although it is considered a young university, Unicamp is already recognized for its strong tradition in teaching, research and relations with society, one example is the Program for Interdisciplinary Training Superior (Profes) course that created 120 new jobs and a new way access to universities for students from public high schools of Campinas, which was awarded the 2012´s prize of best experience in education in Brazil by the Foundation as Péter Murányi (Unicamp, 2013).

In 2012, Unicamp had 32,569 students enrolled in 67 undergraduate and 140 graduate programs offered in three *Campi*: Campinas, Piracicaba and Limeira. In 2012, 2,254 students completed the undergraduate and 2,490 postgraduate (1,232 in Master´s, 853 in Doctoral studies and 405 in specialization degrees).

With regard to its role in the national innovation scenario, Unicamp had, in 2012, 1,739 faculty members (99% of them with at least a PhD degree and 92% exclusively dedicated to the University). The university is responsible for 10% of the academic research produced in Brazil, and have an index of 1.9 papers published in refereed international journals per capita. The University is gradually occupying a prominent place in the state and national innovation systems once it was, in 2012, the Brazilian university with the largest number of patent requests deposited at the National Institute of Industrial Property (INPI) as a result of the activities of its Innovation Agency (named Inova Unicamp).

4.1.2 Technology Transfer activities at Unicamp: history, structure and responsibilities

Long before the enactment the Brazilian Innovation Act, Unicamp already had the Technology Center, created in 1972, which had the responsibility for intellectual property protection activities regarding the knowledge generated by the university as well as the provision of services and technical support to teaching and research units. In January 1984, it was created study group with the mission to deploy the Permanent Commission of Industrial Property (CPPI) (through Ordinance GR 018/84) with the objective of supporting the professors/ inventors (Russano, 2013). In 1990 the Office of Technology Transfer (ETT, as the acronym in Portuguese) was created. It was extinct in 1998 with the implementation of the Office of Diffusion and Technological Services (EDISTEC, as the acronym in Portuguese) that lasted until the year 2003, when the Innovation Agency of Unicamp - Inova Unicamp -

was created by the Resolution GR 51/2003, directly subordinated to the office of the Rector (Lemos, 2008).

4.1.3 Unicamp Innovation Agency – Inova

The Agency four directors responsible for: (i) Executive Management; (ii) Partnerships and Collaborative Projects (iii) Science and Technology Park; (iv) Intellectual Property, as well as a technical and administrative team formed by technical specialists and the administrative support staff.

The technical and staff consists of employees and professors attached to Unicamp hired through public tender; of interns and grantees (temporary staff) and employees hired through selection processes conducted by the Foundation for Development of Unicamp (FUNCAMP, as the acronym in Portuguese). The selection process is the result of a partnership signed between FUNCAMP and Unicamp and the means to pay the technical staff come from the aforementioned Agreement. Employees are selected by a nonprofit private institution (FUNCAMP) and the contracts are governed by the Consolidation of Labor Laws (CLT, as the acronym in Portuguese). There is a period of experience of ninety days, after which and upon positive evaluation of work performance, the contract would be of indefinite duration (FUNCAMP, 2013). In 2013, Inova Unicamp had a team formed by 23 employees and 10 temporary staff (Inova, 2014).

Currently Inova had reviewed its mission so as to be "*identify and promote opportunities to stimulate innovation and entrepreneurship activities, expanding the impact of teaching, research and extension in favor of sustainable socioeconomic development*". The Vision of the agency is to *"become a leader in the ecosystem of innovation and entrepreneurship at the regional and national level, and international recognition*". And its values are: respect for people, commitment, excellence, cooperation and integrity (Inova, 2014, p 68).

In 2013, the Agency had 54 existing contracts of technology licensing and profit sharing, having 8 of these been celebrated in that same year 2013. The total number of patent applications deposits at the National Institute of Industrial Property (INPI, as the acronym in Portuguese) was 75 (being 2 of them international). The total number of valid patents was 866, 11 of which were granted in the year 2013. Table 1, below, presents results obtained by Inova in the period between the years 2009 and 2013.

With regard to the rewards system, it is important to highlight that the Innovation Act assured the creator a minimum percentage of 5% (five percent) and a maximum of 1/3 (one third) in profits earned by the STI, resulting from contracts of technology transfer and licensing of protected inventions of which he has been the inventor, breeder or author. Unicamp defined that inventors would receive maximum participation, up to one third of the gains earned by the university through licensing (Lotufo, 2009).

Furthermore, in an attempt to facilitate contact with professors and researchers interested in collaborative projects with private companies, Inova instituted a "Competence Database" including the main lines of research of colleges and institutes of Unicamp and their research team. This initiative guarantee that all those who are interested in establishing strategic research and development partnerships will receive guidance and assistance to find companies interested in its line of research and also to establish partnership agreements. Information is gathered through an on-line form to be filled at Inova´s website (Inova, 2013).

Table 1: Inova Results from 2009 to 2013 (Inova, 2014).

Activity	2009	2010	2011	2012	2013
Disclosures	55	61	94	107	122
Patent applications at INPI (Brazil)	52	51	67	73	71
Patent applications abroad	8	16	14	1	4
Granted invention patents (Brazil and abroad)	14	8	9	10	11
Valid patents	664	705	765	821	866
Current licensing contracts	36	43	52	65	54
Earned Royalties from licensing (US$)	87,390	85,590	323,610	171,740	239,280
Research and Development Agreements	8	5	13	10	15
Incubated companies at Incamp	10	11	9	10	12
Events and training courses promoted by Inova	42	18	18	16	17

Unicamp also has a Technological Base Business Incubator (Incamp) which was established in 2001 and incorporated by Inova in 2003. Incamp is an environment that encourages the creation and protects the development of new technology-based enterprises through the provision of infrastructure and technological capacity and management for new entrepreneurs. It benefits from the proximity of laboratories and human resources from the University as well as from the innovation network promoted by Inova. The University also

has a Scientific and Technological Park aimed to be an environment approach with companies that promote innovation in the country. The urban project was conducted in 2012 (Inova, 2013) and three buildings have been constructed: an Innovation center and incubator; a Biofuels Innovation Laboratory and an Innovation Center in Software (Parque, 2014).

Due to the successful experience in conducting Unicamp´s Intellectual Property Policy in 2007, Inova has been chosen to lead the InovaNIT Project, a government initiative aimed at creating a training program for NIT professionals in order to reduce the Brazilian "gap" of Scientific and Technological Institutions (STI) related to the establishment of their NIT (Santos; Toledo & Lotufo, 2009; Gimenez, 2012). The project was funded by the Financier of Studies and Projects (FINEP) with the following activities to be conducted by Inova: structuring courses for theoretical and practical training of professionals NIT (classroom and distance); development of training for structuring, implementation and institutionalization of NIT; expert advice; development of publications on topics of interest to NIT: best practices manual for technology transfer, intellectual property management and STI-company interaction; articles and books; partnership with public and private institutions to develop and offer courses on topics related to Science, Technology & Innovation system. Between the months of August 2007 to December 2010, 833 professionals were trained and assisted 279 institutions from all regions of Brazil, and created about 20 NIT (Toledo et al., 2011).

The InovaNIT project had as main purpose to spread the experience of Inova Unicamp and consolidate successful practices of performance in technology transfer, intellectual property management and cooperation between universities and companies and organizations in the innovation process. Inova have been also promoting other actions in order to stimulate an innovation environment such as “Desafio Unicamp” (Unicamp Challenge) a business model competition to stimulate the creation of technological base businesses based on Unicamp technology portfolio. Other programs such as “InovaDescobre”, Mentorship Network, and Unicamp Ventures are described in Inova (2013).

4.2 Second Case: Technology Transfer at Federal University of São Carlos (UFSCar)

4.2.1 Characteristics of UFSCar

The Federal University of São Carlos (UFSCar) is a public higher education institution under the Ministry of Education (MEC). Its activities were initiated in 1968 with the following purposes: training human resources, producing and disseminating knowledge and scientific, technological, cultural and artistic communication.

To achieve its objectives, the University teaches undergraduate and graduate courses that meet the demands of qualification of the society, stimulates scientific and technological research in all fields of knowledge and provide the knowledge produced through extension programs and projects, aimed at advancing science and human development (UFSCar, 2014).

UFSCar currently has four *campi* situated in the towns of São Carlos (1968), Araras (1991), Sorocaba (2005) and Buri-Lagoa do Sino (2013). There are 47 Departments and 8 Academic Centers, which offer 61 undergraduate attendance courses, five undergraduate distance learning courses (with poles in 25 cities in 6 states in the country), 1 special graduation, 72 of specialization and 74 graduate courses.

At the end of 2013, the University counted 18,898 students, being 12,118 in attendance undergraduate courses, 2,689 in distance learning undergraduate and 3,780 in graduate programs. In addition, the institution had 909 technical and administrative staff and 1,093 faculty and 451 research groups.

In 2014, UFSCar has been ranked 18th among 300 universities in Latin America in the Quacquarelli Symonds (QS, 2014) ranking and 10th place in the 2014 University Ranking "Folha" (RUF, 2014) and ranked 43rd place among the 100 best universities in the BRICS.

4.2.2 Technology Transfer activities at UFSCar: history and evolution of the structure

The Foundation of Institutional Support to Scientific and Technological Development (FAI UFSCar), created in 1992, had important influence and predominance in the treatment of issues relating to Intellectual Property, Technology Transfer and Innovation at UFSCar. FAI was established to support UFSCar in their final objectives (teaching, research and extension) and promote: scientific and technological development; artistic and cultural activities; environmental conservation and cooperation between UFSCar and society; enabling the enhancement of the quality of research and teaching at the University.

At first, FAI focused on the management of research and extension projects his performance, strengthening the relationship between UFSCar and the various sectors of society. From 2002 on, without prejudice to its other activities, FAI has taken responsibility for managing the patent portfolio of the University (Agencia, 2013).

It is noteworthy that the issue of Intellectual Property began to be discussed at UFSCar in 1996 with the creation of the Center for Extension-UFSCar Enterprise (Nuemp). This center was designed to encourage interaction between UFSCar and the productive sector, acting to facilitate companies' access to the University, as well as the transfer of research

results to society. Nuemp had several responsibilities such as: initiate the debate around intellectual property at the academic community in order to protect the rights of researchers and the institution on the outcome of research, encourage innovation and the development of new technologies and disseminate the knowledge generated for society. Other activities of Nuemp were: to create a database related to professors and their research lines; to advise companies and entrepreneurs with technological or management problems; to organize the participation of UFSCar in fairs and exhibitions; to conduct seminars, workshops and lectures; to advise on the elaboration of University-Industry Cooperation Agreements.

Thus, the creation of Nuemp is an important milestone in the institutionalization of intellectual property activities in within the UFSCar. However, it was necessary, at that time, to implement an organizational structure more adequate to attend the academic community (Agência, 2013). In the 1990's, FAI and Nuemp worked together considering they had several responsibilities of common interest. Various training activities and interactive events were promoted by them in within the University since the regulation of intellectual property at universities, including the Industrial Property (patents and trademarks), has become a requirement of the Ministry of Education (MEC), by the Ordinance No. 322, published in April 1998.

From the discussions and concepts transmitted in all these events, in 2013, the Ordinance GR Nº 627/03, published by the University Council, implemented the program of protection for intellectual property and technology transfer within the UFSCar regulating the rights and obligations relating to industrial property and other provisions. This same document established the Special Committee on Intellectual Property and Technology Dissemination (COEPI) and the Ordinance Nº 637/03 provided for the Commission regulation. The main responsibility of COEPI was to analyze and judge the legal and economic feasibility of applications for intellectual property protection referred by professors, students, and technical and administrative staff of the University.

Considering the enactment of the Technological Innovation Law in Brazil, between the years 2004 and 2005, UFSCar submitted in 2006, the work-plan "*Creation and implementation of the UFSCar NIT*" to a public call of the Ministry of Science and Technology (MCT), through the Financier of Studies and Projects (FINEP). This project, which involved the participation of faculty members from various departments and employees of FAI, was approved and its activities were completed in 2009, with the Innovation Agency of UFSCar already created.

In 2009, the PRO-NIT-SP1 project was initiated, grouping seven STI institutions of São Paulo State, among them UFSCar, through its Innovation Agency. The project, coordinated by Unicamp, aimed to improve the process of evaluation of the innovative

potential of technologies and marketing of the participating institutions. The funds, which totaled more than R$ 1 million, came from FINEP and CNPq. This project culminated in the creation two years later, the São Paulo Innovation Network - INOVA São Paulo.

4.2.3 Innovation Agency of UFSCar

In view of the requirements of the Innovation Law, it was signed in 2008 the Ordinance Nº 823/08 that established a technological innovation policy and rules related to technology at the University and implemented the Innovation Agency of UFSCar (Agencia, 2013). This ordinance attended two fronts: creating a body responsible for innovation policy at the Institution, the Technological Innovation Council, another one responsible for implementing these policies, the Innovation Agency.

The Innovation Council, subordinated to the University Council (ConsUni), is composed of the Dean of UFSCar (Chairman of the Board), all Associated-Deans, a representative of each of the Academic Centers, the Director of FAI and the Executive Director of the Innovation Agency of UFSCar.

The Innovation Agency of UFSCar is a subsidiary body of the Rectory and aims to manage its innovation policy and to expedite the conduct of initiatives to promote technological innovation, intellectual property protection and technology transfer within the institutional framework. It consists of an Executive Board (Executive Director and Deputy Director) appointed by the Dean and appointed after approval of ConsUni, and the Special Committee on Intellectual Property (COEPI), which analyzes and issue an opinion on the technical and economic feasibility of applications for protection intellectual property submitted to the Agency. The workforce of the Agency is currently composed of 14 people (including 2 interns) divided in the following areas: Intellectual Property, Technology Transfer Legal and Communication.

The implementation of the Innovation Agency required a series of actions that involved: the definition of new work procedures, staff training and the promotion of marketing and communication actions (internally and externally to the agency). Regarding the institutional communication, it were elaborated a new visual identity manual and stationery material as well as a brochure with general information about the Agency (aimed at internal and external community). Some communication initiatives were promoted in order to disclose the portfolio of technologies: a new layout for the Patent Portfolio, some videos with the participation of inventors and the Patent Minute radio spots for UFSCar Radio Station (Agencia, 2013).

Tables 2 and 3 present some results achieved by the Innovation Agency of UFSCar.

Table 2: Royalties and Invention Disclosures from 2010 to 2013

Atividades	2010	2011	2012	2013
Royalties earned through licensing (US$)	153,200	204,360	238,400	278,960
Invention disclosures	21	19	26	43

Agência (2013); UFSCar (2014).

Tabela 3: Protected and licensed Assets until 2013 *(Agência, 2014).*

Type of Asset	Protection and licensing activities
Trademarks	5 registered trademarks, 2 granted trademarks and 3 licensed
Software	8 registered software being 6 granted and1 licensed.
Patents	104 patent applications (98 of them related to inventions and 06 to utility model) 21 Extensions via Patent Cooperation Treaty (PCT) of which 08 are in national phases. 28 granted patents (11 National and 17 Internacional) and 12 licensed.
Cultivars	20 protected cultivars licensed to more than 150 companies

As a result of the consolidation of UFSCar Innovation Agency, in 2013, there have been 43 invention disclosures leading to 104 patent applications and 12 licensed patents, as shown at Table 3. The amount of earnings from licensing activities reached US$ 278,960.00 in 2013.

4.3 Technology Transfer at Embrapa Informatics for Agriculture

4.3.1 Characteristics of Embrapa

Embrapa is a technological innovation institute subordinated to the Brazilian Ministry of Agriculture, Livestock and Food Supply (Embrapa, 2014). It has the mission to generate knowledge and technology to Brazilian agriculture. Founded in 1973, Embrapa is a highly networked organization, formed by 47 Research and Service Centers distributed throughout Brazil, and by an international branch formed by virtual laboratories and business offices located in North, Central and South American countries such as United States, Panama,

Venezuela, and also in Africa, Asia and Europe. It has 9,790 employees, 24% of which are full-time researchers.

Embrapa Informatics for Agriculture is a thematic research unit of Embrapa. Its mission is to provide information technology solutions to research, development and innovation to promote the sustainability of agriculture for the benefit of Brazilian society (Embrapa Informática, 2014). It is located in Campinas, in the state of São Paulo. The Unit has 110 employees, 65% of them reporting to the nine research groups in the fields of: applied bioinformatics, computational biology, information organization, free software, geo-technologies, computational intelligence, new technologies, agro-environmental modeling and mathematical computing.

4.3.2 Technology Transfer activities at Embrapa: history, structure and responsibilities

Embrapa was a pioneer in discussion of issues related to Intellectual Property in the Brazilian agricultural sector, contributing significantly in the definition of public policies in this segment specially regarding cultivars (Santos-Serejo et al, 2007). In 1993, three years before the enactment of the Industrial Property Legislation, Embrapa started to elaborate its rules regarding knowledge protection and, in 1996, the company implemented it´s first corporate policy related to the management of Intellectual Property (Cunha & Botelho Filho, 2007). This policy began to guide the strategic relationship between Embrapa´s researchers and their external partners on issues related to the protection and ownership of innovative technologies and to their transference to the productive sector, through licensing or by other initiatives. The policy was implemented in order to adequate the institution to the new legislation regarding intellectual property also considering the discussions related this matter and the bills in vote at the National Congress at that time.

Between 1998 and 2014, Embrapa´s organizational structure related to intellectual property and technology transfer suffered an intense evolution. Many changes have occurred since the creation of the Department of Intellectual Property (SPRI) in 1998, through the implementation Intellectual Property Adjoint Manager (GPI, linked to the Service Unit "Embrapa Technology Transfer") in 2007 leading to the Office of Technological Innovation (AIT), implemented in 2007 after the enactment of the Innovation Law. AIT was Embrapa´s NIT with the responsibility of providing more agility, flexibility in the management of innovation activities (Bambini et al, 2012).

In 2008, Embrapa established, at its Executive Board, a Director of Technology Transfer (DETT), stimulate and valuing the initiatives promoted to complete the innovative

cycle with regard to the transfer of research results to the various stakeholders of the company. In 2009, a Department of Technology Transfer (DTT) was implemented, subordinated to DETT. The organizational change of Technology Transfer activities was completed in 2012, with the transformation of AIT in a Department of Business (SNE) and with a review of the activities of two sectors: the Unit Embrapa Technology Transfer - which was renamed Embrapa Products and Markets - and the Department of Technology Transfer.

This organizational evolution was conducted in order to improve the management model of Embrapa, aimed at strengthening the process of appropriation of research outputs by society.

DTT activities were reviewed and the department assumed responsibility for coordinating, articulating, guiding and evaluating the directives and strategies of Embrapa regarding the technology transfer as well as planning and promoting the implementation of actions in this area. The newly created Embrapa Products and Markets is a special service unit, whose institutional mission is to implement the strategies and actions of production, promotion, marketing and licensing of pre-technological and technological assets developed by plant and animal breeding programs promoted by Embrapa.

SNE is directly linked to the President-Director of Embrapa and advises the Central and Decentralized units of Embrapa in matters related to business development and in defining strategies and models of public and private partnerships in order to maximize the innovation process at Embrapa. It has four coordinators: Coordination of Regulatory Affairs (CAR); Coordination of Innovation in Business (CIN); Coordination of Negotiation and Contracts (CNC); and the Coordination of Intellectual Property (CPI).

The Coordination of Intellectual Property (CPI) acts at a corporate level and manages the process of intellectual property protection of scientific and technological assets generated by Embrapa such as patents, cultivars, trademarks, software and industrial secrets.

This corporate organizational restructuring of the activities related to Technology Transfer and Intellectual Property at Embrapa aims to increase flexibility, responsiveness and efficiency of the transfer of research outputs to society. The consequences of this new organizational structure and this reorganization of responsibilities and tasks at the corporate level, will certainly have an impact on the local activities of technology transfer and intellectual property of the decentralized research units of Embrapa in the near future.

4.3.3 Technology Transfer at Embrapa Informatics for Agriculture

In 2011, all the 47 decentralized research units of Embrapa had reformulated its internal statutes, with the creation of a Technology Transfer Adjoint Chief (CTT) with the responsibility of managing the activities related to intellectual property, demands prospection, impact assessment and technology transfer implementation, as well as actions of contracting and market communication, configuring it as local level NIT.

The CTTs are organized into three main areas: a sector of prospection and evaluation of technologies (SPAT); a sector of implementation of technology transfer actions (SIPT) and a Local Committee on Intellectual Property (CLPI). The activities of a legal nature are still performed by a corporate Legal Department (AJU), which has a specialized sector contracts and intellectual property. Thus, contractual activities involving execution of agreements, licenses and technology transfer contracts are performed by technicians of the SIPT sector with support from the Legal Department.

It is noteworthy that, prior to the creation of the CTTs, Embrapa Informatics for Agriculture had already created its CLPI in 1997 as a way to foster a culture of innovation and intellectual property protection at a local level. The CLPI has the responsibility to take administrative measures related to the processes of patent applications and trademark and software registrations as well as to support the Unit´s managers on matters related to intellectual property.

The CLPI receives corporate support from CPI/SNE, which orients and provides operational support the activities of intellectual property protection. While CLPI activities involve the provision of advice and preparation of documentation for patenting and records, CPI has the responsibility to analyze and review the processes, implementing them at the National Institute of Industrial Property (INPI) and related international institutes. The negotiations conducted by SNE, involving transfer of technologies and assets of Embrapa are also supported by Embrapa´s Legal Department (AJU).

The Embrapa Informatics for Agriculture has currently 6 employees working at the CTT, being a Chief, 3 people at the SPAT team and 2 people at the SIPT team. The CLPI is formed by 2 people of the SIPT and 5 employees working in the Research and Development (R&D) department. The CLPI has a mandate of two years, renewable for the same period.

The unit has a portfolio of 14 technologies (Relatorio, 2013). Several of them are available for free download or through free web services via the Internet aiming to attend

diverse audiences as extension agents, government technicians, agronomists, producers, researchers and students. It is noticed a great influence of the philosophy of Free Software and Open Science in relation to the tradition of the unity in free availability of technologies and web services. There are some initiatives underway to licensing of technologies upon receipt of royalties.

Being a local branch of Embrapa´s corporate NIT, the CTT area of Embrapa Informatics for Agriculture has less autonomy to develop transfer actions that are corporately analyzed by the SNE and the AJU.

Activities for the protection of intellectual property at the unit involve mainly processes and software and trademark registration at the National Institute of Industrial Property (INPI). From 2010, some research results related to researches in the bioinformatics field have been the target of patent applications at national and international level, none of them been granted yet.

There is a cooperative effort of Embrapa to promote the culture of intellectual property protection and to stimulate of technology transfer actions to private companies, to support public policies and destined to other stakeholders, aiming to promote regional development and the strengthening of Brazilian agriculture. Accordingly, since 2013, the CLPIs have been assigned to evaluate the research projects submitted to Embrapa Management System (SEG) in relation to the intellectual property protection of the expected outputs, to the regularization of cooperative activities and to the transference model of the results. Thus, the research team begins to reflect on intellectual property protection and technology transfer of expected results even before the project starts.

With regard to the skills of the CTT team, Embrapa corporately promotes periodic training in the area of intellectual property and innovation, as well as local training at Embrapa Informatics for Agriculture, which provides courses at the local level or finance participation in external workshops, events and courses.

4.4 Comparative study of the selected factors

4.4.1 Antecedents of the implementation of NITs and organizational model adopted

The three selected STI have a pioneer character regarding the development of an Intellectual Property culture starting in the 1990´s, long before the enactment of the Technological Innovation Law in 2004/2005. The analysis of the antecedents of the NIT´s formation of the three cases evidences a process of organizational change associated with

capacity building initiatives, internal discussion and institutionalization of the management of innovation processes in each organization.

Promoting a culture of protection and technology transfer is an initiative observed in the three cases, with the organization of courses and events on the subject, with particular emphasis on InovaNIT Project coordinated by Unicamp, which aimed to support the organization of NITs at a national level.

The organizational model chosen in the three cases is an independent department in within a public research institute (Inova/Unicamp, Innovation Agency of UFSCar and SNE at Embrapa), as described by Bennet et al (2012). All of the three departments are subordinated to the top management of each institute what shows the importance that each of them gives to the subject of Innovation. Embrapa, as an institution with more than 9,000 employees, has the least flexible structure with the influence of corporate departments in local activities, reducing agility since more bureaucratic steps are involved in the decision processes.

An important positive influence observed in the cases of Unicamp and UFSCar, is the close relationship of the NITs with the university´s foundation (FUNCAMP and FAI, respectively). The foundations are important implementation instruments regarding financial resources management and personnel hiring, giving flexibility in managing NIT work teams.

The cooperative agreement between Unicamp and FUNCAMP allow hiring staff with teams being contracted through CLT contracts, allowing faster changes according to the context, differently of the much more rigid statutory regime that depends on the opening of a tender, as a legal requirement for hiring. Regarding UFSCar, FAI has a similar role.

Embrapa has more rigid rules according to cooperative agreements with foundations, giving little space to synergistic actions related to technology transfer activities and organizing.

4.4.2 Organizational structure and personnel

The team size is variable depending on the different dimensions and areas of each of the STIs. Bennet et al (2012) emphasize that technology transfer activities may be addressed in different manners, always considering local need, resources and legislation.

Table 4 presents the relationship between the teams of NIT (considering only permanent employees) and the research team of each institution. It stresses the capillarity of each team, considering the Research and Development (R&D) staff and NIT personnel. The results of table 4 shows that, even though Embrapa Informatics for Agriculture has the smallest NIT team, is has the biggest capillarity, being able to provide a more personalized relationship of the NIT personnel with the research team. More emphasis could be done in

locally promote an Innovation and IP culture, in order to boost its results regarding protected assets and licensing.

Table 4: Relation R&D staff / NIT personnel

Personnel	Unicamp	UFSCar	Embrapa Informatics for Agriculture
Professors and researchers team	1739	1093	72
NIT personnel (employees only)	23	12	6
Ratio R&D personnel/ NIT personnel	**75,6**	**91,08**	**12**

Note: Data from Unicamp refers to 2012; data from UFSCar and Embrapa refers to 201.

Regarding the NIT structure, the three teams have structures divided in intellectual property activities and technology transfer activities, highlighting contracting and licensing activities. This situation is greatly facilitated by the location of the three institutions, the state of São Paulo, where there is more supply of professionals with this profile.

4.4.3 Results and Incentives

A research conducted in 2009 to examine the level of awareness and use of Intellectual Property (IP) in Latin American Higher Education Institutions (HEIs), under the Project PILA Network (Network of Industrial and Intellectual Property in Latin America) found that the least developed area in Brazilian HEIs is the exploitation of IP, namely the protection and transfer of technology (Gimenez, 2012). However, in our study, Unicamp appears as the HEIs with the highest patenting index in Brazil and has important licensing results and UFSCar, although having a much smaller patent portfolio, has important royalties revenues (the highest among Brazilian STI).

In the case of Embrapa Informatics for Agriculture we can say that the exploitation of IP could be boosted through the promotion of an Innovation culture and the development of public-private partnership strategy. The culture of open science and free software have a strong influence in the technology transfer practices of the research team formed by many computer scientists along with engineers, mathematicians, agronomists, biologists and so forth.

Regarding incentives, Unicamp and UFSCar have a very effective system of rewards in which inventors would earn 1/3 of the gains earned by licensing, which would be the maximum percentage stated in the Innovation Law. Embrapa has not yet stipulated a policy of sharing benefits from licensing initiatives, but it is a matter under study. The institution is reviewing its performance evaluation system with the inclusion of IP and licensing activities as reward indicators.

5. Conclusions

This paper promoted a broad overview of Brazilian legal framework related to Innovation and current statistics regarding national innovative performance as well as the role of Technology Transfer Offices (and NIT) in relation to this scenario.

It was found that the investigated institutions are heavily engaged in activities related to the protection and management of IP, since all have explicit policies in this regard and have permanents structures for this purpose (NIT). Regarding the two universities, it is noticed that the actions of their NIT goes beyond the actions of protection and transfer of knowledge, incorporating an important mission: to foster a culture of innovation and intellectual property, training, advising and encouraging the academic community in to value the creative ideas and the entrepreneurial spirit.

With regard to personnel, as seen, Embrapa has the least flexibility according to the qualification and size of its work team, which is less critical in the two universities that have more agile mechanisms for the incorporation of qualified human resources to their NIT.

The selected case-studies offered a broader overview of origins, evolution and organizational practices of three NIT located the state of São Paulo. Good practices regarding organizational structure and the promotion of an innovative culture were presented, as well as some interesting results regarding intellectual property protection and licensing.

It is important to stress that the reality experienced by the three institutions in São Paulo is not representative of Brazil as a whole. The state of São Paulo occupies a prominent place on the national scene, due to the concentration of postgraduate courses and the high provision of scholarships. Additionally, the state also has a development agency quite strong and active (Foundation for Research Support of the State of São Paulo – FAPESP), which also ensures funding research and offering scholarships for various levels (undergraduate and postgraduate).

We consider that further study should be conducted to analyze advantages and difficulties of Brazilian STIs located in other regions of Brazil, regarding the activities of their NITs.

6. References

AGÊNCIA de Inovação da UFSCar. Relatório de Atividades 2012. São Carlos: UFSCar, 2013. 41p.

_____ Relatório de Atividades 2013. São Carlos: UFSCar, 2014. 42p.

ASSAFIM, J. M. L. *A Transferência de Tecnologia no Brasil* (Aspectos Contratuais e Concorrenciais da Propriedade Industrial). Rio de Janeiro: Editora Lumen Juris, 2010. 333p.

BAMBINI. M.D. , OSAWA, C. C. , SANTOS, A. D,. DOS , BARBEDO, J. G. A., VAZ, G. J. , GIACHETTO, P. F. , SPERANZA, E. A., TELLES, G. A. S. Contribuição da Embrapa Informática Agropecuária para um Brasil Inovador e competitivo: proteção da propriedade intelectual dos resultados de pesquisa e geração de inovações. In: *Anais do Congresso ABIPTI 2012*. Brasilia (D.C.): ABIPTI, 2012.

BENNET, A. B., RAJALAHTI, R. , PAPE-CHRISTANSEN, A. Technology Transfer Offices: Facilitating Intellectual Property Orotection for Agricultural Innovation. In: *Agricultural Innovation Systems: An Investment Sourcebook*. Washington:World Bank, 2012. pp.406-413.

BOZEMAN, B. Technology transfer and public policy: a review of research and theory. Research Policy 19, 2000. pp.627-655.

CUNHA, E.; BOTELHO FILHO, F. Impactos dos direitos de propriedade intelectual na Embrapa. In: In: *Anais do 45o. Congresso da Sociedade Brasileira de Economia, Administração e Sociologia Rural*. Londrina: SOBER/ IEL/IAPAR, 2007. 10 p.

DRUCKER, J. AND GOLDSTEIN, H. (2007) Assessing Regional Economic Development Impacts of Universities: A Review of Current Approaches. International Regional Science Review. 30, 1: 20-46.

DUTTA, S., LANVIN, B., WUNSCH-VINCENT, S. (eds). (2014) The Global Innovation Index 2014: The Human Factor In innovation. Second printing. Fontainebleau, Ithaca, and Geneva: Cornell University, INSEAD, and WIPO.428p. Available at: < http://www.globalinnovationindex.org/content.aspx?page=GII-Home> Access on: 19.Sept. 2014

EDQUIST, C. Systems of innovation: Perspectives and Challenges. In: FAGERBERG. J. , MOWERY, D. , NELSON, R.R. *The Oxford Book of Innovation*. Oxford: Oxford university Press, 2006. pp180-208.

EMBRAPA. Empresa Brasileira de Pesquisa Agropecuária. Available at: <www.embrapa.br/> Access on: 28. Sept.2014.

EMBRAPA INFORMÁTICA Agropecuária. Available at: <https://www.embrapa.br/informatica-agropecuaria> Access on: 28. Sept.2014.

FUNCAMP. Processo Seletivo FUNCAMP nº 245/2013. Campinas, 2013. Available at: <http://www.funcamp.unicamp.br/intranet/rh/interno/processo_seletivo_prod/arquivos/245_2013_11102013_160042.pdf> Access on: 25Aug.2014.

GIMENEZ, A. M. N. *O ensino da propriedade intelectual na educação superior: o caso da Unicamp*. 2012. Dissertação (Mestrado em Política Científica e Tecnológica) – Universidade Estadual de Campinas. Instituto de Geociências, Campinas, SP: [s.n.].

GOUVEA, R. , KASSICIEH, S. (2012) Bridging the Innovation Divide: The Brazilian Experience. *Thunderbird International Business Review*. Vol. 54, No. 3, 2012.

INOVA. *Relatório de Atividades da Agência de Inovação Inova Unicamp 2013*. Campinas, 2014. Avalilable at: <http://issuu.com/unicampinova/docs/inova_relativ_140702_finalweb> Accessson: 21.Sept.2014

_____. *Relatório de Atividades da Agência de Inovação Inova Unicamp 2012*. Campinas, 2013. Available at: <http://www.inova.unicamp.br/sites/default/files/images/relatorio-inova%20web5.pdf> Acccess on: 25.Aug.2014

LEMOS, L. M. Desenvolvimento de spin-offs acadêmicos: estudo a partir do caso da UNICAMP. 2008. Dissertação. (Mestrado em Política Científica e Tecnológica) – Universidade Estadual de Campinas. Instituto de Geociências, Campinas, SP: [s.n.].

LUNDVALL, Bengt-Ake National Systems of Innovation: towards a theory of innovation and interactive learning. London,UK: Pinter Publishers, 1992. 388p.

MANIMALA, M. J.,THOMAS, K.R.. Learning Needs of Technology Transfer: Coping with Discontinuities and Disruptions. *Journal of the Knowledge Economy* 4.4 , 2013. pp. 511-539.

MCTI – Ministério da Ciência, Tecnologia e Inovação.Available at: <http://www.mcti.gov.br/> Acess on: 27.Sept.2014.

MOM, T.J.M., OSHRIB, I., VOLBERDA, H.W. The skills base of technology transfer professionals.*Technology Analysis & Strategic Management*. Vol. 24, Issue 9, 2012. pp.871-891.

MOWERY, D. C., NELSON, R.R., SAMPAT, B.N. ZIEDONIS, A.A. The growth of patenting and licensing by US universities: an assessment of the effects of the Bayh–Dole act of 1980. *Research policy* 30, Vol. 1, 2001. pp.99-119.

NELSON, R.R. (ed.) *National Innovation Systems:* A Comparative Analysis New York: Orford University Press,1993. 541 p.

PARQUE Científico e Tecnológico da Unicamp. Available at: <http://www.inova.unicamp.br/parquecientifico/> Accessson: 27.Sept.2014.

QS - Quacquarelli Symonds Available at: <http://www.qs.com/ranking.html> Access on: 27.Sept.2014

RELATÓRIO de atividades 2012 : pesquisa em TI para a agricultura / Embrapa Informática Agropecuária. - Campinas, 2013. 62 p.

RUF - Ranking Universitário da Folha. Available at: <http://ruf.folha.uol.com.br/2014/> Access on: 27.Sept.2014.

RUSSANO, V. R. S. A motivação de empresas para o licenciamento de tecnologias universitárias: o caso da UNICAMP. 2013. Dissertação. (Mestrado em Política Científica e Tecnológica) – Universidade Estadual de Campinas. Instituto de Geociências, Campinas, SP: [s.n.].

SAMPAT, B. N. "Patenting and US academic research in the 20th century: The world before and after Bayh-Dole." Research Policy 35.6 (2006): 772-789.

SANTOS, M. E. R. ; TORKOMIAN, A. L. V. Technology transfer and innovation: The role of the Brazilian TTOs. *International Journal of Technology Management & Sustainable Development*, v. 12, p. 89-111, 2013.

SANTOS, M.E.R., TOLEDO, P. T. M. , LOTUFO, R. de A. *Transferência de Tecnologia: estratégias para estruturação e gestão de Núcleos de Inovação Tecnológica.* Campinas, SP: Komedi, 2009. 350p.

SANTOS, M.E.R. Boas práticas de gestão de Núcleos de Inovação Tecnológica (NIT). In DOS SANTOS, M.E.R., TOLEDO, P. T. M. , LOTUFO, R. de A. *Transferência de Tecnologia: estratégias para estruturação e gestão de Núcleos de Inovação Tecnológica.* Campinas, SP: Komedi, 2009. pp.75-108.

SANTOS-SEREJO, J. A. DOS; SLUJALKOSVSKY, M. I. A.; REINHARDT, D. H.; DANTAS, J. L. L. *Propriedade intelectual: quem cria protege*. Cruz das Almas: Embrapa-CNPMF, 2007, 2 p. (Embrapa-CNPMF. CNPMF em foco, 02)

SCERRI, M., LASTRES, H.M.M. *The State and the Architecture of National Systems of Innovation.* In SCERRI, M., LASTRES, H.M.M. (eds) *The Role of the State NewDelhi: Routledge, 2013*.pp.1-22.

UFSCAR - Universidade Federal de São Carlos.

Available at: <http://www2.ufscar.br/home/index.php> Access on: 27.Sept.2014.

_____ Relatório de gestão do exercício de 2012. São Carlos: UFSCar, 2013.

_____. Relatório de gestão do exercício de 2010. São Carlos: UFSCar, 2011.

UNICAMP. *Anuário Estatístico 2013: base 2012*. Available at: <http://www.aeplan.unicamp.br/anuario_estatistico_2013/index_arquivos/anuario2013.pdf> Access on: 10Jul2014.

TOLEDO, P. T. M. DE, HOURCADE, V. , MAGALHAES,A. ,LOTUFO, R.A., SALLES-FILHO, S.L.M., BONACELLI, M.B.M. Difusão de Boas Práticas de Proteção e Transferência de Tecnologias no Brasil: a contribuição do Projeto InovaNIT. In: *Anais do XIV Congreso Latino-Iberoamericano de Gestión Tecnológica - ALTEC 2011*. Lima (Peru): Pontificia Universidad Católica del Perú – PUCP/ ALTEC, 2011.

TORKOMIAN, A.L. V. Transferência de tecnologia, inovação tecnológica e desenvolvimento. In: AZEVEDO, A.M.M.; SILVEIRA, M.A. (Org.). *Gestão da sustentabilidade organizacional: desenvolvimento de ecossistemas colaborativos*. Campinas: Centro de Tecnologia da Informação Renato Archer, 2011, v. 1, p. 101-114.

YIN, R. K. *Estudo de Caso: planejamento e métodos.* Porto Alegre: Bookman, 2010. 248p.

YOUNG, T. A. Establishing a technology transfer office. IN: KRATTIGER, A.;MAHONEY, R. T.;NELSEN, L.;THOMSON, J. A.;BENNETT, A. B.;SATYANARAYANA, K.;GRAFF, G. D.;FERNANDEZ, C.;KOWALSKI, S. P (Eds) *Intellectual property management in health and agricultural innovation: a handbook of best practices.* Vol. 1 and 2. IHR (Oxford, U.K.), PIPRA (Davis, U.S.A.), Oswaldo Cruz Foundation (Fiocruz, Rio de Janeiro, Brazil) and bioDevelopments-International Institute (Ithaca, U.S.A.). Available online at www.ipHandbook.org, 2007. pp. 545-558 .