Academic Entrepreneurship in the Context of a Technology Transfer Office

A Case from Brazil

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Abstract

Over the past few decades there has been an increasing number in studies on Academic Entrepreneurship and commercialization of research outputs. Much has been written about experience in the US and Europe where Academic Entrepreneurship practices are more developed. However, Academic Entrepreneurship is a global process that takes place in many developing countries, where higher education systems are different and present other challenges. This policy-oriented study explores how Academic Entrepreneurship functions in the context of a public university technology transfer office (TTO) in Brazil. The main objective of this thesis is to investigate the conditions which allow universities to build their capacity in Academic Entrepreneurship. For this purpose, the thesis analyses the Brazilian national innovation policy documents and the university Academic Entrepreneurship regulatory framework, along with the interviews with the TTO employees. The study shows that Academic Entrepreneurship practices in a public Brazilian university anticipate legal consideration and development. It also reveals a shift from patenting and licensing towards startups creation, entrepreneurial education, and university-company interactions. The study concludes that increasing university autonomy and establishment of Academic Entrepreneurial programs will facilitate Academic Entrepreneurship in Brazilian public universities.

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I also want to thank Maciel Zortea for the encouragement and help with all aspects of my life in Brazil and Joanna Grygieńć for support and discussions.

Abbreviations and Acronyms

ANPROTEC	Associação Nacional de Entidades Promotoras de Empreendimentos Inovadores Brazilian Association of Science Parks and Business Incubators
CAPES	Coordenação de Aperfeiçoamento de Pessoal de Nível Superior Coordination for the Improvement of Higher Education Personnel
CCT	Conselho Nacional de Ciência e Tecnologia National Council of Science and Technology
CEPLAN	Consultoria Econômica e Planejamento National Center for Strategic Planning
CNPq	Conselho Nacional de Desenvolvimento Científico e Tecnológico Brazilian National Council for Scientific and Technological Development
FAP	Fundação de Amparo à Pesquisa Research Support Foundation
FAPERGS	Fundação de Amparo à Pesquisa do Estado do Rio Grande do Sul Research Support Foundation of Rio Grande do Sul
FAURGS	Fundação de Apoio da Universidade Federal do Rio Grande do Sul Support Foundation of the Federal University of Rio Grande do Sul
FINEP	Financiadora de Estudos e Projetos Brazilian Innovation Agency
FORTEC	Associação Fórum Nacional de Gestores de Inovação e Transferência de Tecnologia Brazilian Association of Intellectual Property and Technology Transfer Managers
ICT	Instituições Científicas e Tecnológicas Scientific and technological institutions
INPI	Instituto Nacional de Propreidade Industrial Brazilian National Institute of Industrial Property
IP	Intellectual Property
LAMEF	Laboratório de Metalurgia Física Physical Metallurgy Laboratory
MCTI	Ministro da Ciência, Tecnologia e Inovação Brazilian Ministry of Science, Technology, and Innovation

MEC	Ministério da Educação Ministry of Education
MERCOSUL	Mercado Comum do Sul Southern Common Market
NIT	Núcleo de Inovação Tecnológica Technological Innovation Center
PDI	Plano de Desenvolvimento Institucional Institutional Development Plan
PGTec	Programa Gaúcho de Parques Científicos e Tecnológicos Gaucho Program for Science and Technological Parks
PROPESQUI	Pró-Reitoria de Pesquisa Division of Research
REGINP	Rede Gaúcha de Incubadoras de Empresas e Parques Tecnológicos Gaucho Network of Business Incubators and Technological Parks
REINTEC	Rede de Incubadoras Tecnológicas da UFRGS The Technological Incubators Network UFRGS
SCIT	Secretaria da Ciência, Inovação e Desenvolvimento Tecnológico Secretary of Science, Innovation and Technological Development
SDECT	Secretaria de Desenvolvimento Econômico, Ciência e Tecnologia Secretary of Economic, Technological, and Scientific Development
SEDETEC	Secretaria de Desenvolvimento Tecnológico da UFRGS Secretariat of Technological Development of UFRGS
TTO	Technology Transfer Office
UFRGS	Universidade Federal do Rio Grande do Sul Federal University of Rio Grande do Sul

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1 INTRODUCTION

1.1 Understanding Academic Entrepreneurship

1.1.1 Three conflicting perspectives

Over the past few decades there has been an increasing number of studies on Academic Entrepreneurship and commercialization of research outputs. Various aspects of this phenomenon have been discussed from a theoretical basis of Academic Entrepreneurship (Barth & Schlegelmilch, 2013; Meyer, 2003; Phan, Siegel, & Wright, 2005; Wood, 2011) to practical implications, for instance: stimulating students to create new firms (Åstebro, Bazzazian, & Braguinsky, 2012) and managing the university technology transfer process (Harmon et al., 1997); spin-off formation (Kroll & Liefner, 2008; Lockett, Siegel, Wright, & Ensley, 2005) and measurements of their outcomes (O'Shea, Allen, Chevalier, & Roche, 2005; S. A. Shane, 2004); university-based technology transfer mechanisms and industry linkages (Debackere & Veugelers, 2005; Gideon D Markman, Gianiodis, Phan, & Balkin, 2005; Gideon D. Markman, Phan, Balkin, & Gianiodis, 2005).

On the other hand, several authors emphasize the clash of ideas between traditional practices (teaching and research) and the emerging Academic Entrepreneurship system. In this context they discuss how the university system changes (Baldini, 2014), what are the real challenges facing technology transfer (Bubela & Caulfield, 2010), and how conflicts between traditional and emerging activities can be overcome (Philpott, Dooley, O'Reilly, & Lupton, 2011).

Current discourse on Academic Entrepreneurship reveals three conflicts that inspired this work.

First, there is a conflict between the business-like approach towards Academic Entrepreneurship, when it is looked at through the lenses of economic value creation and the traditional university values that are difficult or even impossible to convert into numeric format. Universities are one of the oldest institutions in the world and differ significantly from a big corporations created for the commercial success. The attempt to measure the commercial returns of university research outputs strongly conflicts with its scientific, cultural and educational university missions. Academic Entrepreneurship as a new university mission

puts a lot of pressure on universities and “has the potential to cause widespread disharmony amongst the academic community and impede progress towards achievement of the third mission” (Philpott et al., 2011). That is why understanding of how entrepreneurship works within academia and how the new mission is perceived by its members is important.

Second, simplified understanding of nature of university and research leads to high expectations of the society from the Academic Entrepreneurship results. University is a complex organization that includes various departments working with different areas of knowledge. Therefore, the commercialization potential for the knowledge produced by, for example, engineers and linguists, is not equal. However, it does not mean that research result of latter is not valuable for the society.

The metrics for Academic Entrepreneurship activities focus on quantitative achievements like numbers of filed and granted patents or spin-off companies. However, the qualitative outputs remain beyond the scope of measurement. Many universities initiate policies to promote entrepreneurship, technological transfer and spin-offs creations. However, it is not clear what the qualitative outcomes of these activities and how to measure them.

Third, much has been written about the Academic Entrepreneurship in the US and Europe where Academic Entrepreneurship practices are more developed and, thus, have a better defined structure and the stages of the process are more transparent. Yet, Academic Entrepreneurship is a global process that takes place in many developing countries, where higher education systems are different and present other challenges.

In other countries such as Brazil, the Academic Entrepreneurship trend has also followed and developed.(Pereira & Plonski, 2009; Santos Silva, Kovaleski, Gaia, Garcia, & Andrade Júnior, 2013)

Still it is not obvious how the Academic Entrepreneurship system functions, if it is well-integrated into the traditional university community, what kinds of tensions and obstacles a developing country university faces in the process of shifting towards Academic Entrepreneurship.

The study presented attempts to contribute to an understanding of the Academic Entrepreneurship adopting sociological perspective instead of economic value grounds, at one particular university in Brazil.

1.1.2 What is Academic Entrepreneurship?

The scope of activities that universities undertake to become entrepreneurial include technology transfer, commercialization of research outputs through licensing, patenting, or spin-off creations, and related consultancy along with the improvement of university industry linkages through networking and collaboration are understood in this work as Academic Entrepreneurship.

In literature Academic Entrepreneurship can be interpreted in different ways. According to Cantaragiu (2012, p. 685) there are three types of definitions for Academic Entrepreneurship: commercial, knowledge transfer and value creation.

The commercial understanding of Academic Entrepreneurship is wide-spread and refers mostly to university spin-offs and for-profit companies. (Barth & Schlegelmilch, 2013; Phan, Wright, Ucbasaran, & Tan, 2009; S. A. Shane, 2004)

The knowledge transfer definition focuses on commercial value creation and includes “hard” (patenting, licensing, spin-off) and “soft” (publication, grant-seeking, contract research) activities. (Cantaragiu, 2012, pp. 685-686) However, the author argues, categorizing different activities as entrepreneurial mainly depends on national legislation.

The third type of definition is value based. It focuses mainly on the social value and the process, not only the result. The value based view is “mostly encountered in social sciences and humanities related discussions of the entrepreneurial dimension of academic activities and it broadens the scope in order to fit with the realities of these fields of study” (Cantaragiu, 2012, p. 686). This viewpoint is important in the university context where academic values and beliefs may conflict with the business paradigm.

1.1.3 Universities' new mission

Academic Entrepreneurship is interpreted as the new university mission (Ćulum, Rončević, & Ledić, 2013; Shore & McLauchlan, 2012). Over the past few decades the functions of higher education in society have been revised. From initially serving as a mechanism of elite reproduction, cultural transfer and knowledge creation (Trow, 1970, p. 2) universities are expected to become a key player in innovation-based economy, to strengthen industrial

competitiveness, to create stronger links between research and business, and to support new job opportunities.(Clark, 2004; EU, 2011; Youtie & Shapira, 2008)

Academic Entrepreneurship calls for significant transformation of the legal regulations, university structure, and academic culture. All levels adapt towards the new university role that according to Clark is the "third way between state and market"(2004, p. 356). The universities are now seen as an active force in creating economic value. Academics have been encouraged to collaborate with business, promote their inventions to the market either by filing for patents, licensing, or creating startup companies. Following the legislation changes at the governmental level, universities have introduced new regulations that allow commercialization to happen. They have established services and offices responsible for facilitation of this process, dissemination of entrepreneurial practices and commercialization of knowledge.

1.1.4 Legal changes

The most important legal change that fostered Academic Entrepreneurship was the adoption of the Bayh-Dole Act in the US in 1980, which subsequently influenced many countries, including Brazil.

As the result of the Bayh-Dole Act being passed universities can now own their inventions that are made within publicly funded research. The Act addressed the problem of commercialization research allowing universities to establish partnership with industry. In this way, research-based inventions could be developed into products and be introduced to the general public. The Act allowed universities to receive royalties and to share them between inventors.

It was argued by many scholars that the Bayh-Dole Act resulted in expanding technology transfer activities at universities (Henderson & Smith, 2002; Loise & Stevens, 2010), while Shane (2004) suggests that the Act did not increase entrepreneurial activities directly but rather provided legal instruments for commercial exploitation of the university technology.

The incentive has also been criticized for shifting the focus from fundamental research towards applied projects and creating conflict of interests between academia and investors. (Henderson & Smith, 2002)

Nevertheless, the positive effects of the Bayh-Dole Act on the economic growth outweigh the drawbacks, and many countries followed the US example in order to be competitive in the global economy. (Siepmann, 2004) A part of Brazilian Innovation Law was inspired by the Bayh-Dole Act. (Sbragia, Moreira, Cota, & Almeida, 2008, p. 9)

1.1.5 Organization structure changes

Academic Entrepreneurship has changed the structure of university. Many universities today have agencies that one way or another participate in the process of commercialization of the research outputs and entrepreneurship. Among them are technology transfer offices, incubators, science parks, startup companies.

The aims and missions of these agencies may differ depending on university policy. However, they have become part of the university landscape and are incorporated in its hierarchy.

Each of these actors is very well described and defined in the literature. (Aaboen, 2009; Bergek & Norrman, 2008; Gideon D. Markman et al., 2005; Phan et al., 2005) However, not much has been written about the university as a host institution. Usually scholars adopt the perspective where these agencies are seen as separate organizations. There is also not much written about the connection between different agencies due to their "multilevel nature" and dynamism. (Phan et al., 2005)

The Technology Transfer Office (hereafter abbreviated as TTO) is an institution "managing the shifting relationship between researchers, the private sector and other partners". (Bubela & Caulfield, 2010, p. 447) TTO is seen as "a mediating institution for improving the link between science and innovation" (Debackere & Veugelers, 2005, p. 322) or a "technology intermediary" that "transmit[s] technological innovation from the lab bench to industry"(Gideon D. Markman et al., 2005, p. 242).

Science parks and incubators are the intermediate organizations that provide the social environment, technological and organizational resources, and managerial expertise for the transformation of a technology-based business idea into an efficient economic organization. (Phan et al., 2005, pp. 170-171) It is important to note that science parks and incubators can exist outside universities.

1.1.6 Role changes

The shift from traditional roles (teaching and research) towards Academic Entrepreneurship is a complicated process. On one hand, governments want to see the research results produced by public institutions commercialized (Bubela & Caulfield, 2010, p. 447) and concretely contribute into socio-economic development. On the other hand, public funded institutions have limited capacities for achieving high performance level due to the lack of resources and professionals who would understand science and business equally well. (Bubela & Caulfield, 2010, p. 448)

However, the main reason is the conflict between different stand points on how far the university role goes into economic growth: should the university turn into a mechanism of creating commercial products, and what happens to the faculties and departments with "non-commercial" research outcome, for example, the humanities. It is unclear if the new paradigm means everything that university produces should be pushed to the market. These important questions address the discourse about the public good and public goods in higher education.

A key difficulty created by the market imaginary is that it prevents policymakers (and many scholars) from thinking clearly, in either a social science sense or a policy sense, about those functions and activities of higher education and university-centered research that do not fit the neoliberal market model. The market imaginary allows one to think clearly about private goods but not public or social goods. (Marginson; Kaur, 2011, p. 23)

Facing new challenges, most universities today deal with real markets and adopt business-like behavior. Universities create TTOs, host incubators and science and technology parks. These organizations inside university, of course, have their own tasks and visions.

1.2 Research question

The main objective of this thesis is to investigate the conditions allowing universities to build capacities in Academic Entrepreneurship. To do this, I will focus on the case of a TTO and ask the following questions:

How do the TTO professionals understand their *mandate* in a *broader* sense of the university mission with respect to Academic Entrepreneurship?

How do they assess performance of the TTO?

How are they connected with other university actors involved in Academic Entrepreneurship?

What are the main difficulties they deal with?

1.3 Case of the project: Why Brazil?

This study will focus on Brazil for three reasons.
First, the country is one of the fastest growing economies in the world. When compared to other BRIC countries, it has important socio-economic and political advantages: it is richer and more politically stable. (Xavier, 2013, p. 3)

Second, Brazil is already well-known for technological innovation in the fields of aircraft, gas and oil, and energy industries. It has developed a growing network of technological science parks and incubators associated with universities. (Leahy, 2013) Yet, the country faces many problems that influence its innovation capacities including heavy bureaucracy, corruption, and low tertiary enrolment rate. (Lopez-Claros, 2010) All these are the common challenges developing counties deal with in the process of establishing Academic Entrepreneurship.

Third, the author of the thesis has recently moved to the South of Brazil and has an interest in understanding the current challenges in Brazilian higher education, specifically regarding Academic Entrepreneurship development in the local context.
Furthermore, Brazilian South hosts the biggest number of technological incubators in the country (Etzkowitz, de Mello, & Almeida, 2005; Lahorgue & Hanefeld, 2004), many are situated in the most southern state of Rio Grande do Sul. Thus, Academic Entrepreneurship is well-developed in the region.

1.4 Federal University of Rio Grande do Sul: regional and institutional context

1.4.1 Regional context

The Federal University of Rio Grande do Sul (UFRGS) is the oldest university in the state. It is ranked 4th in the nation according to the Ranking Universitário Folha (RUF)[1] and 6th position among Brazilian universities according to Shanghai Ranking[2].

Rio Grande do Sul is the southernmost state of Brazil with the population of about 11 million, of which 1.5 million inhabit the capital, Porto Alegre. It is one of the few Brazilian states bordering with two other countries: Uruguay and Argentina. Besides, it has maritime access through the Port of Rio Grande and good connection with the Brazilian and Mercosur markets. (SDECT, 2011) This factor makes the university an important institution not only for Brazil but for the Cone Sul region, the southernmost area of Latin America.

The state has the fourth largest GDP in Brazil and the largest in the South region.(IBGE, 2014) The region has the biggest production of agriculture, transport, electrical-electronic and automation equipment in Brazil. It is also the first producer of biofuels, leather and footwear in the country. Besides, the state has quickly developed a wine industry (80% of all Brazilian wines are produces here) and food processing sector. Overall, about 60 % of the state's GDP generated by the service sector, while 30% come from the agribusiness. (SEPLAN, 2014)

UFRGS is the strongest and most favorable university in the region[3], and was created in 1934 as the University of Porto Alegre. It united four schools (Pharmacy, Engineering, Medicine and Law) that were initially established in the 19th century and were since engaged in the country's economic, political, and cultural development. It has built a strong reputation on the political arena: many important political figures including three Brazilian presidents graduated from the university.

[1]RUF is provided by the Brazilian newspaper *Folha* de *S.Paulo*. The newspaper ranks 192 Brazilian universities on the basis of their performance in research, innovation, internationalization, education and the exposure on the market. Retrieved 18.06.2015, from http://ruf.folha.uol.com.br/.
[2]Retrieved 01.02.2015, from http://www.shanghairanking.com/.
[3]According to the RUF ranking. Retrieved 18.06.2015, from http://ruf.folha.uol.com.br/.

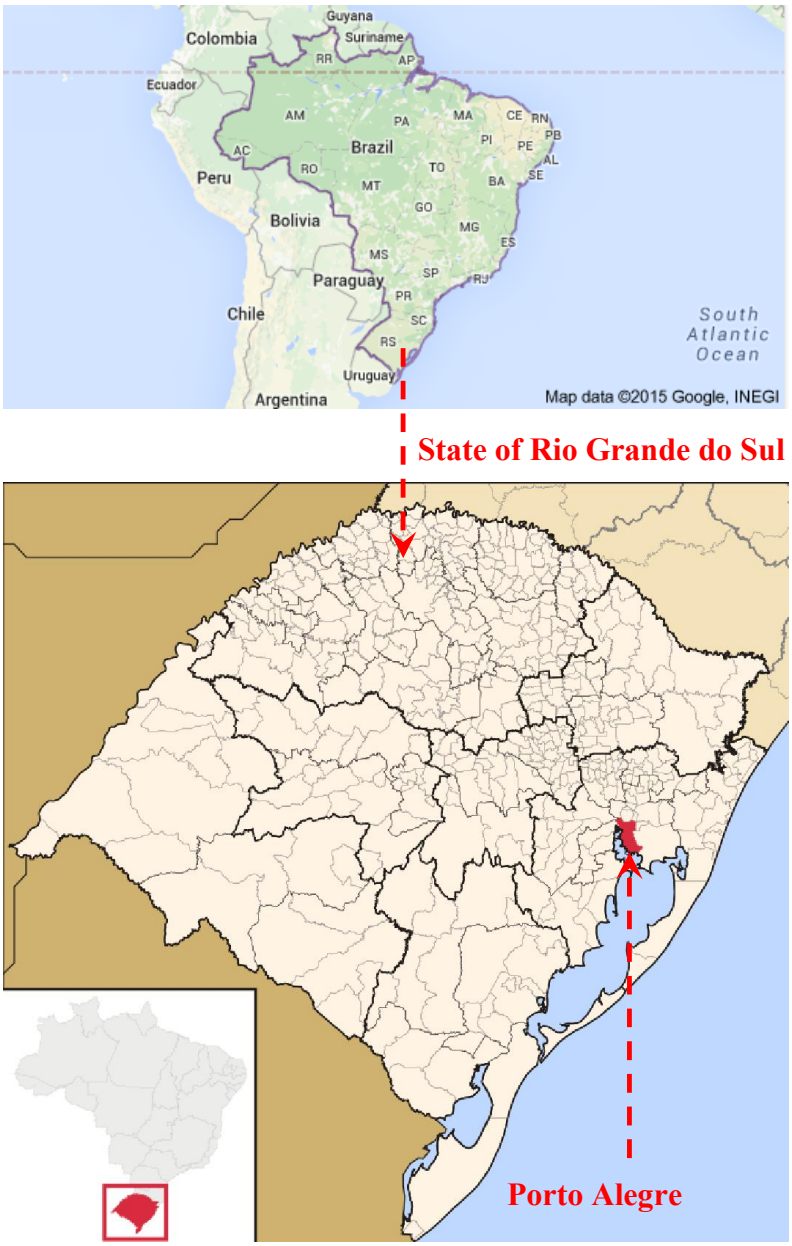

Figure 1 Maps of Rio Grande do Sul state and Porto Alegre

The federal status means that university is fully subsidized by the federal government, while employees are regarded to be civil servants in the federal public administration. The university employs 5411 people. Applying to the civil servant's position candidates have to take public examinations like in any other governmental organization in Brazil.

Because of the better education quality, higher chances of employment and, most importantly, absence of tuition fees, UFRGS is students' first choice[4]. As for 2014 there are about 29000 students enrolled into bachelor's and master's degree programs. In 2015, 39,849 people applied with only 3,996 places available[5]. (UFRGS, 2015)

Similarly to other Brazilian regions, the demand in higher education in Rio Grande do Sul exceeds the supply greatly. (Knobel, 2011, p. 3) However, this does benefit the university as they receive all best candidates. Most of the students come from the rich households. They have more chances to pass the examinations successfully as they most likely have received sufficient secondary education provided by private schools. (Marcus, 2015)

The university sees its mission in "serving the community and [to] building its future with a critical consciousness". It also "respects diversity, prioritizes innovation and, above all, reaffirms its commitment to education and spreading of knowledge, inspired by ideals of freedom and solidarity". (UFRGS, 2015)

1.4.2 Institutional context

At UFRGS the most important managing bodies are the Board of Trustees (CONCUR) and the University Council (CONSUN). The Board of Trustees supervises the budget and the economic and financial performance of the University. The University Council is the highest decision-making body that is responsible for institutional development. It consists of rector and vice-rector and representatives of all the university units.

Rector is the highest official and legal representative elected by university staff and students every 4 years. The rector and his cabinet are responsible for the work of various management units, including Division of Research, Division of Community Outreach, and Technology Transfer Office (SEDETEC). Additionally, rector and vice-rector participate in the work of Science and Technology Park Council.

[4] When compared to applicant numbers in other public and private universities in the region according to the RUF rating. Retrieved 18.06.2015, from http://ruf.folha.uol.com.br/.
[5] For comparison, 12,895 candidates were competing for 5, 688 places in the most popular private university of the state (PUCRS) in 2015.Retrieved 23.11.2015, from http://www.pucrs.br/portal/?p=noticias&n=1417632206.html and http://www.pucrs.br/portal/?p=noticias&n=1433855779.html.

The university comprises of 87 undergraduate level courses, 71 master level courses, and 68 PhD level programs. They have organized 27 Institutes, Faculties and Schools, covering areas of law, medicine, mathematics and natural sciences, humanities, social sciences, and engineering.

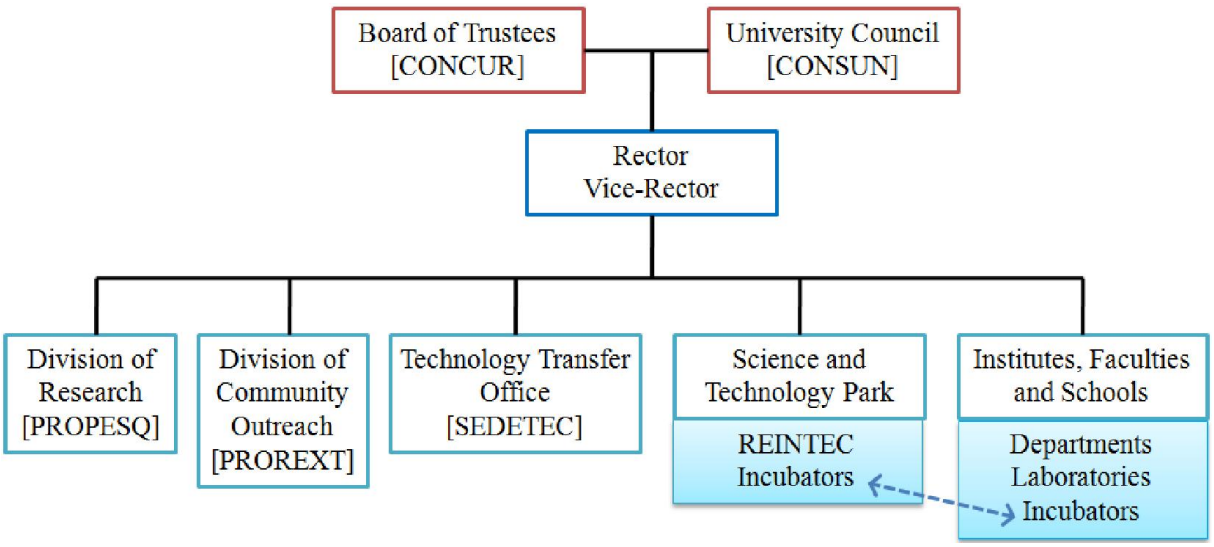

Figure 2 UFRGS. Organization[6]

The schools, faculties, and institutes host various research groups and centers, laboratories and are managed by their own boards and executive committees. Their representatives participate in the work of the University Board.

The university infrastructure also includes museums, cinemas, libraries, a secondary school, and the Clinical Hospital of Porto Alegre.

The university has 5 campuses. This thesis will focus on two of them, Campus Central and Campus Vale. Campus Central, which is located in the city center, contains the university administration, faculties of law, economics, architecture, education and the school of engineering. The TTO is also situated there, sitting in the beautiful historical building called Château.

[6]The partial organization chart focuses only on the specific university units related to the case of this study. The full version can be found at http://www.ufrgs.br/ufrgs/a-ufrgs/organograma.

Campus Vale is located on the southern outskirts of the city, about 12 kilometers from the center of Porto Alegre. The Vale is the largest university campus and hosts faculties of agronomy, veterinary sciences, and institutes of informatics, physics, mathematics, chemistry, philosophy and philology. Many laboratories and research centers, including 4 out of 5 incubators, are located in Campus Vale.

Furthermore, in the future the Science and Technology Park will be situated in Campus Vale. Its building is currently under construction and will provide a common space for the university laboratories, incubators, and companies. Now, however, the Science and Technology Park shares space with the TTO at Château.

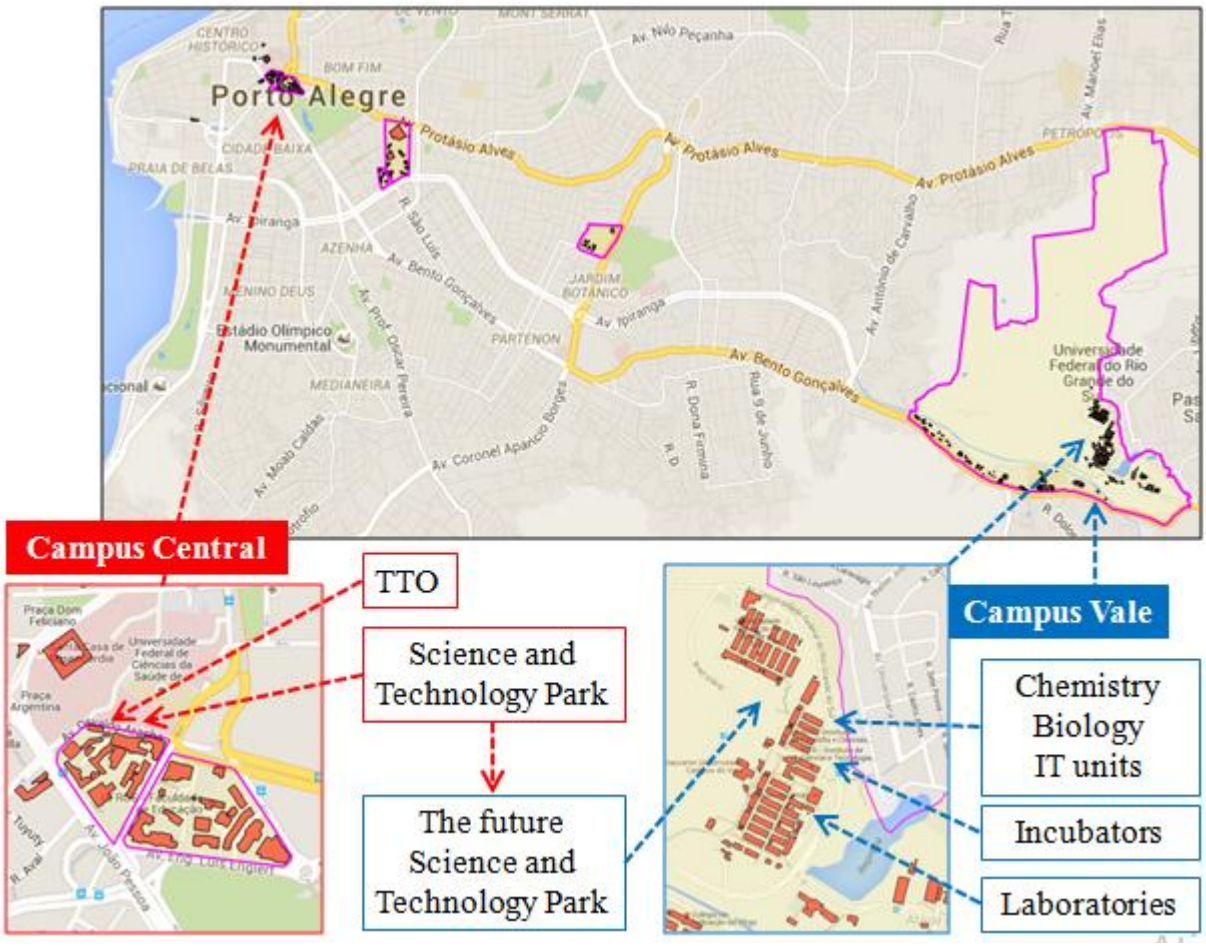

Figure 3 Map of UFRGS campuses

1.5 Thesis outline

The thesis is organized into 7 chapters. This chapter provides background in understanding Academic Entrepreneurship and overviews legal and organizational changes that universities adopted as a respond to entrepreneurial practices. The research questions and bases for the case choice, and case representation are also presented in Chapter 1. Chapter 2 focuses on theoretical and analytical framework. Research design is presented in Chapter 3. The Brazilian national innovation policy and its implementation at different levels are discussed in Chapter 4. Chapter 5 analyses Academic Entrepreneurship regulatory framework at UFRGS. In Chapter 6, the interview findings are presented. Chapter 7 concludes the study, provides the answers to the research questions, policy implications, and topics for further research.

2 ANALYTICAL FRAMEWORK

My analytical framework has three components: the techno-economic network concept (TEN), the third mission "radar", and the concept of traditional and emerging Academic Entrepreneurship.

Initially two of these components, TEN and the third mission "radar", were used to understand how TTO functions in the context of Academic Entrepreneurship. The techno-economic network concept (TEN) (Callon, 1991; Laredo & Mustar, 1996) was used to understand the role of TTO in a technology transfer process. However, because technology transfer is just one aspect of Academic Entrepreneurship, the PRIME – OEU project[7] third mission "radar" was applied to map the diverse functions a TTO comprises of as an Academic Entrepreneurship actor.

These two notions served as a framework to analyze how TTO specialists understand the mission of their office and to delineate the conflict between the traditional academic culture and emerging entrepreneurial culture at university. However, these approaches do not help to capture the transformation that has happened to Academic Entrepreneurship during the last decade. The significance of this change arose when the first interviews had been completed. The early results showed that the role of the TTO is changing, involving new actors and practices. To explain this shift the concepts of traditional and emerging Academic Entrepreneurship (Siegel & Wright, 2015) were added to the analytical tools.

2.1 The techno-economic network (TEN)

According to Callon (1991) the techno-economic network (TEN) is understood as a "coordinated set of heterogeneous actors which interact more or less successfully to develop, produce, distribute and diffuse methods for generating goods and services"(Callon, 1991, p. 133). TEN is organized between three "poles":

- Scientific (produces certified knowledge)
- Technical (develops and transforms artifacts)

[7] "Observatory of the European University" (OEU) is a project coordinated by the European Network of Excellence on Policies for Research and Innovation in Europe (PRIME) that aimed to provide universities with adequate tools for their governance of their research activities. (OEU, 2006)

- Market (generates consumers' demands).

These poles are connected through the intermediaries (texts, objects, skills and money). Actors associate these intermediaries and transform them into new ones. For example, "scientists transform texts, experimental apparatus and grants into new text". (Callon, 1991, p. 141)

TEN diagram illustrates how basic research can be transformed into technologies and then reach the market.

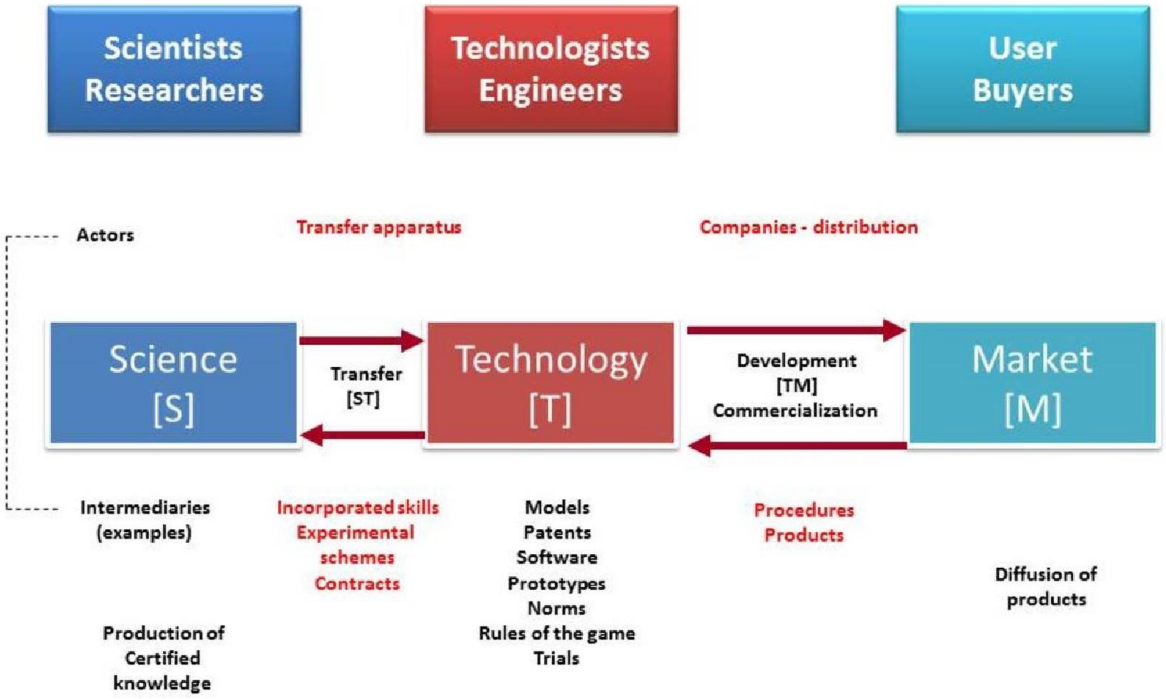

Figure 4 The Techno-economic network[8]

The intermediaries within different poles are represented by scientific knowledge for the scientific pole, models, patents and prototypes for technology, and a final project for the

[8] Figure source: Mazzarol, T. (2014) Iscommercialising Australia's research an insurmountable challenge? *The Conversation*, p.130.Retrieved 21.07.2015, from http://theconversation.com/is-commercialising-australias-research-an-insurmountable-challenge-26276.

market. Different actors are employed throughout the process, including the transfer apparatus and the companies. The most challenging phases of the process are transforming research results into a product and commercializing this product. This is the university TTO's role in the process.

The TEN concept was used to visualize the place of TTO in the technology transfer process. The science and market poles are presented as two opposite forces in the technology transfer and innovation process. According to our vision various Academic Entrepreneurship actors can be positioned in a range from mostly scientific-orientated to mostly market-orientated. Therefore, the scientific pole can be linked to the traditional university mission and represents interests of the academic community, whereas the market-oriented pole fosters business-like actions and direct societal benefit.

2.2 The third mission perspective

The PRIME – OEU project examines Academic Entrepreneurship in the context of the third mission. (OEU, 2006) The project's methodological guide suggests indicators for measuring the third mission activities, namely the university's non-academic relationship with industry, public authorities and society. The indicators are represented as a third mission "radar" (Figure 2), combining societal and economic dimensions. The economic dimension comprises of human resources, intellectual property, spin-offs and contacts with industry, while the societal dimension includes public understanding of science, involvement in social and cultural life, participation in policy-making and contracts with public bodies. This model is characterized as "a user-friendly illustration that helps to visualize the different types of 3rd mission" (OEU, 2006, p. 130).

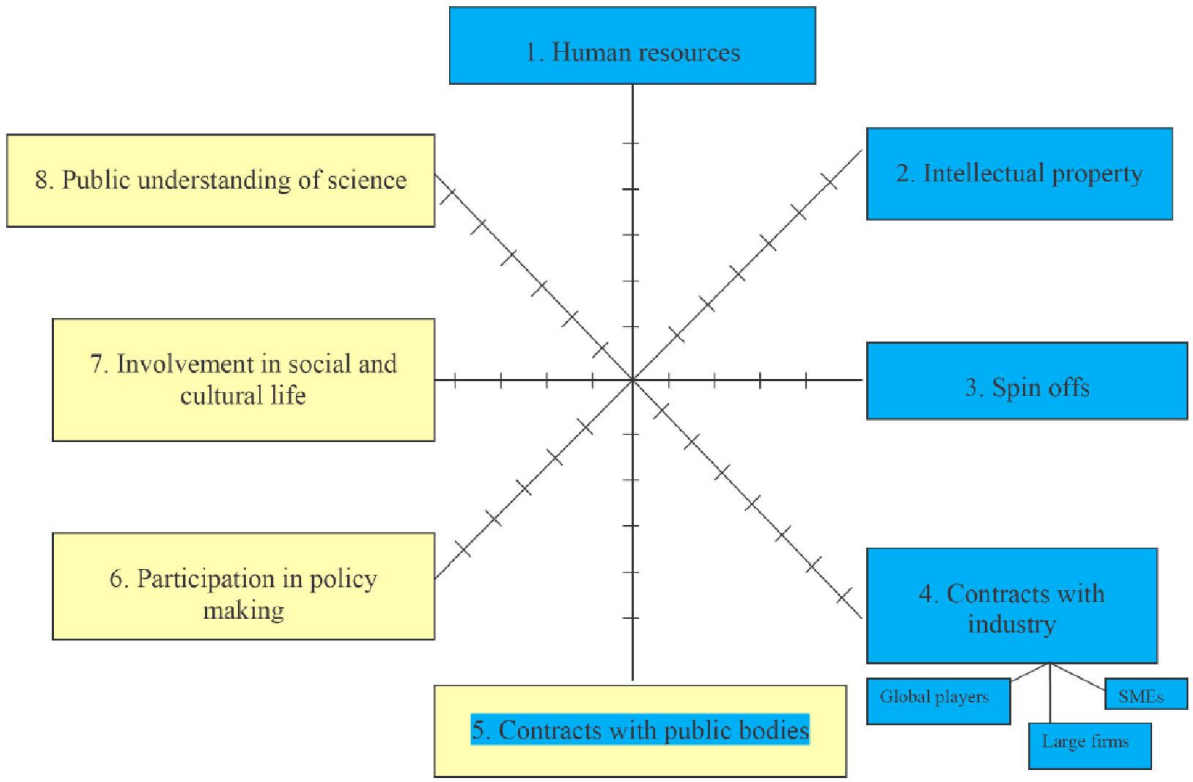

Figure 5 The "radar" of third mission elements proposed by the PRIME –OEU Project[9]

However, the distribution of indicators between two dimensions is debatable. Some of them can bring both economic and societal benefits. According to the PRIME-OEU Project results, representation of each indicator depends on the character of universities and their strategic missions. The university policy documents imply that Academic Entrepreneurship practices should be embedded into outreach and research missions.

This analytical framework helps to understand how the Academic Entrepreneurship actors (TTO professionals, in our case) position themselves, where they see the point of university and which of the activities they would recognize as most important and valuable in their work.

[9]OEU. (2006) Methodological Guide. Observatory of the European University, PRIME Project. Retrieved 12.09.2015 from www.enid-europe.org/PRIME/documents/OEU_guide.pd

2.3 Traditional and emerging perspectives on Academic Entrepreneurship

The new framework for analyzing Academic Entrepreneurship suggested by Siegel and Wright (2015) focuses on the shift from traditional to emerging activities. The authors argue that the range of entrepreneurial activities is extending: from traditional IP protection and licensing towards a greater variety of commercialization strategies that would contribute to society and its development. In addition, Academic Entrepreneurship attracts more stakeholders, including "students, a younger generation of faculty and post-doctoral fellows who are more comfortable working with industry than the previous generation, federal agencies that support entrepreneurship programs and alumni". (Siegel & Wright, 2015, p. 8) The traditional rationale for Academic Entrepreneurship at university is fostering commercialization of research results and receiving additional funding through royalties. (Ibid. , p. 10) Nevertheless, for many institutions commercialization outcomes are rather modest due to the lack of resources and capabilities. (Ibid., p. 11) That, however, does not mean that Academic Entrepreneurship activities do not bring any benefits. They can contribute to social and economic development through education and dissemination of entrepreneurial culture. The authors encourage re-thinking the rationale for Academic Entrepreneurship and change the focus from the "research- third mission nexus" to the "teaching/education- third mission nexus informed by research". (Ibid., p. 27)

While reflecting on a new Academic Entrepreneurship framework, Siegel and Wright (2015) provide key elements that facilitate entrepreneurship at university. These elements include:

- increasing the number of property-based institutions, such as incubators/accelerators and science/technology/research parks;
- substantial growth in the number of entrepreneurship courses and programs on campus for staff and students (p. 11);
- increasing creation and development of start-ups by faculty and students, along with the presence of alumni and other industry partners on campus (p. 20).

The shift from the traditional to new forms of Academic Entrepreneurship is in focus of the suggested framework. The authors of the framework suggest that the shift "reflects policy developments that focus on the need for universities' knowledge transfer to make a wider

contribution to society" (Siegel & Wright, 2015, p. 11) and should be considered by policy-makers at university and governmental levels. (Ibid., p. 28)

The perception of the shift within Academic Entrepreneurship is summarized in the following table (Table 1), where the changes in four dimensions (rationale, activities, actors, and forms) are shown. (Siegel & Wright, 2015, p. 12)

Table 1 Traditional and new perspectives on Academic Entrepreneurship

Theme	Traditional Perspective	Emerging Perspective
Why	To generate direct financial returns	To provide a wider social and economic benefit to the university ecosystem
What	Academic Spin-offs; licensing; patents	Student and Alumni start-ups; Entrepreneurially-equipped students; Job creation in the local region or state
Who	Academic faculty and post docs	Students; Alumni; on-campus industry collaborations; surrogate entrepreneurs
How	TTOs; science parks	Accelerators; Entrepreneurship garages; student business plan competitions; collaborative networks with industry and alumni; employee mobility; public-private 'incubators'

Some remarks should be made on the implementation of the framework in this study. In practice, emerging elements presented in the framework need time to appear. Besides, they may grow at different times and speed. In the case of Brazil, Academic Entrepreneurship practices were legitimized by the federal Innovation Law (2004) significantly after they became common at universities (Sbragia et al., 2008, p. 18).That is why it is possible to see elements from the both traditional and emerging perspectives. For example, IP and startups have been established earlier, while entrepreneurial trainings for students are recent. Similarly, TTOs may have considerably longer history than science parks. Although the scheme does not necessarily reflect the actual practices, it captures the transformation within the Academic Entrepreneurship that is important for understanding the TTO history and Academic Entrepreneurship structure in the case.

3 REASEARCH DESIGN AND METHODOLOGY

3.1 Case study

As the study focuses on the practice of one TTO, the single-case study design has been chosen. According to Yin preference should be given to this strategy “when "how" or "why" questions are being posed” and “when investigator has little control over events, and when the focus is on a contemporary phenomenon within some real-life context.”(Yin, 2003, p. 1) Indeed, the study explores *how* a TTO in a Brazilian university works. The research, however, also looks at the history of the TTO in order to understand *why* certain practices occurred and *how* TTO was created. The case study was also chosen because of importance of contextual conditions for this study. (Yin, 2003, p. 13)

The research was planned and conducted within four stages:

Stage 1 Studying relevant literature and collecting primary data about the case.
In order to get an overall understanding of how Academic Entrepreneurship functions at a Brazilian university, various sources, including articles, federal and regional laws and university regulations, and webpages were studied. Early contacts with the professors at the university of inquiry were made. This networking was very important, because the author is not Brazilian and did not have previous experience within the country.

Stage 2 Observation ‘on-site stage’ in Brazil.
During this stage visits and observation of different actors within university Academic Entrepreneurship were made. For instance, the author participated in the workshop for the incubator applicants[10]. Even though the results of these activities are not included into the study, the informal communication with staff and participants served a valuable source of knowledge about the Academic Entrepreneurship reality: practices, actors, and institutional hierarchy. These activities also provided the opportunity to have a closer look at the general context of a Brazilian university. Furthermore, the observation helped to choose the TTO case

[10] The workshop took place on February 24, 2015 at The Center for Entrepreneurship in Informatics (CEI), UFRGS. As the result of the workshop, I and my colleague applied to the incubator with a startup company project.

for the study among other university units involved in Academic Entrepreneurship. In addition, the university website and the webpage of the TTO was a valuable source of supplementary information about the organizational structure, mission, and history of UFRGS.

Stage 3 Studying and analyzing legislative documents and reports on the national, regional, and institutional level.

According to Yin (2003, p. 87), "the most important use of documents is to corroborate and augment evidence from other sources". The analyzed documents were used to verify facts, names, and organizational structure of the case. (Appendix D)

At this stage the case database was created with NVIVO software. The software was also used as a preliminary tool of analysis for identifying nodes, themes, and patterns in the data. However, because the software assists the analysis but does not replace it, the detailed manual examination of the documents followed. The documents were first analyzed in an open manner, and then, according to pre-set codes based on the analytical framework.

Stage 4 The interviews were prepared and conducted with respect to document analysis and data collected during the 2nd stage.

The interviews were transcribed and coded with NVIVO tool. Similarly, after exploratory coding with the software, all the interviews were read several times, and traditional analytical practices were implemented. After the completion of the interview analysis and corroborating with the prior inferences, results were summarized and reported.

3.2 Sources of evidence

3.2.1 Document Analysis

Three types of documents have been analyzed in the work: federal (2004, 2006) and regional laws (2009) on innovation, university decisions and decrees concerning technology transfer and Academic Entrepreneurship (1994-2004), and university annual reports representing the results of various activities (2000-2014). All the documents are available for public and can

be found on the governmental and university webpages. They are written in Portuguese language and were translated by the author.

The process of the search, identification and classification of the relevant documents went in two directions. First, the key documents were identified on the governmental websites through the search engine, for example, Portal Brasil (www.brasil.gov.br) on the federal level and Webpage of the Rio Grande so Sul Government (www.rs.gov.br) on the regional level.

Secondly, the relevant documents were found through reading articles and reports on the topic. It was easy to work with the key documents, like the Innovation Law, because they have been widely represented in publications. Many of the documents were scrutinized but were not included into the final analysis due to their specific or technical nature. However, they helped to understand overall dynamics concerning intellectual property and technology transfer in the Brazilian legal system.

The institutional documents relevant to Academic Entrepreneurship were more difficult to identify even though all of them are available online. As the first step, the documents represented on the webpage of the university TTO (SEDETEC) were studied and the links to decisions, decrees and orders were identified. The documents dealing with technical or specialized topics, for example, registration on new plants species, were excluded from the final analysis.

After that, the documents were studied and coded in the open manner with the NVIVO software. Then, the careful manual examination followed, including creating a profile for each document and visual analysis for revealing the links between the contents.

In case of federal and regional laws on innovation, the structures of the documents were compared. Some university regulations were also likened to their earlier versions, which helped to understand how the regulatory framework developed. Then, main concepts, Academic Entrepreneurship activities, actors, and structures were classified according to the analytical framework. The **actors** were labeled according to science-technology-market poles (TEN). The **university understanding** of Academic Entrepreneurship was classified as embedded into outreach or research missions. The **actors and activities** were identified according to the third-mission “radar”.

Moreover, the finding of document analysis helped to formulate interview questions. (See Appendix C) Interviews were designed to clarify some fact about Academic Entrepreneurship at university that remained unclear in the records.

3.2.2 Interviews

The selection of respondents for the interviews was limited by the nature of the case: employers of SEDETEC. It is a relatively small office with only 19 employees[11], 14 of which directly work with different aspects of technology transfer. Out of 14 potential respondents, 10 replied to the emails and phone calls and agreed to be interviewed, which makes respondent rate 70 per cent. The representatives of all SEDETEC sectors involved in Academic Entrepreneurship participated in the interviews.

It was important to find the right way to contact the potential respondents as in case of a low responding rate it would have been impossible to find an alternative. In the first, so called 'on-site' observation stage, some early contacts within university and the office were made in order to understand how eager the employers were to participate in the research and if the language would be an obstacle.

When the study arrived to the interview stage, an email in English describing the purpose of study and the procedure of the interview was sent to the initial contact within SEDETEC. (See Appendix A) The letter contained the purpose of the study, suggestions for the dates and interview procedure, and confidentiality issues. The possibility of the language difficulties and the ways to overcome them were also mentioned.

The letter was written with consideration of the cultural differences. When the first draft of the letter was discussed with the interpreter, it was regarded as too straightforward. According to the Brazilian view, we then used "softer" language and less direct forms.

At first, the recruitment process was done in English. However, after the respond rate turned out to be quite low, letters in Portuguese were sent and, in some cases, followed by a phone call. (See Appendix B)

A conversational strategy was used within an interview guide approach. (Patton, 2001, p. 347) This allowed following the key questions from the guide while leaving other items as topics

[11] According to the web-page. The receptionists are not included.

to be explored at the interviewer's discretion. This strategy proved to be appropriate as most of respondents worked with various aspects of Academic Entrepreneurship and, thus, could share with the author specific experiences that were not covered by the interview guidelines.

Depending on the type of work the specialists were involved in, the interviews took about 45-60 minutes. Seven of the respondents used English during the interviews and only three spoke in Portuguese during the meetings. The presence of an interpreter was offered as an option for all the interviewees[12]. Though five of them required the presence of the interpreter in two cases, the translation into English or to Portuguese languages was needed only for clarifying certain words or phrases. With the permission of the respondents, all the interviews were recorded. Notes were taken during the interviews and integrated in the transcription for further analysis.

Right after the meetings, all the interviews were anonymised by labeling audio and corresponding text files with a random number from 1 to 10. The access to the interview data was restricted to the author and, in case when the interviews were in Portuguese language, to the interpreter, who was also required to comply with confidentiality issues.

After that, the material was transcribed and coded. Similarly to document analysis, NVIVO software was used, first for transcribing interviews and later for coding and grouping transcribed materials thematically. (See Appendix E)

The interviews that were held in Portuguese were transcribed by the interpreter and translated together with the author. Subsequently, the findings from the interviews and document analysis were verified.

3.3 Constraints and Strengths

The main constraint of this study is connected with the international focus of the inquiry. The author of the study is Russian with 3 years' experience of living and studying in Norway. In a cross-cultural case study an international researcher brings his or her own ideas and

[12]The interpreter assisting with the interviews in Portuguese language was not a professional. However, they had an academic background and knowledge on the topic of this study. The interview recruiting letter, interview questions, special terms, and confidentiality issues were all discussed with the interpreter before the interview process.

preconceptions about the national context of the phenomenon. This increases the possibility for misunderstanding significantly. (Patton, 2001, p. 391)

However, the fact that the author of the thesis belongs to a different culture, could help better understand the overall context and avoid cultural blindness, which is understood as a "phenomenon which has to do with the fact that you may become blind to what you experience every day". (Brock-Utne, 2002, p. 244) Thus, observation in the unknown context is more precise. The hope is that this position of the investigator helped to observe objectively the practice of TTO in the Brazilian context.

In this study, Portuguese language skills were needed. All the documentation and information concerning the case is available only in Portuguese language. Additional time and sufficient Portuguese language skills were needed to find, understand, translate and summarize the information. Limited time and language skills could, in the end, lead to certain inaccuracies in translations and interpretations. Even though the help of interpreter was used during the interviews and data transcribing, the results could be influenced by the language difficulties as some of respondents used their native language, while others used English.

Additionally, this study demanded understanding of technology transfer practices that may differ from country to country. Many theoretical positions come from the studies focusing on Academic Entrepreneurship in Europe and North America, while universities in Latin America and Brazil function within other social and economic conditions. Therefore, the perspective used in the thesis might not fully acknowledge all the complexity of the Brazilian context.

To address these challenges, the author started to collect the information on the case early, studied the relevant literature regarding the Academic Entrepreneurship, Brazilian higher education, and Brazilian culture before and during the study and was constantly improving her Portuguese language skills.

3.4 Validity and reliability

To ensure the quality of the case study research design, the concepts of validity and reliability were used. (Yin, 2003) **Construct validity** shows how well concepts are represented by the indicators, and was accomplished through the use of multiple sources of evidence (university

documents and interviews), reliance on the previous studies and following the analytical framework which combines several approaches to Academic Entrepreneurship.

Establishing **internal validity**, which is the evaluation of interpretation that something is influenced by another thing, complies with the use of theories and data triangulation. Kleven (2008) argues that "the heart of the validation process in the context of internal validity is evaluating the likelihood of, and if possible ruling out, alternative causal interpretations" (p. 227). In this case study, the implication of several theoretical perspectives along with converging lines of inquiry within multiple sources of evidence, helps to deduce possible explanations.

External validity refers to validity of inferences from the context of the study to a wider context or to other contexts. (Kleven, 2008) In other words, this is the possibility to generalize the inference for other cases, which, according to Yin, can be ensured by use of the theory in a single-case study. The observations and inferences of this study refer to a single TTO in a particular Brazilian university and may not fully reflect the situation in other states, types of universities or different TTOs. However, use of the analytical frameworks (TEN, third mission, and notion of the emerging practices) suggests that similar interferences can be drawn for other cases in public Brazilian universities.

Reliability of qualitative studies indicates that the data collection and data analysis were accomplished in a clear and transparent manner, so that other researchers following these procedures can reach similar results. In this study reliability is achieved through creating the case database with the NVIVO software, which facilitated the accuracy and accessibility of the data. (Welsh, 2002)

4 CONTEXT: POLICY AND GOVERNANCE OF INNOVATION IN BRAZIL

This chapter discusses realization of Brazilian innovation policy on federal, regional, and institutional levels as a framework for Academic Entrepreneurship. On the institutional level the case of the Federal University of Rio Grande do Sul (UFRGS), is investigated. Additionally the overview of the legislative base, agencies that assist the realization of the innovation policy and Academic Entrepreneurship are characterized.

4.1 National Level

The current innovation policy traces back to 1951 when the important agencies crucial for the Brazilian science policy were established: the Brazilian National Council for Scientific and Technological Development (CNPq) and Brazilian Federal Agency for the Support and Evaluation of Graduate Education (CAPES). These agencies were central in developing "domestic science and technology base" to promote technological independence from the foreign countries and multinational corporations. (Balbachevsky & Botelho, 2011, p. 3)

According to Coutinho (2013), until 1960ies, teaching was the main mission of Brazilian universities. However, after 1968 the mission started to expand towards research and technological development.

The National Institute of Industrial Property (INPI) responsible among other things for granting patents and trademark registration was created in 1970. The National Plan for Economic development introduced in 1971 also focused on the national science and technology support. In the same year, the Brazilian Innovation Agency (FINEP) was created to fund research avoiding excessive bureaucracy and creating positive climate. (Balbachevsky & Botelho, 2011)

In the 1970s despite increased support for research, there was a lack of articulation of higher education policy in regards to technological development and innovation. (Coutinho, 2013, p. 6)

This climate, however, changed in 1980th when the funds deceased. The military regime (from 1964 to 1985) kept the Brazilian market away from international competition and the importance of science and technology lost momentum. Nevertheless, after the fall of the regime in 1985 the country shifted towards the open market and greater competitiveness. The notion of scientific development returned to agenda. At this time, universities try to establish first TTOs (Coutinho, 2013), and in 1987 Brazilian scientific parks and business incubators establish their association known as Anprotec. In addition, some governmental programs aiming to increase technological capability in industry and institutions started to emerge[13].

Besides, some important adjustments were introduced in the legislative framework. New laws for Agricultural Innovation (1997) and Software (1998) were presented for the first time, while the laws for Industrial Property (1996) and for Authors Rights (1998) were updated.

In addition to these important reforms, a new agency, the National Council of Science and Technology (CCT) was established in 1996.

The significance of science and innovation was emphasized at the National Conference of Science and Technology in 2001. This conference resulted in wide discussions on the innovation policy and publication of the Green Book. (Balbachevsky & Botelho, 2011, p. 8) All these became a solid base for the Innovation Law (***Lei de Inovação***) that was introduced in 2004 and came into power in 2005. The law presents three objectives:

- Creating an environment for strategic partnerships between universities, technological institutes and companies;
- Encouraging the participation of science and technology institutions (ICT) and universities in the innovation process;
- Encouraging industry to invest in innovation.

The university becomes the center of technological innovation and is expected to control legal aspects of knowledge protection. In addition, the Law states the strategies for commercializing knowledge through patents or licensing agreements, possibility for researchers to leave universities and develop their own businesses ideas. (Chapter II) The industry and private companies are granted permission to benefit from public research

[13]For example, the first action within the Support Program for Scientific and Technological Development (PADCT) was launched in 1985, and the Industry and Agricultural Development Program (PDTI/PDTA) started in 1993.

infrastructure including human resources. (Chapter IV) The Law also promotes creation of technological parks and incubators. (Chapter V)

Furthermore, the Law obliged the public higher education institutions to establish NIT, Technological Innovation Centers, responsible for IP and technology transfer facilitation.[14] (Chapter III, Art. 16)

According to Sbragia et al. (2008) the Innovation Law made "academia–private enterprise interaction process … more transparent and organized, although it is still not easy to understand and put into practice". The Law also allowed companies and universities to increase the number of calls for proposals for the government funding of scientific projects, however not many companies participated. (Ibid., p. 18) One of the reasons is the lack of understanding between universities and companies. "The gap between these two universes must therefore be bridged, and each party needs to build a greater understanding of the other". (Sbragia et al., 2008, p. 19)

In 2006 the *Good Law* was introduced. This aimed to reduce taxes for the companies involved in technological innovation activities. The amendment known as "MEC Law" allowed tax reduction also for the partnership between academia and industry. "This change made it possible for companies to deduct 50% to 250% of investment made on research, technology, and innovation projects carried out by ICTs for tax purposes…"(Sbragia et al., 2008, p. 10) However, many companies experienced difficulties when trying to reap the benefits due to little understanding of the mechanisms behind it.

In 2006 the Brazilian Association of Intellectual Property and Technology Transfer Managers (FORTEC) was created. It became a representative body for universities, TTOs, and research institutes on policies and activities related to intellectual property and technology transfer. Thus, after 2004 the innovation policy in Brazil advances. The Innovation Law legitimizes cooperation with industry, technology transfer, innovation and entrepreneurship at university and enables Academic Entrepreneurship.

[14] Some authors, for example Balbachevsky and Botelho(2011) and Pojo, Vidal, Zen and Barros (2013) refer to NIT as a Brazilian equivalent of TTO. However, some TTO experts argue that the terms have different meaning (See Chapter 6 of this thesis for discussion).

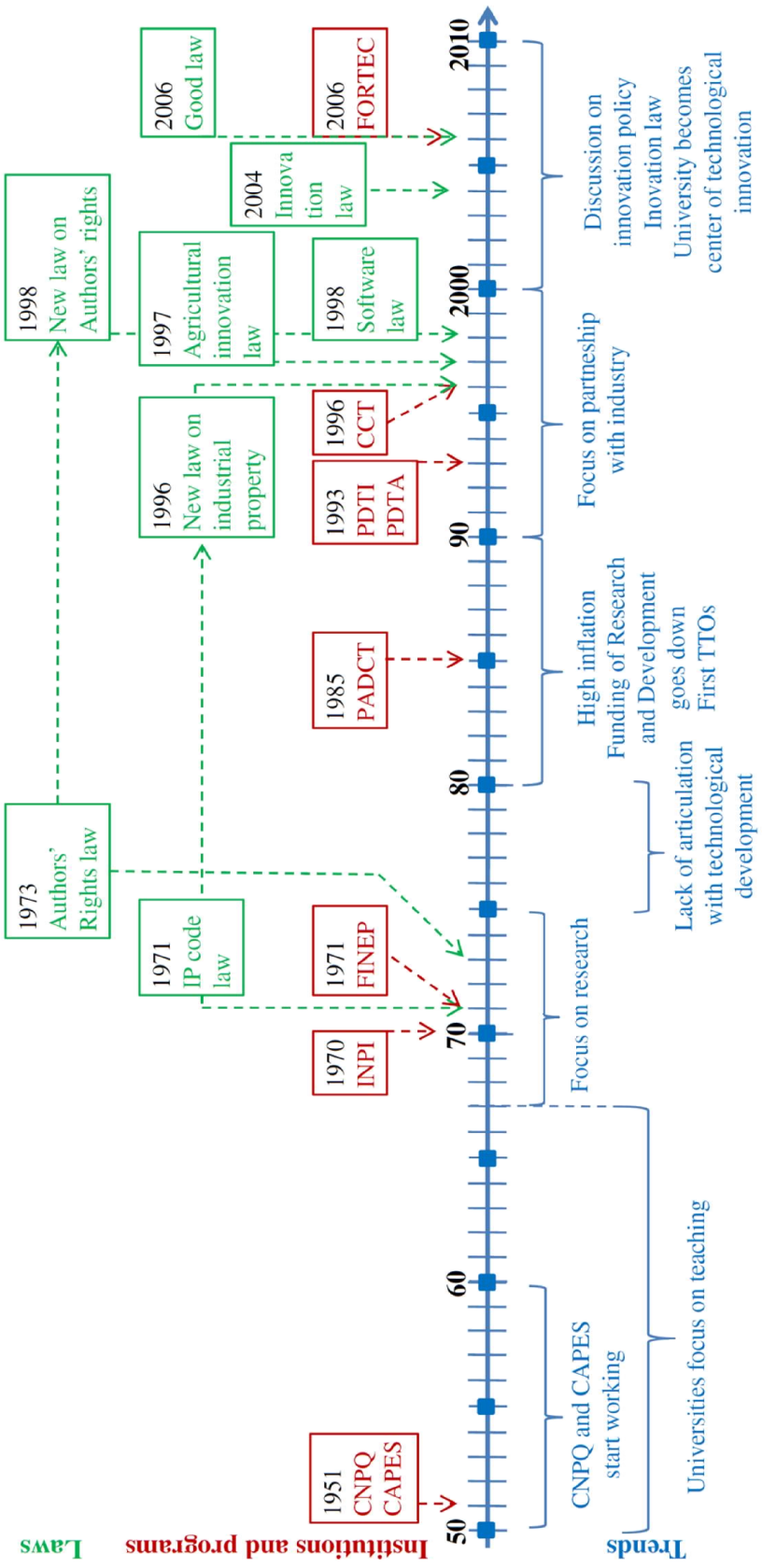

Figure 6 Historic overview on Trends, Laws, Incentives and Institutions in Innovation Policy in Brazil (1950-2010)

4.2 Regional Level

While the national Innovation Law illustrates the main direction of the innovation policy in Brazil, the laws at a regional level present more details on how this policy can be implemented. The Innovation Law of the state of Rio Grande do Sul (2009) contains ten chapters. First of all it defines main concepts including the innovation, inventor, technology transfer and etc. Secondly, it focuses on the process regarding participation of science and technology institutions in the innovation activities, clarification of the measures to encourage researchers to take part in the process; reveals the details on benefits a researcher can gain and the working conditions in the industry for researchers.

The fourth chapter is dedicated to innovation and TTO. The Law characterized the TTO as a service department of a science and technology institution (for example, university) that bears a responsibility for monitoring innovation policy implementation. Any institution involved in innovation activities that may lead to the creation of new scientific and technological knowledge is obliged to set such an office, which has to be directly linked to the highest level of institutional management. TTO is also responsible for legal matters concerning licensing and patenting of inventions. In order to provide the best practices within TTO, institutions can establish partnerships with other public or private institution for staff training.

The regional Law also aims to support investments in scientific and technological research, technological development along with financial and tax incentives. The main Law was complemented by financial measures to support innovation (2009) and decrees on Incubation (2012).

4.3 Institutional Level

On the institutional level the main document that addresses the issue of innovation is the Development Plan of the University for 2012-2016, hereafter “The Plan” (UFRGS, 2013a). The document referring to the federal Innovation Law states that one of the university objectives is to strengthen partnerships with the community through contributing to society’s development with the new knowledge produced at UFRGS. Another task is dissemination of entrepreneurship culture through education programs, which is not clearly defined in the document. (UFRGS, 2013a, p. 25)

The university TTO (SEDETEC) plays the central role in accomplishing this mission: it coordinates actions that are directly related to entrepreneurship, innovation, development and technology in society in order to promote the technological capabilities developed by UFRGS. In addition to the tools and methods that are established to map scientific knowledge and evaluate commercialization potential, SEDETEC is also responsible for increasing partnerships with companies as well as expanding participation in strategic areas. Another important area for SEDETEC according to the Plan is expansion of the international entrepreneurship network and improvement visibility of the innovation activities abroad, first of all through Redemprendia network, which is presented in the next section of this chapter.

It remains unclear in the document how many of SEDETEC goals overlap with the tasks also covered by the Science and Technology Park. For example, according to the Plan, Science and Technology Park is also responsible for increasing technology transfer and partnership between academics and industry. (UFRGS, 2013a, p. 24)

Other institutional regulations concerning innovation include: the decree on patenting (1998), the decree on intellectual property (IP) protections of plants and plant breeding produced at UFRGS (2002) and commercialization of transgenic plants (2002).

4.4 Actors

- **National level**

The main actor on the national level is the Ministry of Science, Technology and Innovation (MECI). It coordinates the work of several agencies including the National Science Foundation (CNPq) with the mission of promoting research and preparing national scientists. Another important actor is the Brazilian Innovation Agency (FINEP) that is responsible for the public support to science and innovation in companies and universities.

Incentives for financial support of innovation are usually realized through the programs and grants within these agencies. However, it is the National Council of Science and Technology (CCT), the advisory body connected directly to the president of the Republic, which determines the science and technology policy in the country. The Brazilian Association of

Intellectual Property and Technology Transfer Managers (FORTEC) also plays an important role in the national innovation policy.

- **Regional level**

All the states in Brazil have state foundations for research support (FAPs) for assisting research, scientific and technological innovation. The Support Foundation of the Rio Grande do Sul state is called FAPERGS. It finances activities fostering research projects and programs. For example, programs supported by the foundation include institutional grants to encourage the involvement of undergraduate students in technological developments (PROBIT) and scholarships for research and innovation in various areas of knowledge (PRONEM)[15].

Besides, the Secretariat of Science, Innovation and Technological Development of Rio Grande do Sul (SDECT/RS) participates in the state government's policy. SDECT coordinates initiatives for the development of Science and Technology Parks and incubators in the state (Tecnópole and PGTec) with UFRGS as a participant.

- **Institutional level**

The innovation system at UFRGS includes TTO, Science and Technology Park, 5 Incubators, Centre for Entrepreneurship and laboratories.

TTO

The Secretariat of Technological Development (SEDETEC) is a university TTO. Initially the Office of Technology Transfer and Interaction (EITT) was created in 1997 for facilitation of academia – industry partnership. SEDETEC was established in 2000 and absorbed EITT.

According to the SEDETEC website it was created "to provide the community with the conditions to transfer scientific and technological expertise generated at UFRGS"[16]. SEDETEC has 8 sectors including administration and finance, management and planning,

[15]FAPERGS. Foundation for Research Support of the State of Rio Grande do Sul (2015) Retrieved 29.01.2015 from http://www.fapergs.rs.gov.br/.
[16]SEDETEC. Retrieved 29.01.2015, from www.sedetec.ufrgs.br.

legal assistance and IP, Entrepreneurship Program, IT scholarships and FINOVA, Technological Development research group and projects on university-company interaction.

The main activities at the office are linked to the legal consulting. It fulfills the task of "the institutional management of IP, from the procedures for registration and protection of an invention, software or cultivating through the marketing in the productive sector"[17].

However, SEDETEC is also involved in the process of dissemination of entrepreneurial and innovation culture through "collaborating with academic units and other segments of the community, through seminars, workshops, industry, etc.[18]"

One initiative, which aims to stimulate and disseminate the entrepreneurship culture at UFRGS, is called Entrepreneurship Program. The main action developed by the program, is the Entrepreneurship Marathon, extension course focused on entrepreneurial training. The program includes business plan contest. Another incentive is the Entrepreneur Training Program that is similar to the one described above but focuses on financial and legislative matters.

Redemprendia is an international **global** network, sponsored by Banco Santander, for universities in Spain, Portugal and Latin America with the task to promote responsible innovation and entrepreneurial projects. Redemprendia promotes exchange programs that are available for students and entrepreneurs through SEDETEC[19].

In addition, Redemprendia supports research on Academic Entrepreneurship (*Embaixadores* 360°) which looks at the ways of dissemination the entrepreneurial practices at universities[20].

Furthermore, the SEDETEC is in charge of the scholarship programs (Bolsas IT) that are supported by CNPq, FINEP and FAPERGS. The scholarship "aim[s] to promote the interest for technological development and innovation in UFRGS' undergraduate students"[21] allowing them to work in the projects connected with technological development and innovation at university. The results of their work are presented and evaluated during the Technological and Innovation Fair (FINOVA) organized by SEDETEC every year.

[17]SEDETEC. Retrieved 29.01.2015, from www.sedetec.ufrgs.br.
[18] Ibid.
[19] UFRGS joins in 2011. SEDETEC. Linha do tempo. Retrieved 24.11.2015, from http://www.ufrgs.br/sedetec/?page_id=1519
[20] UFRGS. Empreendedorismo. Retrieved 19.10.2015, from http://www.ufrgs.br/sedetec/?page_id=413.
[21]UFRGS. Bolsas IT. Retrieved 19.10.2015, from http://www.ufrgs.br/sedetec/?page_id=1079.

The Science and Technology Park and Incubators

The Science and Technology Park at UFRGS is seen as a way to push forward the economic growth. One of the main purposes of the Park is the knowledge technology transfer and linking research with the industry[22]. Besides, business incubators develop enterprises that contribute into local economy and provide new working places.

The Park hosts five incubators that represent traditional industrial sectors like agriculture and new technologies and IT: HESTIA (engineering and physics), ITACA (food and agriculture), ITCP (economy), CEI (informatics), IE-CBiot (biotechnology).

For example, IE-CBiot incubator targets traditional agro business. It also supports business in healthcare and environment that corresponds to the emerging health equipment industry. BioPlus is one of the 8 spin-off companies graduated from the incubator. The company develops solutions for the agriculture and wastewater treatment using biological methods.

Hestia Technology Incubator is based on the School of Engineering and Physics Institute and aims to support spin-off companies in the area of electronics and software. One of the graduate companies is Science Technology & Engineering (STE) offering engineering modeling for several industries including oil and gas.

Even though the companies graduating from the Incubators are not large, some of their activities are linked to the essential economic areas in the region.

There is no strong evidence that research at UFRGS is specifically targeting prospective areas of oil, maritime, or renewable energy. However, many incubators and research groups are able to offer solutions to the new areas.

Centre for Entrepreneurship

Both SEDETEC and Science and Technology Park took part in creation of the Center for Entrepreneurship in 2012. The tasks of this actor are greatly overlapped with those mentioned for SEDETEC. According to the SEDETEC website the center was created to disseminate the

[22]UFRGS, Science and Technology Park. Retrieved 20.01.1015, from http://www.ufrgs.br/parque.

culture of entrepreneurship among students, technical and administrative staff at the university.[23] The center develops teaching and outreach activities in the area of entrepreneurship. For example, the Entrepreneurship Laboratory is a short seminar for students covering the topics like entrepreneurial behavior, creative process, design thinking, innovation plan and business models[24].

Laboratories

UFRGS has a network of 856 laboratories (UFRGS, 2012, p. 253), and some of them are active in Academic Entrepreneurship. They have strong connections with industries usually based on personal contacts and long-term cooperation. One example of such a successful laboratory is the Physical Metallurgy Laboratory (LAMEF) in Metallurgy Department of School of Engineering, founded in 1956[25]. The laboratory comprises 8 groups developing solutions for various sectors from equipment for gas and oil to dental implants in health care. LAMEF has developed a strong research profile along with unique experience in cooperation with industries that surpass SEDETEC proficiencies. Nevertheless, LAMEF is a rare case at university, since most of the laboratories lack strong links to companies.

FAURGS

Besides, university has its own Support Foundation (FAURGS). Similarly to the regional foundation it implements research programs and facilitates the collaboration between the public university and private sectors. It is also in charge of money allocation gained by the university as the result of university-industry cooperation.

In short the material under investigation can be summarized in the following table.

[23]UFRGS. Núcleo de Empreendedorismo.
Retrieved 19.10.2015 from http://www.ufrgs.br/sedetec/?page_id=413

[24]UFRGS. Science and Technology Park. Laboratório de Empreendedorismo teve sua primeira edição. Retrieved 20.01.1015, from http://www.ufrgs.br/parque/noticias?b_start:int=24.

[25]LAMEF. History. Retrieved 17.10.1015, from http://www.lamef.demet.ufrgs.br/english/index.html.

Levels	Actors
Global	• Redemprendia
Federal	• Ministry of Science, Technology and Innovation (MECI) • National Science Foundation (CNPq) • Brazilian Innovation Agency (FINEP) • National Council of Science and Technology (CCT) • Brazilian Association of Intellectual Property and Technology Transfer Managers (FORTEC)
Regional	• Support Foundation of the Rio Grande do Sul (FAPERGS) • Secretariat of Science, Innovation and Technological Development of Rio Grande do Sul (SDECT/RS)
Institutional	• SEDETEC • Science and Technology Park • Incubators • Centre for Entrepreneurship • Laboratories
Unit	• Legal assistance and IP • Entrepreneurship Program • IT scholarships and FINOVA • Technological Development research, etc.

Table 2 Academic Entrepreneurship actors

5 REGULATORYFRAMEWORK AND UNIVERSITY PLANNING

This chapter characterizes and analyzes the documents that addressing Academic Entrepreneurship. The main ideas of the documents are identified and the understanding of the Academic Entrepreneurship is traced. All the documents used for analysis are available online.

5.1 Regional and Federal Innovation Law Analysis

The documents in this part can be divided into 3 groups: national, regional and institutional. The latter group contains different types of records (decrees, decisions, and plans). (See Appendix D)

REGIONAL AND FEDERAL INNOVATION LAWS

The Innovation Law (*Lei de Inovação*) provides incentives for the support of strategic alliances between business companies and research institutions. It contains six chapters including definitions of the main concepts, measures for creating the alliances, the incentives to encourage research institutions, companies and independent researchers to participate in the cooperation. It also describes the legal procedures regarding the funding, IP rights and responsibilities.

The Regional Innovation Law is issued in 2009 and represents the measures applicable to scientific and technological institutions of Rio Grande do Sul State. The Regional Law represents a more detailed account of the main concepts, and highlights the importance of innovation for the regional growth and strengthening of competitiveness and capabilities of the state.

The Federal Law defines the science and technology institution as a public entity whose mission includes basic and applied research. (Chapter I, Art.2, V) In the Regional Law such

an institution performs human resources training, technological innovation, development and outreach along with the research responsibilities. (Chapter I, Art.2, II)

According to the Federal Law the TTO is an entity created by one or several institutions for managing the innovation policy (Chapter I Art. 2, VI), whereas the Regional Law defines the office as a member of the institution with has the task of implementation, managing and maintaining the innovation policy. (Chapter I, Art.2, V)

In the article 16 of the Federal Law and article 17 of the Regional Law the minimum functions and competencies of a TTO are established. The Office evaluates and ranks the invention projects, provides the legal support regarding the invention disclosure, patenting and monitoring of the maintenance of intellectual rights for all the forms of technology transfer. Technology transfer is recognized as a public good by the Federal Law (Chapter III, Art. 6, §5). The research institutions provide TTO staff with training (Chapter VI, Art.26).

The measures for the creation of innovation environment includes also establishment of scientific and technological parks and incubators. The Federal law labels this process as technological entrepreneurship (Sole paragraph). In the Regional Law, however, the notion of scientific and technological parks and incubators receive more attention (Chapter VII). The primary goal of the park is generating income and jobs, promoting sustainable development of the region, and facilitating technology transfer between academia and business (Chapter VII, Art.25, §2). Unlike TTO, science and technology parks and incubators create and maintain technology-based companies (Chapter VII, Art. 25) but are involved in the process of technology transfer and use the university infrastructure (Chapter I, Art.2, X).

The Federal and Regional Laws on innovation both establish the rules for technology transfer and regulate the cooperation between science and technology institutions and business. Compared to the Federal Law, the Regional Law is more detailed, refers to the wide spectrum of concepts, and gives more attention to the regional development.

5.2 University Regulations Before 2004

The regulations and decisions issued by the Federal University of Rio Grande do Sul can be divided into two groups: those issued before or after the Federal Innovation Law came into

power. UFRGS became active in technology transfer as early as 1990[26] when the first patent application was filed. At that time University already provided a few legislative tools for facilitating technology transfer, but further regulations followed after the introduction of the federal and regional innovation laws.

Before 2004:

The analysis of the university documentation shows that that the attempt to regulate the university-business cooperation appeared some years earlier than 2004. Besides, the key agencies like TTO and incubators were established in 1990th.

The **decree on agreements and contracts** (Decree N5518, 13/11/1994) between university and private entities that involve university and university professors into projects outside academia establishes the legal regulations and limitations. For example, 5 per cent of the project outcome should be devoted to university teaching, research or outreach activities. The decree also sets a limit of 8 hours a week for the outside project participation for the full-time professors. (UFRGS, 1994) It suggests that some forms of university professors' involvement in cooperation with private entities already existed, and the decree formally recognized it and formalized the rules.

In 1998 an important **Decree on Rules and Regulations** of technology transfer was issued (UFRGS, 1998). The Decree was based on the University Management Plan (1996-2000) and aimed to develop a model of science and technology management at UFRGS. The decree underlines the need of evaluation of creative activities at UFRGS, definition regulation of the university **policy** regarding the research results and their commercial use, establishing rules and criteria for technology transfer. The document contains ten articles referring to different aspects of ownership, transfer, and management of industrial property. According to decree all the inventions become exclusive property of the university, the university holds responsibility to apply for patenting, and bears costs of patent and licensing agreements. The income of the invention is awarded in three parts, one of which goes to the inventor, one to the faculty, and one pays work of administration and registration fees.

In the third article the intention to support technology transfer and encourage inventors and faculties to apply for patenting and disclose their inventions, is expressed. However, no further measures above technical support are suggested.

[26] SEDETEC. Linha do tempo. Retrieved 24.11.2015, from http://www.ufrgs.br/sedetec/?page_id=1519

The decree operates with clear and well-defined concepts and suggests a straightforward instruction for the faculty or inventor dealing with the invention case. It might suggest that university formalized and structured the procedures that in some form already existed at faculties. At the same time it does not provide much information about how the university intends to develop technology transfer, spread the information or stimulate faculties and faculty members to participate in the process.

Based on the decree on technology transfer rules and regulation, the act on **establishing TTO** was signed by the rector. (UFRGS, 2000a) This short document declares the TTO a body responsible for management of economic gains received by the university as the result of the exploitation of invention patents and industrial property registration. This document illustrates that initially the TTO was expected to work with technical procedures facilitating financial and legal aspects of technology transfer.

5.3 University Regulations After 2004

There is a considerable gap in documents related to entrepreneurship, technology transfer, and innovation at UFRGS between 2000 and 2010. This may be explained by the fact that only documents represented in the open sources were investigated. However, it is also plausible that after 2004, when the Federal Innovation Law was issued, there was no rapid change in the way the university worked with technology transfer and entrepreneurship and university policy and normative base have been changing gradually.

However, the university issues several documents regarding guidelines and rules for interactions between universality and third parties. For example, Decision 242/2005 updates a similar decree from 1994 (Decree 5518), that will later be replaced by Decision 193/201.

In 2010, UFRGS designed their first institutional **Development Plan** (Plano de Desenvolvimento Institucional - PDI). This document is seen as a milestone for university profile, as it reflexes strategic and tactic in planning and development. It formulates the university missions and outlines three principal areas: teaching, research, and community outreach. The notions of innovation, technological transfer, and entrepreneurship are manifested as significant aspects of research and community outreach activities. (UFRGS, 2010a, pp. 17-18)

The research goals include “attending to social demands as a result of the pursuit of human development by transformation of social and economic reality” (6), “programs in technological innovation with objective to improve production and social progress” (8), integration into productive sector via technology transfer (9), improvement of the technology transfer policy aiming to evaluate, register and commercialize the results of university research (11). (UFRGS, 2010a, pp. 17-18)

The community outreach mission, among other things, targets implementation of the policies aiming to attract students to the outreach projects (14), and encourage entrepreneurship actions among students, professors and technical administrative staff (15). (UFRGS, 2010a, p. 20)

The Development Plan represents a long-term university strategy that frames short –range actions. The main ideas of the Plan are developed in several later documents.

The outreach mission is clarified in the Decision 266/2012. The document defines the outreach mission as a “two-way relationship” between academia and society that is “important for students’ education and teachers’ qualification”. The outreach policy aims at increasing business opportunities (7) and expanding access to knowledge, social and technological development. (UFRGS, 2010a, p. 17)

The Management Plan (*Plano de Gestão* 2012-2016) is based on the Development Plan (2012) and constitutes a tactic document representing concrete actions to achieve results in strategic areas formulated in the Development Plan. It marks 6 important areas including “academic excellence and innovation” (UFRGS, 2013b, p. 12), and “expansion of interactions with business – areas connected with technology transfer and academic entrepreneurship”. (pp. 24, 31)

Academic excellence and innovation, aims, through institutional projects, to integrate teaching, research and community outreach. (III, 1, p. 12). The outreach allows society, state and the country benefit from academic knowledge, research and technological innovation. (III, 2)

It is stated that the interaction between academia and society requires established policies. The Management Plan clearly represents the functions of various entities of the university and provides the scope of projects assigned to the university agencies with clear-cut goals and

objectives. While the Development Plan elaborates the concepts, the Management Plan provides guidelines for implementation of projects.

The largest part of the document is dedicated to the projects and actions directed to the strategic areas. The projects connected to innovation, technology transfer and Academic Entrepreneurship include initiatives in technological development and innovation (1.6.2), Cross Program and Interdisciplinary Entrepreneurship Education (1.6.3) (UFRGS, 2013b, p. 24), strengthening of technology transfer of shares and industrial property, Innovation Management at UFRGS (2.1.8 - 2.1.9, p. 31), International entrepreneurship networks, Promotion of the University innovative profile internationally. (3.2.2 - 3.2.3, p. 40)

SEDETEC is responsible for these projects. The detailed account of how SEDETEC is represented in the reports will be discussed later in this chapter.

Based on the Innovation Law and the Management Plan, the **new Decree on Technology Transfer** (Decree 6869/2013) appears in 2013. The new Decree represents the "model of science and technology managements, which facilitates the transfer of technical and scientific knowledge to society". (UFRGS, 2013c) Even though that this document appeared 13 years later after the first university Decree stating the rules of technology transfer in 2000, it is identical to the former. The actual difference can be seen only in the list of reference laws and acts that the two technology transfer decrees are based on. The latter Decree obviously refers to the Innovation Law (2004) that did not exist when the first Decree was issued. The plausible explanation can be seen in the fact that some technology transfer practices were already developed and settled at UFRGS by the time when the Innovation Law was issued. Thus, there were no crucial changes in the way the technology transfer was performed after the Innovation Law came into power and legal instruments that were adopted by the university before the federal law stayed sufficient.

Another important document, which is clearly based on earlier versions (Decree 5518/1994 and Decision 242/2005), is the university board Decision (193/2011) on Academic Interaction. Even though the Decision does not mention the early version of the Decree on Academic Interaction in the opening, the succession seems to be obvious. As the early document of 1994, the 2011 Decree regulates university interaction with society. However, the new document is better developed and provides to broader understanding of academic interaction. This is seen as the university purpose to maintain the interaction with society as

the university owns knowledge, human resources, and "highly relevant" materials (b), which the community can benefit from. (UFRGS, 2011a) The document is also based on the Innovation Law (2004) and grants the permission to professors to combine their work at the university with external projects.

The Decision contains a detailed account on the agreements between university and third parties: limitation regarding the working hours and types of contributions the external projects should bring to university (UFRGS, 2011a, p. 2 , Art.4), the description of the procedure of cooperation approval (Art. 6, pp. 2-3), requirements to the participants (Art.7, p.3), financial resources (Art. 11, p.4), etc. Compared to the decree of 1994, the Decision also contains some minimal changes: for example, number of hours allowed for the external projects increased from 8 hours per week to 10 hours per week (Art. 4, §1, p. 2).

However, the main change is in complexity of the procedure, involvement of several university entities in the process of approval[27], and the reference to the broader university mission as the obligation of academia to contribute to the society's development.

The Decision is followed up by a more technical document (**Decree 2679/2011**) that clarifies the academic interaction system, additionally explains the sequence of agreements approval for different types of cooperation. (UFRGS, 2011b)The Decision illustrates how the interactions that were already in practice for almost two decades have been further elaborated and linked to the university strategic missions.

5.4 SEDETEC representation in university documents and reports

In this section of the chapter I am going to look into how the UFRGS's Technology Transfer Office (SEDETEC) [28]is represented in the university decrees, decisions, and reports.

The earliest document that mentions SEDETEC is the **Decree 2108** issued and signed by the university rector in **2000**. (UFRGS, 2000a) This is a short document that initiates the creation of the office to manage the one third of income that the university gains as the result of

[27]TTO is the one of the bodies that approves the agreements, for example FAURGS and CONSUN
[28]Initially called the Project Management Office (EAP), then the Interaction and Technology Transfer Office (EITT); as for 2015 - SEDETEC

invention exploitation and commercialization. The document does not contain details on the office functions.

According to the text of the **Decree** on Rules and Regulations of technology transfer **(1998) (UFRGS, 1998)** and later to almost identical **Decree of 2013 (UFRGS, 2013c),** the management functions were not allocated to any specific entity but performed by the university. However, in the **Decision on Academic Interaction (2011)** SEDETEC is mentioned as the body responsible for registration, analysis, legal aspects and partly for the approval of the external contracts.(UFRGS, 2011a, Art. 6) The follow-up **Decree on Academic Interactions (2011)** also refers to SEDETEC as one of the entities involved in the university system of academic interaction. (UFRGS, 2011b, II, III)

The most valuable in terms of SEDETEC's profile document is the **Management Plan** (2012-2016), which, as it was mentioned in the previous section, contains a detailed account of projects and actions in the area of technology transfer and Academic Entrepreneurship.

SEDETEC is responsible for:

- Encouraging technological development and innovation, through the granting of initiation grants for technological development and innovation (1.6.2., p.24);
- Stimulating the entrepreneurship culture in UFRGS through Transversal Programme and Interdisciplinary Entrepreneurship Education, to be offered to students from all undergraduate and graduate UFRGS (1.6.3, p.25);
- Creating mechanisms to strengthen partnerships with the community (2.1.8, p.31);
- Coordinating actions directly related to entrepreneurship, innovation, development and transferring technology to society (2.1.9, p. 31);
- University's participation in international projects of entrepreneurship, aimed at internationalization of enterprises, promoting and encouraging students and professionals to participate in the international entrepreneurial activities. (3.2.2, pp. 39-40);
- Expanding, stimulating, and strengthening international partnerships for the possibility of transfer and protection of international assets (3.2.3, p.40). (UFRGS, 2013b)

According to the Management Plan, the SEDETEC's functions were significantly extended from the initial management of the research commercialization income. The comparison of

the Management Plan with the earlier documents also suggests that SEDETEC received a strategic position at the university. From being involved in the legal aspects of technology transfer and royalties allocation, SEDETEC takes the lead on dissemination of research results, entrepreneurial culture, and international cooperation in Academic Entrepreneurship.

REPORTS

The annual reports (**Relatórios de Gestão)** reflect the university performance. They also illustrate the strategic visions and verify whether the university actions have achieved their goals. Starting from the year 2000 the university published 13 reports that are available online. All reports contain general overview and the accounts on the units' achievements. The results of **SEDETEC**'s project and activities have been analyzed.

Annual Report 2000

The earliest of the available reports was issued before 2004, thus, the lack of technology transfer and Academic Entrepreneurship policy is an important issue reflected. The traditional ways of knowledge dissemination like conferences and publications are replaced by business creation, patenting and licensing. The report, however, reveals that the university-industry interactions do exist and are supported by the university. These relationships become bases for the university policy. UFRGS creates structures to facilitate the process of the new knowledge transfer mode: **the Office of Interaction and Technology Transfer** (EITT) and **the Network of Incubators** (REINTEC). In the report it is recognized that there is a difficulty with the coordination of these bodies. That is why SEDETEC has been established. Its' purpose is, among others, to create a coordinated action strategy, internal and external, to stimulate new forms of partnership with industry. (UFRGS, 2000b, p. 16)

SEDETEC has a decision-making autonomy that allows making quick and flexible decisions and therefore achieving better and more effective interaction with the society. The new office also has strong ties to the central administration that fosters activities implementation and provides better transparency. This way, it is seen in the report that the function of SEDETEC is the coordination between the already existing entities.

2001

In the report of 2001 the main results are shown by the Interaction and Technology Transfer Office (EITT). It is responsible for supporting researchers in the preparation of agreements

and contracts. The Incubator Network is also seen as the area managed by EITT. When the report was issued, only two incubates (biotechnology and informatics) existed, while three more were under development. The report also refers to the II Entrepreneurship Marathon, the event aiming to spread entrepreneurship culture in the university community and identify good projects for incubation. The office is also involved in international cooperation.

SEDETEC as the new TTO is not mentioned as an active force, and the main tasks are fulfilled by other entities. However, it identifies clearly three main areas that appear in the university normative documents: assistance with contract, entrepreneurship culture dissemination and international cooperation.

2002-2003

The results presented in reports are similar to the results of two previous years, most plausibly due to reorganization process. In 2002 the organization of technology transfer and Academic Entrepreneurship was changed. Interaction Office and Technology Transfer (EITT) and Incubators Network (REINTEC) become parts of SEDETEC. The re-organization aimed to get the innovation activities in line with academia, by introducing new skills, for example seminars on IP (UFRGS, 2002, p. 81) and launching new mode of entrepreneurial activities with the III Entrepreneurship Marathon (UFRGS, 2002, p. 82)

The main activities performed are connected with patenting and licensing, support of university-industry interaction, creation of business incubators and new companies, interaction with other institutions, **promoting research and technological development.**

2004

The report highlights the importance of relocation of all the structures included into SEDETEC into one space and a significant structural novelty. These structures include EITT, REINTEC, the Science and Technology Park, and the Entrepreneurship Program. The Science and Technology Park is the new university project, and initially is included into SEDETEC. The three main areas presented are: IP and interaction, patents, and incubating.

2005-2006-2007

Along with the activities previously performed by SEDETEC (patents, incubation) the main target is the creation of the Science and Technology Park, from the establishment of a

working group which elaborates on the project (UFRGS, 2005, 1.7.1) into its realization (UFRGS, 2006, p. 36). According to the report, in 2007 SEDETEC was mainly involved in the entrepreneurship and innovation program, and incubators network. (UFRGS, 2007, p. 93)

Since **2008** all the accounts of SEDETEC's activities are marked as self-evaluation. (UFRGS, 2008, p. 132) The Office gives more attention to the lectures and seminars on IP in 2008, while in **2009** it stresses out the participation in cooperation with other institutions, introducing the IP and business plan workshops. It also reports on expanding REINTEC and Entrepreneurship Marathon activities, and coordinating the Science and Technology Park project.(UFRGS, 2009)

In **2010** SEDETEC intensified the lectures, technical meetings with companies and researchers. The Science and Technology Parks and REINTEC became separate bodies within the innovation system. SEDETEC coordinated the Science and Technology Park project together with the university division of research (PROPESQ). In April 2010 the Science and technology Park became a separate body. (UFRGS, 2010b, p. 218)

In **2011-2012** SEDETEC reports the revision of the legal instruments based on the new university normative documentation: Decision 193/11 and Decree 2679/11. This revision aimed to check how many SEDETEC's legal processes are in line with the IP policy. The 2012 report also focuses on disseminating the entrepreneurial culture among undergraduate and post-graduate students. (UFRGS, 2012, pp. 317-318)

The latest available report of **2013** SEDETEC is presented as a body "bringing together researchers and companies". (UFRGS, 2013d, p. 318) It continues to focus on entrepreneurship, IP, technology transfer, and incubators. Another initiative is to expand the academic education with the entrepreneurial knowledge.

The overview of the reports demonstrates that SEDETEC was an entity created in order to improve coordination between the bodies that had already existed in the innovation and Academic Entrepreneurship arena. While the normative documents (Decree 2108/2000, Decision 193/2011 and Decree 02679/2011) suggest that SEDETEC have a formal technical role in the innovation and entrepreneurial process, the reports reveal that certain strategic visions, like for example, entrepreneurial culture dissemination and the need of transmitting the knowledge to society though technology transfer, existed already when the office was created. The possible answer can be found in the fact that SEDETEC was not the first TTO

created by UFRGS, and it had a technical mission to restructure existing bodies. Another important point, that has already been mentioned earlier, is that federal, regional and university legislation appeared when technology transfer and Academic Entrepreneurship were already in place.

The following timeline presents regulations, programs, actors and trends in Academic Entrepreneurship at UFRGS.

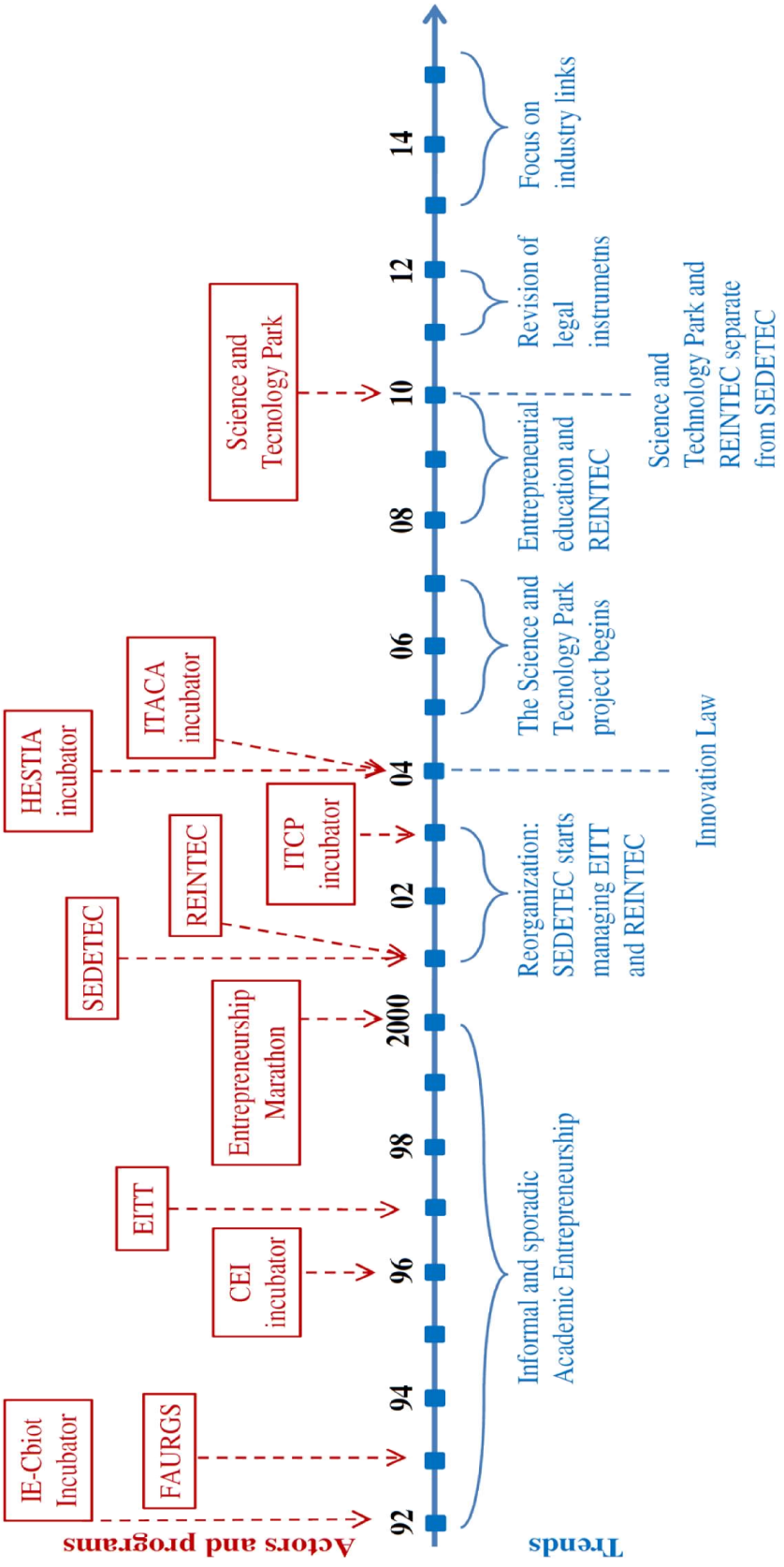

Figure 7 Timeline of Academic Entrepreneurship Activities and Actors at UFRGS

5.5 Concluding observations

The analysis of the documents relevant to Academic Entrepreneurship, technology transfer and innovation indicates several important points.

Firstly, the regulations on the federal and regional levels appear after practices of entrepreneurship activities already existed at university. Some university regulations, for example, Rules and Regulations of technology transfer (1998), remained unchanged after the introduction of the federal Innovation Law (2004). The references to the regional Innovation Law (2009) in the institutional documents were not found. The timeline (Figure 3) suggests that the legislative initiative on the institutional level is more consistent and practice-orientated.

The strategic documents Development (2010) and Management (2013) plans are uncertain about whether the Academic Entrepreneurship belongs to the research or to the community outreach. According to the map of organization, SEDETEC is on the same hierarchical level with the Division of Research (PROPESQ) and the Division of Community Outreach (PROREXT), therefore it does not depend on these bodies. (See Fig. 2) However, the scope of tasks assembled by SEDETEC suggests that it contributes to both strategic areas.

The results of SEDETEC activities are presented in the annual reports that contain account of the unit's achievements and events. Though initially SEDETEC is positioned as a complementary service to facilitate Academic Entrepreneurship activities at university, the reports often refer to its strategic vision, which will be further investigated in the interviews.

6 PRACTICES AT SEDETEC

This chapter considers how SEDETEC employees understand the mission of their agency and the mission of university with respect to Academic Entrepreneurship. The two previous chapters provide the legislative and administrative setting for the TTO activities. In addition, Chapter 5 discusses the results of SEDETEC work according to the annual reports.

Using this background, this chapter further examines SEDETEC's practices and structure. First, the SEDETEC role and rationale are discussed. Then, the traditional and emerging practices, coordination between SEDETEC and other Academic Entrepreneurship actors at university are described. Finally, the challenges and perspectives of SEDETEC are presented.

6.1 SEDETEC role and rationale

The SEDETEC employees point out that the rational for its creation is 2004 Innovation Law, The Law, in turn, emerged as a response to the already existing practices of university-industry cooperation and need for legal mechanisms that would regulate them:

There were some initiatives but probably from the researchers that [were involved in] these interactions [with industry]... Probably SEDETEC was created to help or not to lose IP". (INT 6)

At the same time, some interviewees think that the motivation could be external. The changing economic situation forces universities to be proactive and "more practical". The example of China has been mentioned as a country that commercializes successfully. Therefore, the influences of other countries encourage Brazil to seek for statutory forms of Academic Entrepreneurship:

"Yes, this law came because of a need. I don't know if this was influenced from (this) what happens in the world […] the entire world is doing this, we have to do it too… We have to think for tomorrow, of course, but we can do some things for today, to generate products not just knowledge. I think, the world is changing so fast and this is the need in this fast world to be more flexible". (INT 9)

Thus, the university innovation policy is predefined by law and translated into practice by SEDETEC. In addition, the law outlines the minimal SEDETEC's functions and regulations that guarantee safe interaction between companies and laboratories and researchers.

The possibility to control the financial revenues that come with royalties is also named as an important factor. One interviewee commented that "SEDETEC is the only unit inside the university that brings income". (INT 3)

Another emphasizes that university has the duty to provide public good by transferring new knowledge and technologies from public university to private companies in the legal way because "it is not fair to give the technology to enterprises without receiving anything" (INT 2) It is reported that in the past cases occurred when the companies could benefit from university research without paying royalties. Therefore, most of interviewees agree that society has the right to know how public universities are financed and how the results of the researched are used.

When defining the role of SEDETEC in the university and in society, the respondents voiced various ideas that can be divided into the following groups:

1. Connecting research and industry

The majority of specialists working at SEDETEC see the role of the unit in connecting research and industry. This described as the "bridge between university and society, especially in industrial sector". (INT 8) SEDETEC then acts as a translator because industry and academia use "different languages". (INT 9)

This connection can be achieved by presenting technologies to the industry and making research results more visible and, and the same time, making researchers aware of what companies need and require. This should eventually lead to creation of "some kind of cluster of researchers" and help in "developing industry here in our state" (INT 6).

2. Legal protection and reputation

The initial role of IP protection remains important. That is why many see SEDETEC as a service to those who want to commercialize their invention and need help with the bureaucratic procedure. (INT 3)

According to one of the interviews, SEDETEC "becomes a reference to companies and other educational and research institutions" in context of external interaction. (INT 1) In other words, SEDETEC represents legal procedures that are trusted by both researchers and their partners. This work enhances university reputation and encourages companies to seek for cooperation, despite of heavy bureaucracy.

3. Creating social and economic benefit

However, SEDETEC is often seen in a broader institutional and societal context. The notion of public good is referred to by many interviewees:

"A lot of investments were made here in Brazil to make relevant research. But this research just results in papers. And people do not read papers. Knowledge must be converted in services by industry to reach people. I think this is an important task of the university to help researchers and industry to reach society". (INT 6)

There should be a connection between research results and public benefits, so the TTO then works with the mechanism transforming academic knowledge into products and services and helps society to develop further. Many interviewees believe that successful cases of Academic Entrepreneurship inspire researchers to be more orientated to what society needs.

4. Disseminating new entrepreneurial culture

Many SEDETEC professionals see its role in dissemination of a new entrepreneurial culture among academics and students. Almost all mention that entrepreneurial behavior is not typical at university and the change is needed:

"Some time ago we did not have this culture here. The person has to work for society not for money. And now this culture is changing. A professor is now interested in patents, to show the technology to the market, to commercialize and get profit". (INT 2)

Through the entrepreneurial program SEDETEC encourages students and professors to see alternatives to the academic career and helps to create new employment opportunities and inspires them to become entrepreneurs. The program helps them to "think more globally, to see things with a different perspective, not just scientific". (INT 4)

There is also a wider understanding of entrepreneurship and innovation that SEDETEC diffuses, which is not only opening businesses but also cultivating entrepreneurial thinking: "we want to show them that it is possible to innovate in all kinds of areas". (INT 10)

Those specialists, working with the researchers admit that there is a conflict between the traditional understanding of university mission and the emerging mode of commercialization. Many agree that TTO should promote Academic Entrepreneurship among researchers, though it does not happen yet.
Generally, the results of the interview show that SEDETEC specialists define its role as a legal tool for university-industry interaction, but recognize its wider social and economic benefit.

6.2 Traditional and emerging practices

Throughout the interviewing process the Intellectual Property (IP) protection was referred as a core activity at SEDETEC. According to the law, the research results produced by employees belong to the university. That is why results and inventions have to be reported to SEDETEC. However, sometimes this may not happen because the university does not have a control system to insure all the inventions are claimed. The SEDETEC specialists do not collect data on these cases.

Normally a researcher, who wishes to patent his or her invention, applies to SEDETEC. The application is analyzed, so the specialist can decide if the case is patentable or not. When it is possible to patent, SEDETEC creates a file for the invention in the National Institute of Industrial Property (INPI). Otherwise, the technology with commercial value should be presented to industry in search of partnership.

The partnership with industry can be executed in two ways: licensing agreements, which is allowing a company to use a technology or invention in exchange for a financial compensation, or strategic alliances, meaning that, for example, a company and a laboratory will develop a technology together. (Baron, 2014, pp. 313-314) The search for partners is a new strategy for SEDETEC that has not yet been fully developed.

Another traditional practice is when researchers or laboratories have already established the

connection with a company and seek for the legal approval of the supporting documents. In this situation SEDETEC checks the formalities, for example, that the numbers of hours dedicated to the project by researchers does not exceed the limit. SEDETEC specialists can also participate in negotiations between the partners. Agreements between enterprises and incubators or the Science and Technology Park are also under the responsibility of SEDETEC.

At SEDETEC patenting seems to be the most used strategy, while licensing and working with the start-ups are quite new for the staff. Many SEDETEC specialists agree that patenting is a long, complicated and costly process without guaranteed results and returns in form of royalties. The focus is, in fact, changing towards licensing:

"*This is what I see more normal in the university. These technologies have more potential to be licensed. The technologies without a co-author are more difficult. The researcher has to do it alone and then a protection is made and that is in the database and nobody looks at it*". (INT 4)

SEDETEC's specialists are working on a method to evaluate technologies. First step is to understand the technologies and identify the markets. The second step, that has not been reached yet, is to approach the enterprises and present the product. Addressing the industry is seen as the most difficult stage mainly because this is where SEDETEC is lack of experience:

"*I think the most difficult part [is] to talk with the industry. And make this link; offer the technologies of UFRGS to the industries, to find the industry, to find the right people in the industry to talk with*". (INT 9)

At the same time, research departments and laboratories have better experience with industries through personal contacts. For example, the Physical Metallurgy Laboratory (LAMEF) situated in the same building, has more experience in contacting companies and does it better than SEDETEC (INT 9). Knowledge transfer through entrepreneurship and start-ups creation are mainly performed by the incubators and the Science and Technology Park.

Nevertheless, SEDETEC works with several programs that focus on other types of Academic Entrepreneurship that are integrated into the university entrepreneurship program. The entrepreneurship program managed by SEDETEC embraces several initiatives aimed at promoting entrepreneurial culture and non–technological startups.

The scholarships for students (*Bolsas* IT) allow them to work in projects connected with technological development and innovation at university. The result of work is presented during the Technological and Innovation Fair (FINOVA); Entrepreneurship Marathon – the course open for students, professors and general public targeting project creation for business incubators.

The undergraduate student scholarships are distributed by the professors. This is believed to be a good way to monitor the projects themes and their linkage to innovation. (INT 4) Professors can choose the student who would work with them in the project, students, in turns, prepare a working plan that has to be approved by a committee consisting of other professors in the field. At the end of the project, students present the results of their work at FINOVA.

Even though the scholarship (*Bolsas* IT) amount is rather small (about 100 € per month), the number of applications has increased during the last four years. SEDETEC tries to attract more applicants through the university media and through the personal contacts between professors and students.

The majority of students receiving the scholarship come from applied sciences, for example from the Engineering School, Faculty of Medical Science, and Faculty of Agriculture and Live Sciences. The program, however, attracts a few students from linguistics, psychology, administration, economics, and law. Reaching students from humanities and social sciences is seen as an important objective:

"*We want to show the university that technology does not always relate to engineering, or this kind of field. Everybody can do innovation inside their field. So we try to offer these scholarships to other areas as well… It prepares students to become more open globally, to see things with a different perspective, not just scientific.* (INT 4)

Besides, the professionals working with the program believe that studying entrepreneurship potentially increases alumni employment opportunities. Students learn how to start a business and acquire diversified perspectives on their future career.

According to the interviews, SEDETEC does not collect information about the alumni and their projects in systematic manner. The interviewees recall some successful cases, when the projects resulted in patents or startups.

Besides, SEDETEC manages programs from the international network Redemprendia. Redemprendia supports a number of actions at UFRGS, including an entrepreneurship course, known as The Entrepreneurship Marathon, and student and startup exchanges.

The Entrepreneurship Marathon is open to students and professors, as well as to the general public. Similarly to the scholarships, the idea behind the marathon is to "show that it is possible to innovate in all kinds of areas". (INT 10)

The Entrepreneurship Marathon complements the work of incubators, trying to identify the markets for the potential startups. However, not all companies necessarily involve new technologies. Some of the companies opened as the result of The Entrepreneurship Marathon are connected with non-technological innovation services and products, for example, food delivery and design.

The participants acquire knowledge and skills for enhancing their experiences and improving their startup idea. At the end of the course, the project is introduced for evaluation. The best projects receive assistance with opening and maintenance of the company. The program's aim is to initiate and supports startups during the first months, after that incubators and the Science and Technology Park are supposed to help in scaling up new businesses. Surviving of new companies after the program is reported to be the main obstacle. It appears that SEDETEC needs more experience in this field.

SEEDTEC also manages the Redemprendia exchange programs designed for startups and students. Students with an innovative business idea can join a program that gives them an opportunity to spend 2 or 3 months abroad studying the practices of a company associated with the network. The experience can help to understand the strengths and weaknesses of a business model in practice and boost the participant's knowledge about the area. International training can also add to an individual's vision of business. The SEDETEC specialists

characterized this internship as a good chance to explore the international reality that can, in fact, not only teach how to manage a company but expand the business network and cultivate internationalization. However, the number of participants does not seem to be impressive: it has been mentioned about one individual participating in the exchange. That could be due a busy academic schedules and rather low awareness about the program among the students. Besides, the participation requires a good business idea that can be a challenge for the students.

Startups can also do exchanges under similar conditions: they can spend some months at a university linked to Redemprendia. This way, entrepreneurs have a change to explore a new market, create networks and commercialize their product abroad. Despite this attractive opportunity, the exchange turns out to be a challenge to new companies because it demands considerable time and resources that may be problem at the early stages of their performance. Nevertheless, 13 companies created at UFRGS, participated in the program over the years.

SEDETEC professionals believe that internationalization is an important aspect of Academic Entrepreneurship because it allows “seeing things in a different perspective” and “to create something that can be global”. (INT 4)

During the discussion of the education value of entrepreneurial programs for students, some respondents assumed that integrating entrepreneurial courses into the curriculum can lead to greater social benefits.

6.3 Other actors involved in Academic Entrepreneurship

The Brazilian name NIT that stands for technological innovation unit refers to the entity that was created by the Innovation Law mainly for IP protection. Many interviews have referred to the important difference between NIT and TTO.

TTO is understood as a unit that is entitled to a broader range of tasks, while NIT mainly focuses on legal protection. According to the interviewees, SEDETEC, in practice, deals not only with the legal protection but with other aspects of Academic Entrepreneurship. The structure of Academic Entrepreneurship at university is complicated because incubators

appeared independently before the Innovation Law, later have been guided by SEDETEC and now structurally belong to the recently created Science and Technology Park. Thus, because these actors appeared at different times, their functions and structure have changed during the past 15 years. Many of the SEDETEC projects are closely connected with incubators and the Science and Technology Park, so understanding of the SEDETEC work is possible only within the contexts of these Academic Entrepreneurship actors.

SEDETEC, incubators and Science and Technology Park are all university Academic Entrepreneurship actors. Though understanding the distribution of the tasks that are assigned to each actor is not easy. In the past SEDETEC managed some activities of the Incubators, for example REINTECI - incubators network. However, currently this network is managed by the Science and Technology Park because structurally the incubators have been moved to the park, although the latter does not have the physical structure yet. It is reported in the interviews that the Science and Technology Park is planned to be located in the campus Vale where the incubators and some life sciences faculties are situated and "where industry has its units". (INT 9)

The actors have their own agenda and strategic plans (INT 1), and there is an agreement between the actors on the functions performed. This is determined by the rector, university council and actors' own management. (INT 2) Nevertheless, SEDETEC is responsible for all the legal documentation coming from incubators and the Science and Technology Park: the general management over the incubators is performed by the park, while SEDETEC is responsible for all the questions regarding IP, both for the incubators and for the Science and Technology Park.

When it comes to understanding the difference in roles of the Academic Entrepreneurship actors, one professional points out that SEDETEC initiates the projects between university researchers and enterprises that can be later supported either by incubators or the Science and Technology Park. (INT 8) The incubators, however, are open to the public though only the companies dealing with the assigned technological areas can apply. Their role is described as "connecting all the dots" in the process of a company creation:

"They don't want a company in the beginning of the process of incubation, they prefer to work with entrepreneurs that … have an idea but … do not know if this idea is good or not". (INT 10)

With regards to the Science and Technology Park mission, most of the interviewees are less precise in their definitions referring to the fact that this structure is new and has not fully developed yet. That is why the Science and Technology Park relays on the SEDETEC's knowledge and experience in its activities. The focus of the Science and Technology Park is "to boost companies and boost startups, to [encourage] students to build their companies and to give support to them" (INT 9), though there was quite a few remarks on actual projects preformed. In other words, the Science and Technology Park being nominally a separate agent is still in the process of formation and shares infrastructure of SEDETEC and incubators. As one of the interviewees puts it, "the Science and Technology Park is the SEDETEC's son", though not quite separated from his 'mother'.

Obviously, because of greater capability, SEDETEC experiences fewer problems with IP than with the emerging practices like licensing.

6.4 Human resources

Most of SEDETEC specialists recognize that for both traditional and emerging practices human resources remains a problem. Specialists involved in technology evaluation are often trained in business or administration and have difficulties in understanding technology.

SEDTEC is not directly involved into specialist training, but most of interviewees acknowledge that they had had very little knowledge about SEDETEC before they started to work in the office:

"I have never heard about the patents or technology transfer. It was new for me when I started". (INT 3)

Because it is a public university, all of the employees come to SEDETEC through the public contest. The list of specialists that can by contracted by university is defined by the Ministry of Education. That is why it is not possible to hire certain specialists:

"It is possible to contract administration, but not engineers or chemists, who would evaluate some chemical components. They are not allowed as permanent member in the TTO, just for a while [to work in] some project". (INT 6)

Participants of the contest do not know exactly the position or department they will work for. Starting to work in a new area is extremely difficult and they need more than a year of special training to understand the technology (INT 9).

The courses and trainings are organized on a national level, for example, by the National Institute of Intellectual Property (INPI). Besides, INPI has a master course in innovation and IP. However, the conferences and trainings focus on specific aspects of IP, and specialists prepared by the institute do not receive advantages in public contests. Thus, the system that prepares technology transfer agents or specialists working in TTO in Brazil needs to be developed:

"[The school of management] does not prepare to do this. The hard sciences do not prepare to do this… the management is prepared to know the market but the technology is not integrated". (INT 9)

There are two ways in which SEDETEC deals the problem. First of all, there is a possibility to hire specialists through scholarships. Such scholarships are available from the Brazilian National Council for Scientific and Technological Development (CNPq), however, according to interviewees, it is not regular. These specialists enter SEDETEC for 3 or 4 years to complete a project, but there is no certainty of what happens next:

"*I think that a scholarship can be a hint for a public contest in the future. Because if our work is done well, shows some results, [universities]can say to the Ministry of Education: "…We need a guy who stays here to do this, not just [with the scholarship] because it is for some years and then this guy goes away…". So, they can then influence the government, the ministry of education to open the position like this".* (INT 9)

Many agree that the university should develop a program preparing the specialist for evaluating technologies and working with technology transfer. However, the establishment of a new program is a long and complicated process. One possibility to deal with this is to train students that participate in projects:

"We are using students to evaluate technologies in the project. … And we are developing these abilities [abilities to evaluate technologies] on this study".(INT 6)

Besides, students are the main target group of entrepreneurship programs. Students participate with the project that can be later developed into businesses. However, SEDETEC does not collect regular data on what happens to the students afterwards and if the project results and skills help them in their future employment.

Many interviewees agree that generally students and researchers have become more active in Academic Entrepreneurship in the past 15 years. Some researchers have significant experience in cooperation with industry, thus, they are acquainted with the IP protection procedures and work with SEDETEC on a regular basis. However, many SEDETEC specialists feel that involving more scholars into Academic Entrepreneurship remains a challenge. One of the reasons is the focus on publishing and conference participation as a traditional way to present research results. Another task is to promote Academic Entrepreneurship opportunities among researchers that may not know that their invention can be commercialized. It appears that SEDETEC lacks visibility at university. Many interviewees think there should be a special effort to promote SEDETEC inside the university and inform departments, laboratories, and researchers about its mission.

6.5 Addressing challenges and facilitating Academic Entrepreneurship

Besides the lack Academic Entrepreneurship professionals and special training, specialists discuss other challenges facing SEDETEC.

Many agree that the main obstacle is connecting to the industry. The university needs a specific technology transfer structure which has just started to be built. There are worries being expressed that the university and companies may have different expectations: while researchers may need funding and industry support when the technology is still in the process of development, the companies expect a final product ready to launch. Another doubt is that there is not enough information from both sides: researchers may not be aware of the industrial needs while the companies may not know that they may search for the solutions in academia.

Most of the contracts with industry are done through the long-term relationship between the individuals. Many of these ties were established before SEDETEC was created and the Innovation Law came into power, through consulting or other forms of cooperation. The idea is to exploit this experience and to follow the path of the successful laboratories and units. However, establishing the connections with the companies is still very new for the employees.

One anticipated complication comes from the fact that the structure of many Brazilian companies is unclear. Just a few big enterprises like gas and oil giant Petrobras, have R&D departments. However, the interviewees mention cases of cooperation between businesses and university through the special events:

"Some companies that I know have a challenge, and they came here to talk about their challenges and try to find some researchers to help them to develop to try to create a solution to this problem". (INT 10)

The importance of the feedback from the industry has been voiced:

"The feedback from the industry can generate a new product or the improvement of the product. I think this feedback is very important". (INT 9)

Achieving long-term contracts with industry is cited as core objectives. Nevertheless, stable cooperation seems to be a thing of the future. At the same time, the interviewees say that they do not feel pressure from the university management or government to pursue collaboration or push researchers into commercialization. (INT 1, INT 3)

While discussing the particular problems of launching new Academic Entrepreneurship practices many respondents highlighted more general issues of the university autonomy. An example is in the case of hiring specialists where all the public university routines are regulated by law. The emerging practices should be executed only within the existing legislative framework. This created numerous constraints in the process of commercialization and internationalization of Academic Entrepreneurship. This is the example one of the interviewees uses to describe the situation:

"An Israeli university and two Brazilian universities have developed a project. Israeli partners then could sell the technology to the company in the US. In Brazil, however, it is not possible because in order to make an exclusive license agreement, public universities are

obliged to publish a request for tender. After this the companies can apply to participate in open competition. The whole process takes more than 90 days." (INT 1)

In this context, many SEDETEC specialists compare the Academic Entrepreneurship practices in a big state private university (Pontifícia Universidade Católica, PUCRS) and UFRGS. Because private universities have more autonomy, Academic Entrepreneurship there is characterized as less bureaucratic and better structured. Respondents also mention the cooperation between two offices, for example, joint events and training courses. Besides, there is a flow of specialists between the private and public university TTOs. However, because the UFRGS has a better reputation it is more trusted by the industry:

"They [PUCRS] have the [Science and Technology] Park, they have a cluster, [they are] less bureaucratic. But the minds are here at UFRGS, [the level of] the professors, the staff, is higher." (INT 3)

According to the interviews, the lack of autonomy also causes the management problems inside SEDETEC. Most appointments in higher administration of the university are political: university staff basically does not have control over selection of the rector or key administrative figures. Similarly, the head of the office is not elected by the employees but appointed by the university rector:

"Everything depends on who is in power. The rector [decides] who will be our manager here. Currently, we have the prospects for growing. There will be [rector] elections next year, and we do not know what will happen and who will come here". (INT 7)

Many interviewees feel that the current management approach is problematic. They think it is important that the head of the office has more experience in managing people, business profile and connections with industries. Some also emphasize that there is a specific culture of secrecy at SEDETEC that prevents effective communication between the colleagues:

"Communication between our employees is the main problem. Nobody knows what other sectors are doing". (INT 2)

The "secrecy mode" creates a lot of tension among the employees and fosters an atmosphere of injustice and misunderstanding. Of course, this influences the way interviewees talk about

their job and the office. Some of respondents talk positively about the SEDETEC team, while others think that it is rather disintegrated.

On the other hand, there is a general agreement between respondents that the SEDETEC work has been successful. Especially, the improvements of the last 6-7 years have been reported as particularly significant. The quantitative results include the number of patents, licensing agreements and the royalties' amount. Among the qualitative indicators, many distinguish greater visibility of SEDETEC inside and outside university, more contacts with industry and better communication with researchers.

Even though, the SEDETEC professionals have quite a few possibilities to influence the university policy, many have shared their vision on how Academic Entrepreneurship can be facilitated.

1) The visibility of SEDETEC inside the university can be improved. Many agree that the unit should increase awareness of Academic Entrepreneurship and make the results of the office's work more visible. It can be done through the university newspapers and special events:

"Perhaps we could have a little more disclosure of our work here. I think it lacks a bit. There are many people who still do not know, I think that could be done to improve an outreach work". (INT 6)

One respondent notices that SEDETEC is situated quite far away from the Vale campus, where many laboratories sit. This geographical distance can also influence negatively the communication between SEDETEC and researchers. While existing at a distant campus, it is important that SEDETEC increases contacts with laboratories and improves the university network.

2) Systematizing the results of entrepreneurial programs and making the successful cases public. The respondents mention the separate attempts to bring together the data but admit the importance of a tracking system to follow the students and entrepreneurship program participants in their future endeavors.
3) Accelerating the process, for example, through the digitalizing and creating a general information system, that would allow the employees to share the information about their projects.

4) Attracting more people with specific technical knowledge for working in the technology evaluation.

There are very different views on what may happen to the SEDETEC in the future. All the respondents agree that the job that is done by SEDETEC is important. While some believe that the unit will continue to grow, employ more people and develop their competences, others doubt that the unit will continue in the same way:

"*I think it will be kind of absorbed by other department or something. It will not be possible to continue as a separate office*". (INT 3)

Nevertheless, even if the TTO transforms or merges with other university units, its Academic Entrepreneurship mission will continue at university.

6.6 Concluding observations

Despite the emerging importance of entrepreneurial and innovation aspects, SEDETEC mainly works with IP protection. The changes that have occurred in the structure of SEDETEC and scope of projects it is involved in are still new to the employees. The responses like "it is new here", "we are just in the beginning" and "it has just started" were heard many times in the interviews. There is a clear gap between the presumed role and actual SEDETEC capacities.

However, the shift in strategies from patenting to licensing is visible. In spite of the bureaucratic problems that SEDETEC faces, the structure of the office is changing and more people with a technical background are appearing at SEDETEC. It is moving away from just being an "IP protection secretary" to a unit with the broader role.

Generally, a public university lacks autonomy. Most problems are caused by heavy bureaucracy and dependence on federal regulations. SEDETEC professionals agree that there is a little influence SEDETEC has over the institutional policy. A public university TTO in Brazil acts within strict legislation and most of practices are firmly defined by the law or the ministry. The problem of contracting specialist illustrates this point.

SEDETEC has grown out of its original role of an IP protection office and now it is turning into an Academic Entrepreneurship actor. However, SEDETEC does not have capacities for

fulfilling this broader mandate. Thoughtful legal and administrative changes in legislation would allow more freedom and could improve the situation.

7 CONCLUSIONS

7.1 Introduction

Academic Entrepreneurship in public universities in Brazil is in a transformation process. The phenomenon appeared later and developed slower than in most developed countries. The inquiry of the case shows that industry-university interactions were initiated by professors and academic in early 1990s. But due to absence of legal framework they underwent numerous challenges. As an example, commercial *exploitation of an invention without regular legal framework failed to guarantee investment returns for the university and inventors.*

Nevertheless, universities created special decrees and regulations that would assist the Academic Entrepreneurship. Our case shows that some documents regulating the collaboration of researchers with industry were already issued in early 1990s. Therefore, there was a need for an infrastructure to facilitate the process, and many Academic Entrepreneurship actors like incubators and TTO were created at that time (1993-2000).

The document analysis demonstrates that initially SEDETEC's functions were limited to the work with the technical and legal aspects of technology transfer. Gradually, the range of functions increased to, for example, creation of other Academic Entrepreneurship actors and participation in national and international networks. SEDETEC developed into a university Academic Entrepreneurship actor with the capacity to manage national and international programs and the development of the university entrepreneurship infrastructure.

Despite the university efforts in regulating Academic Entrepreneurship activities, decisions on the national level were needed. Such a regulation, known as the Innovation Law, appeared in 2004. This law provided Academic Entrepreneurship with legal status; obliged public universities to establish TTOs and decided the rules of technology transfer. In fact, it legalized many Academic Entrepreneurship practices that had been already common in many universities.

After the Innovation Law came into power, universities updated many of Academic Entrepreneurship regulations. A close look at these documents shows, however, that their content did not change dramatically. It again suggests that Academic Entrepreneurship

practices already in use proved to be sufficient, and the Innovation Law did not add novelties to the process but rather formalized the established system.

The strategic vision of the TTO role appears in the university Management Plan (2010). The document defines the place of Academic Entrepreneurship within the university landscape, and connects the TTO mission to research and community outreach policies. Thus, according to the documents, Academic Entrepreneurship contributes to interactions between university and society and institutional research development.

Moreover, the Management Plan states extended functions of TTO. In addition to IP protection and royalties' management, the office is authorized to promote the university innovation profile, cooperate with national and international networks, and facilitate education programs for entrepreneurial culture dissemination. The university policy documents imply the strategic role of the TTO.

The analysis of the TTO's reports (2000-2013) clearly illustrates the broad scope of TTO functions. The main project reflected in the reports is the formation of Science and Technology Park and the Incubators' network (REINTEC). In the period between 2000 and 2013, the office underwent some organizational changes, for example, absorbed other university Academic Entrepreneurship actors. More importantly, the reports show the early awareness of the strategic role of TTO in Academic Entrepreneurship. The notions of entrepreneurial culture dissemination and research, result exploitation through technology transfer already appear in the first reports. It again indicates that actual Academic Entrepreneurship practices in a public Brazilian university anticipate legal consideration and development.

7.2 Summary of Findings

This study explores how Academic Entrepreneurship functions in context of a public university TTO in Brazil. In order to understand this, four questions have been asked.

How do TTO professionals understand the mission of their agency and the mission of university with respect to Academic Entrepreneurship?

The opinions on the mission of the TTO within Academic Entrepreneurship can be organized in four groups:

1. **Connecting research and industry**. Many TTO professionals see this as a main mission of their unit. The TTO is seen as an "agent" that is able to understand both research and business realities and thus serves and a mediator between two fields.

2. **Legal protection and reputation**. The TTO is a legal expert with respect to technical transfer and other forms of Academic Entrepreneurship. It then can be trusted by both academics and their partners from industry. The transparency of legal procedures earns the university a good reputation.

3. **Creating social and economic benefit**. In a broader perspective, research results produced by universities should contribute into social development and fulfill the needs of the community.

4. **Disseminating new entrepreneurial culture** is becoming more important for two reasons. First, it is promoting entrepreneurial and innovative thinking that could push *students and researchers* into being more active in their fields. Secondly, the creation of possible alternative employment for graduates.

Two conceptual frameworks were employed to understand the TTO mission: TEN and the third-mission "radar". The views presented by TTO professionals agree with the TEN concept notion, where TTO is an intermediary between the scientific and market poles. At the same time they recognize the importance of the third mission of contribution to society and its development through education and dissemination of entrepreneurial culture.

How do they access entrepreneurial performance of their agency?

Overall, all TTO professionals agree that the performance of the unit has been successful.

The quantitative indicators, including some patents and licensing agreements, program participants, show significant improvement. Furthermore, everybody at TTO agrees that during the past 15 years the activity of students and researchers in Academic Entrepreneurship has risen and become more visible. The TTO specialists are establishing new practices, like *technology evaluation* with the perspective of further commercialization. They also aim to tackle students and researchers with *different disciplinary backgrounds* to

widen the range of participants in the entrepreneurship programs. The growing *internationalization* of Academic Entrepreneurship is also seen as a positive factor for the university development.

How are they connected with other actors involved in Academic Entrepreneurship?

The Academic Entrepreneurship structure in the case is rather confusing, first of all due to its history. There are three main actors at the university level: TTO, Incubators, Science and Technology Park.

TTO acts as a managing and connecting force in this structure. First of all, **procedurally**, because all the legal documents have to go through the TTO. Secondly, **organizationally**, because TTO has been involved in the process of the Science and Technology Park creation and manages some projects for incubators. According to the TTO professionals, the role of the office is in **initiating cooperation between researchers and industry** that can be later passed to either the Science and Technology Park or one of the incubators.

The traditional and emerging perspectives on Academic Entrepreneurship help to explain the transformation in the university structure, like formation of new units, and the overall shift from licensing and IP protection to other entrepreneurial strategies.

What are the main difficulties they deal with?

With respect to the organization, the lack of university autonomy is seen as the main obstacle by most of TTO experts. A public university is strictly bound to federal laws. This leads to constraints the TTO faces in **hiring staff**. The office only can contract people according to the positions approved by the ministry. That makes it difficult, for example, to employ a specialist with the technical background for technology evaluation, because such a position at TTO is not provided by the ministry. That is why hiring certain specialists is only possible through the scholarships.

The lack of autonomy also leads to management problems. The TTO employees cannot influence the choice of their chief. Such decisions are made on the university top management level and lead to tensions inside the office.

Regarding TTO functions, the emerging tasks, like contacts with industry, are recognized as the most challenging part. The TTO does not have enough experience in this field. Besides,

the structure of many Brazilian companies is unclear, so finding the channels in business realm for presenting the university technologies is a critical issue.

7.3 Policy Implications

National Level

The findings of the study suggest that TTOs at Brazilian universities need specialists with knowledge of both technologies and commercialization strategies. Therefore, the Ministry of Education should authorize new **courses and programs** preparing students and researchers for this task.

Moreover, these specialists should be later employed at universities on a regular basis. Hence, the Ministry of Education should officially introduce the position of a **technology transfer agent** that would allow candidates with eligible qualification to participate in the public contests.

University Level

On the institutional level, the university needs a **strategy** for TTO development. First, it needs special efforts to improve its visibility inside and outside university. While promoting entrepreneurship activities, the TTO should address students and laboratories, most of which seem to know very little about this university unit. Besides, the TTO can learn from the experience of the successful labs and adopt their strategies in contacting industry.

Furthermore, the experience of students participating in the entrepreneurial programs should be promoted at the faculties. SEDETEC can organize a database of the programs graduates, track their further careers, and use the successful cases to inspire other students.

TTO Level

It is also very important to increase the coordination inside TTO. The study demonstrates that the TTO needs **better management** strategies with the focus on a productive climate inside the unit.

Finally, expanding **internationalization** for students, academic entrepreneurs, and TTO employees can be beneficial. For example, it will help to bring the best practices from abroad

and implement them into the TTO work. Additionally, internationalization will allow exploring new markets for the Brazilian companies and generate income.

7.4 Further Research

Because this case study focuses only on one TTO at a Brazilian public university, it would be interesting to compare the Academic Entrepreneurship experiences of other public universities in other states. In our case, some changes at university Academic Entrepreneurship structure have been inspired by another Brazilian institution. It suggests that some successful practices may officially or non-officially influence the university policies.

Furthermore, interviewing other Academic Entrepreneurship actors within and outside the university will lead to a better understanding of university policies and practices. Our case shows, for example, that some university units, like laboratories, had a background in collaboration with industry before the TTO creation. It could be valuable to understand how their work and practices changed with legal and structural developments.

Also, the perspective of private universities can better explain the legal constraints of the public sector. The private Brazilian universities are flexible in Academic Entrepreneurship procedures, for instance in respect of hiring specialists. That is why their experience could give a clear picture of what might happen if some legal regulations for the public sector change.

Finally, the focus on internationalization of Academic Entrepreneurship in Brazil and Latin America can contribute to understanding the role of the international actors. The international network Redemprendia proves to be an interesting experience in promoting Academic Entrepreneurship. The cooperation between national and international Academic Entrepreneurship actors can give a greater picture of universities policy in this field.

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Appendices

Appendix A

Recruitment Letter in English

Dear<Name>

My name is Ksenia Nazaryeva, I am a masters student at the university of Oslo, Norway. At the moment I am in <City> collecting data for my thesis on the role of technology transfer office in academic entrepreneurship at <University>. Through interviews and document analysis, I am aiming to understand how TTO works and how professionals understand the mission of their agency.

I would be very grateful if I could interview you for my project. If possible, I would like to meet you at <Place>, and schedule our interview preferably between 3rd and 23rd of August, 2015, at the times that is convenient for you. With your permission, I would like to audio-record the interviews and produce written transcripts. The interview will take 45- 60 minutes.

I will use English language at the meetings. For your convenience, I am enclosing the interview guidelines. I am planning to conduct semi-structured interviews. That is why the guidelines contain major questions I would like to discuss. However, during the conversation I may ask some follow-up questions, if needed.

I will use the results of the interviews for research purposes only. If you have any questions about my Master thesis project, please feel free to call me at <phone number> or send me an e-mail.

I greatly appreciate your help.

Thank you for your time and consideration,

Kind regards,

Ksenia Nazaryeva

Appendix B

Recruitment Letter in Portuguese

Prezado <Nome>

Meu nome é Ksenia Nazaryeva, sou mestranda do programa de Ensino Superior na Universidade de Oslo, Noruega.

No momento resido em <Cidade>e estou coletando dados para a minha dissertação que será sobre o papel de escritórios de transferência de tecnologias no empreendedorismo acadêmico, focando, como estudo de caso, na <Universidade>.

Provavelmente você tenha recebido informações sobre mim e meu projeto no e-mail que a <Nome> gentilmente encaminhou no dia 11 de Agosto.

Eu gostaria de saber se você tem tempo e disponibilidade para se encontrar comigo para uma entrevista. Caso afirmativo, você poderia me sugerir uma data e horário, que melhor lhe convier, tentativamente entre os dias 25 de Agosto e 15 de Setembro?
Gostaria de encontrá-lo no <Lugar>, se possível. A entrevista levará cerca de 45 minutos.

Se possível, gostaria que a entrevista fosse em língua Inglesa. Entretanto, se você preferir usar o Português, posso pedir para um amigo me acompanhar e ajudar com a tradução, já que eu não falo fluentemente o Português.
Para sua conveniência, eu poderia enviar-lhe com antecedência as questões que eu gostaria de abordar.

Para sua tranquilidade, os resultados das entrevistas serão totalmente anônimos e tratados confidencialmente. Os resultados serão utilizados apenas para fins de pesquisa cientifica.
Terei o maior prazer de enviar-lhe uma copia do resultado final do trabalho assim que estiver concluído.

Se você tiver dúvidas ou curiosidades sobre o meu projeto de mestrado, não hesite em enviar-me um e-mail. Alternativamente, você pode contactar-me no <telefone>.

Desde já, muito obrigado pela atenção. Sua ajuda será muito apreciada.

Fico no aguardo da sua resposta.

Cordialmente,
Ksenia Nazaryeva

Appendix C

Interview Guidelines

English	**Portuguese**
Q1. Can you describe your function and your role in the work of university TTO? How long have you been working for SEDETEC?	***Q1.*** Você pode descrever qual é a sua função e seu papel no Núcleo de Inovação Tecnológica (NIT) da Universidade? A quanto tempo você trabalha na SEDETEC?
Q2. What is the role of TTO at university in your opinion? What are its goals? Why is it important for the university to have TTO?	***Q2.*** Na sua opinião, qual é o papel do Núcleo de Inovação Tecnológica na Universidade? Quais são os objetivos? Por que é importante para a universidade ter o Núcleo de Inovação Tecnológica?
Q3. Which other units at university are involved in the work SEDETEC does? How are the relationships with such units organized? How do they work? How different is the work that SEDETEC does from Incubators and Science and Technology Park?	***Q3.*** Que outras unidades da universidade estão envolvidas no trabalho que a SEDETEC faz? Como são organizadas as relações com tais unidades? Como estas unidades funcionam? Quão diferente é o trabalho que a SEDETEC faz se comparado as Incubadoras e o Parque Cientifico e Tecnológico da UFRGS?
Q4. How would you assess the work of TTO? Can you characterize the work of TTO as successful, why or why not?	***Q4.*** Como você avalia o trabalho do Núcleo de Inovação Tecnológica? Você caracterizaria o trabalho do Núcleo de Inovação Tecnológica como bem sucedido? Por que ou por que não?
Q.5. What are the main challenges TTO faces? What are the main challenges in your work?	***Q.5.*** Quais são os principais desafios que o Núcleo de Inovação Tecnológica enfrenta? Quais são os principais desafios no seu trabalho pessoal?
Q.6 Do you have any questions? Would you like to add anything?	***Q.6*** Você tem alguma pergunta? Gostaria de acrescentar alguma coisa?

Appendix D

List of Documents Analyzed

Name in Portuguese	Name in English	Year	Level
Lei Nº 10.973 Lei de Inovação	Law No. 10.973 Innovation Law	2004	National Level
Lei Nº 13.196 Lei de Inovação do Estado do Rio Grande do Sul	Law No. 13.196 Innovation Law of the Rio Grande do Sul State	2009	Regional Level
Portaria Nº 5518 Convênios, acordos, ajustes e outros instrumentos legais firmados por instituições publicas e privados com a universidade	Decree 5518 Agreements, Contracts between universities and third parties	1994	Institutional Level
Portaria *Nº* 3064 Modelo de gestão de ciência e tecnologia, que viabilize a transferência de conhecimento técnico-científico para a sociedade	Decree 3064 Model of science and technology management	1998	Institutional Level
Portaria Nº 2108 Escritório de Transferência de Tecnologia	Decree 2108 On Technology Transfer Office	2000	Institutional Level

Plano de Desenvolvimento Institucional (2011-2015) PDI	Institutional Development Plan (2011-2015)	2010	Institutional Level
Plano de Gestão 2012-2016 Anexo à Decisão nº 237/2013	Management Plan (2012-2016) Annex to Decision No 237/2013	2013	Institutional Level
Decisão Nº 193 Interação Acadêmica	Decision 193 Academic Interaction	2011	Institutional Level
Portaria Nº 2679 As Interações Acadêmicas	Decree 02678 System for Academic Interaction	2011	Institutional Level
Decisão Nº 266 Política de Extensão	Decision 266 Outreach Policy	2012	Institutional Level
Portaria Nº 6869 Regras para a transferência de tecnologia e registro da propriedade intelectual	Decree 6869 Rules on technology Transfer	2013	Institutional Level
Relatórios de Gestão	Management reports	2000-2014	Department level

Appendix E

Sample of *NVIVO Interview Coding*

Classification	Aggregate	Coverage	Number Of Coding References	Reference Number	Coded By Initials	Modified On
Nodes\\entrepreneurship						
	No	0,0668	7			
				1	KN	21.10.2015 12:53

Because entrepreneurship is not only open a business. Being a entrepreneurs inside the company, outside in your life like this, and the ... we organize some activities like courses, workshops, lectures to help and to stimulate people to open their business and more than this ... to think in an entrepreneurial way, like this.

2	KN	21.10.2015 13:01	

innovation entrepreneurship. Because we know that there are a lot of different kinds of entrepreneurship and here at [redacted] we have some partners that work with these traditional business companies.

3	KN	21.10.2015 13:03

Innovation it is work in the relationship with entrepreneurship. For us it is impossible to work with entrepreneurship without working with innovation. Because it is a new way to look and to put into practice something that worked before in a traditional or another way. And now they try to optimize or improve some functions or some characteristics about this program or this service. Okay, you can create a new program or new service, this is okay, this is a radical innovation. But you can work with incremental innovation, like working with segment. You need thinking about your segment: what they need really. What are the challenges of our society? How can we ... help our society to look for the future? We need to try to help our society to be better in the future. ... or to be better now.

4	KN	21.10.2015 13:05

And when you pass in this step death valley you need to try scale up and the Science and Technology Park, the incubators they can help these entrepreneurs to scale and to survive in our society. Because we know that the first years of the business are the worst to try to survive in our society.

5	KN	21.10.2015 13:07

Incubators nowadays they start the process only working with pre-incubation and working with entrepreneurs.

6	KN	21.10.2015 13:07

they prefer to work with entrepreneurs that want ... okay you can have you need to have an idea but you do not know if this idea is good or not but if you are ... a good entrepreneur you can transform a good idea in an excellent opportunity in the market.