UNIVERSIDADE ESTADUAL DE MARINGÁ

JULIANA MARANGONI AMARANTE

INSTITUTIONAL PRESSURES, INSTITUTIONAL WORK AND THE TRIPLE HELIX OF INNOVATION:
A Case Study on the Development of Stanford University's Entrepreneurial Turn

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Tese de doutorado apresentada como requisito parcial para a obtenção do título de Doutora em Administração pelo Programa de Pós-graduação em Administração da Universidade Estadual de Maringá.

Orientador: Prof. Dr. João Marcelo Crubellate.

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Tese apresentada como requisito parcial para obtenção do grau de doutor em Administração, do Programa de Pós-Graduação em Administração, da Universidade Estadual de Maringá, sob apreciação da seguinte banca examinadora:

Aprovada em 20 de março de 2018

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(presidente)

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(membro examinador PPA)

MARINGÁ
2018

Para minha pequena grande família:
minha mãe, Cristina e meu esposo, Calíli,
todo o meu amor.

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The realm of human agency is bounded. Human beings produce society, but they do so as historically located actors, and not under conditions of their own choosing….Structure must not be conceptualized as simply placing constraints upon human agency, but as enabling. This is what I call the duality of structure. Structure can always in principle be examined in terms of its structuration. To enquire into the structuration of social practices is to seek to explain how it comes about that structure is constituted through action, and, reciprocally how action is constituted structurally.
(GIDDENS, 2013, 168-169)

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RESUMO

Nas sociedades baseadas no conhecimento, a inovação e, conseqüentemente, o desenvolvimento econômico emergem de relações da tripla hélice, isto é, da interação entre universidade, indústria e estado, que juntos criam condições para a produção, transferência e aplicação do conhecimento. Portanto, algumas universidades adotaram uma direcionamento empreendedor que inclui não apenas as práticas empreendedoras em si, mas também os processos internos que de fato levam a essas práticas. Com base na literatura pertinente sobre a Tripla Hélice da Inovação, Empreendedorismo Acadêmico e Teoria Institucional, em especial, Pressões Institucionais e Trabalho Institucional, sugiro, nesta tese, a seguinte proposição teórica: o direcionamento empreendedor de universidades é contingente ao trabalho institucional e pode ser compreendido como o resultado de uma confluência de forças que atuam de fora para dentro e de dentro para fora, e que são formadas por meio de uma interação histórica e recursiva entre pressões regulativas, normativas e culturais-cognitivas, derivadas de cada ator da tripla hélice, isto é, o estado, a indústria - ou a sociedade em um sentido mais amplo - e a universidade. Minhas principais contribuições teóricas consistem em: a) Posicionamento do direcionamento empreendedor de universidades no epicentro de todas as pressões e lógicas institucionais concorrentes no que se refere à criação de inovação; b) Caracterização do direcionamento empreendedor de universidades como um resultado da interação recursiva entre pressões regulativas, normativas e culturais-cognitivas, derivadas de cada ator da tripla hélice; e c) Ênfase no papel fundamental do trabalho institucional realizado por empreendedores institucionais no processo de desenvolvimento do direcionamento empreendedor de universidades. Visando uma verificação empírica de minha tese, foi escolhido compreender o desenvolvimento do direcionamento empreendedor da Universidade de Stanford. Para atingir esse objetivo, realizei um estudo de caso baseado principalmente em dados secundários, devido à característica histórica do fenômeno, e dados primários apenas complementares, como entrevistas conduzidas com membros do Office Of Technology Licensing em Stanford - OTL. A análise dos dados mostrou evidências da centralidade do direcionamento empreendedor de Stanford no desenvolvimento da região inovadora do Vale do Silício. Revelou também aspectos da interação recursiva entre a universidade e seu ambiente institucional que ajudou a moldar não apenas seu direcionamento empreendedor, mas também o contexto institucional como um todo; e finalmente, tornou-se evidente o papel central do Trabalho Institucional realizado pelos Empreendedores Institucionais, especialmente Frederick (Fred) Terman, no desenvolvimento do direcionamento empreendedor de Stanford e, portanto, no desenvolvimento da região inovadora do Vale do Silício.

PALAVRAS-CHAVE: Teoria Institucional. Tripla Hélice da Inovação. Universidades Empreendedoras. Empreendedores Institucionais. Universidade de Stanford. Vale do Silício.

AMARANTE, J. M. Institutional Pressures, Institutional Work And The Triple Helix Of Innovation: A Case Study On The Development Of Stanford University's Entrepreneurial Turn

ABSTRACT

In knowledge-based societies innovation and, consequently, economic development arise from triple helix relations, that is, from the interaction between university, industry and state, that together create conditions for the production, transfer and application of knowledge. Therefore some universities have taken an entrepreneurial turn which includes not only the entrepreneurial practices themselves, but also the internal processes that actually lead to these practices. Based on pertinent literature on the Triple Helix of Innovation, Academic Entrepreneurship and Institutional Theory, in special, on Institutional Pressures and Institutional Work, in this thesis I suggest the following theoretical proposition: universities' entrepreneurial turn is contingent on institutional work and may be understood as a result of a confluence of inward and outward forces that are shaped through a historical and recursive interplay between regulative, normative and cultural-cognitive pressures, derived from each actor of the triple helix, that is, the state, the industry - or society in a broader sense - and the university. My main theoretical contributions consists on: a) placing the universities' entrepreneurial turn at the epicenter of all the competing institutional pressures and logics when it comes to innovation creation; b) characterizing the universities' entrepreneurial turn as a result of the recursive interplay between regulative, normative and cultural-cognitive pressures, derived from each actor of the triple helix; and c) stressing the fundamental role of the institutional work performed by institutional entrepreneurs in the process of developing the universities' entrepreneurial turn. Aiming at an empirical verification of my thesis, I choose to comprehend the development of Stanford University's Entrepreneurial Turn. In order to achieve this goal I conducted a case study based mainly on secondary data, due to the historical characteristic of the phenomenon, and just complementary primary data, such as interviews conducted with members of the Office Of Technology Licensing at Stanford - OTL. The analysis of the data showed evidence of the centrality of Stanford's Entrepreneurial Turn in the development of the innovative region of Silicon Valley. It also revealed aspects of the recursive interplay between the university and its institutional environment that helped to shape not only its Entrepreneurial Turn, but also the institutional context as a whole; and finally, it became evident the central role of the Institutional Work performed by the Institutional Entrepreneurs, especially Frederick (Fred) Terman, in the development of Stanford's Entrepreneurial Turn and, therefore, in the development of the innovative region of Silicon Valley.

KEYWORDS: Institutional Theory. Triple Helix of Innovation. Entrepreneurial Universities. Institutional Entrepreneurs. Stanford University. Silicon Valley.

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1. INTRODUCTION

Universities serve a multitude of purposes guided by different interests from different actors (Pache & Santos, 2010), as they possess a key role in the development of society, not only in its cultural context, but also socially and economically (United Nations Educational, Scientific and Cultural Organization [UNESCO], 1998) creating, transmitting and disseminating knowledge. “Far from being ivory towers, today universities have come to be regarded as important engines of economic growth and social change” (Vorley, 2015, xxiv).

The ways through universities relate and contribute to the environment in which they operate can be summarized in three main missions that comprise diverse activities. The first mission is teaching and it serves both the individuals, providing a learning experience that will influence their lives as a whole, and organizations, providing prepared workforce.

The second mission is researching, which is connected in the short run to the impetus for discovery, and in the long run the basis for teaching. According to Brew (2009) researches can serve a multitude of interests, most of the times conflicting, arising from the government, the industry, the media and the academics themselves.

The third mission embraces a wide range of activities that represent universities’ commitment to engage in attending society’s needs in more direct ways such as: extension courses; services to benefit the local community, and informal or formal relationships with industry. “[…] concerned with the generation, use, application and exploitation of knowledge and other university capabilities outside academic environments. In other words, the Third Stream is about the interactions between universities and the rest of society.” (Mollas-Gallart, Salter, Patel, Scott, & Duran, 2002, pp. iii-iv)

In knowledge-based societies, innovation arises from triple helix relations, that is, from the interaction between universities, industries and the government (Etzkowitz, 2008). Given the great impact of innovation, as a non-material resource, on regional competitiveness and consequently on its economic development (Capello, Olechnicka & Gorzelak 2013), the role of universities in this context is overt.

It is important to highlight that as long as universities are not expected to literally produce goods as a factory, some of the discoveries that emerge from academic research demand third parties involvement to achieve their full potential and benefit the general public, and that is when the universities' third mission acquires an entrepreneurial characteristic.

According to Schoen *et al* (2006) the third mission encompasses knowledge transfer from the universities to the industry; the capitalization of knowledge by its ownership and commercial use; the creation of contracts both with industry and public spheres; and the academics active participation in policy making, both directly or indirectly through advisory boards, for example.

But being entrepreneurial not only has to do with commercializing inventions, it also demands a whole supportive structure to allow it to happen properly. Therefore, some universities have taken an 'entrepreneurial turn' that, according to Goldstein (2010), includes:

> 1) the active involvement of universities—as institutions—in the development and commercialization of technology stemming from university-based research; and; 2) changing the internal regulations, rewards and incentives, norms of behavior, and governance of universities to remove barriers to individual faculty, other researchers, and research centers/institutes engaging in behavior that leads to the commercialization of university-generated knowledge. (pp. 84)

Connected with the concept of the universities' entrepreneurial turn is the concept of what Vorley and Nelles (2008) refer as the 'entrepreneurial architecture', which can be understood as internal factors that, in aggregate, shape universities' entrepreneurial agendas. This architecture involves *structures*, such as technology transfer offices, incubators and technology parks; *systems* that allows connections between the administration and the structure; *leadership* of key people within universities that influence other's behavior, such as the 'star scientists', or department heads; *strategies* refer to the institutional goals and policies related to the universities' third mission, and; *culture* that refers to the norms and attitudes towards entrepreneurship both institutionally, departmentally and individually.

However, universities just do not come out of nothing to take this turn into a more entrepreneurial direction. This turn is taken as a result of a complex set of pressures, that can be synthesized as regulative, normative and cultural-cognitive (Scott, 2014), derived from each one of the elements of the helix, that is, the state, the industry (society, in a broader sense), and the university itself. And the most important point is that this is not a one-way process, but instead, a two-way kind. In other words, as the universities take a more entrepreneurial turn, their behavior influences the institutional environment back, creating new pressures, new conditions and standards, allowing that continuous cycle to happen, since "a field constructs a social universe in which all participants are at once producers and consumers, caught in a complex web of social, political and cultural relations that they themselves have woven and continue to weave" (Ferguson, 1998, pp. 598).

Thus, given the contextual nature of universities' third stream activities, institutional theory is regarded to be a particularly appropriate approach to understand the historical dynamics that shape the institutional environment in which the universities' entrepreneurial

turn is embedded. As pointed out by Lawrence, Leca and Zilber (2013, p. 1.024) “For more than three decades, the role of institutions in shaping organizational life has been a central concern in organization studies”. This is easily understandable, because as stated by Hoffman (1997),

> the institutional environment, in large part, defines the range of organizational reality. In setting strategy and structure, firms may choose action from a repertoire of possible options. But the range of that repertoire is bound by the rules, norms and beliefs of the organizational field. (pp. 148)

In fact, Institutional theory has proved that its explanatory capacity within organizational studies is far from being exhausted, as stated by Scott in a recent interview (Scott, 2016). This theoretical framework continues to call attention from researchers all over the world, including in Brazil, where it can be seen many institutional theory publications in recent years, as for example, Rossoni, Guarido Filho and Coraiola (2013); Popadiuk, Rivera, and Bataglia (2014); Rossoni (2016); de Mello (2017) and Machado, Sartori and Crubellate (2017).

Complying with the institutional environment provides legitimation in a particular field, as stated by Suchman (1995) “Legitimacy is a generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs and definitions.” (pp. 574)

However, according to Scott (2014), being legitimate means different things if we take into consideration the regulative, normative or cultural-cognitive elements of institutions. The basis of legitimacy differs among them, because each one lays greater stress on some specific

aspects or spheres of social life. For example, being legitimate according to the regulative pressures within a specific environment is something achievable by following the rules under which an organization is subject.

Differently, achieving legitimation according to the normative systems implies following the expected goals and the expected ways to pursue them. The fundamental question that actors make to themselves if they want to be legitimate according to the normative pillar is : “Given this situation, and my role within it, what is the appropriate behavior for me to carry out?” (Scott, 2014, pp. 65).

And finally, being legitimate in accordance to the cultural-cognitive pillar means to have shared understandings culturally supported, that provides shared logics of action (Scott, 2014).

Yet, we need to be aware of field permeability, that is, fields are not closed, but rather open systems. This permeability allows alien logics to gain legitimacy in a particular field e.g.: the rise of commercial logics within scientific research at universities (Colyvas & Powell, 2007).

Institutional logics guide the action of actors embedded in specific contexts, indicating what goals should be pursued and how it should be done (Thornton & Ocasio, 1999; Owen-Smith & Powell, 2008). Complex organizations, such as universities, are subject to many conflicting demands simultaneously (Pache & Santos, 2010), and so, they have to learn how to deal with the logic multiplicity in order to keep their functioning. Maybe universities are one of the best examples of this type of institutional complexity, because they depend on many contradictory logics that are, at the same time, central to their operation (Besharov & Smith, 2014).

According to Kodeih and Greenwood (2014, p. 32) “Institutional complexity…can be experienced as providing opportunities for accomplishing an aspired identity”. Their argument is that while responding to institutional complexity, what influences organizational behavior the most is what they would like to be rather than what they actually are.

This allows the so called “institutional work” or “institutional entrepreneurship”, that is, the transposition of institutional logics between different contexts by the actors (Boxenbaum & Battilana, 2005). Thus, one can think of the actors, including organizations, as both products and producers of institutional logics (Bjerregaard & Jonasson, 2014).

In this sense, the role of institutional work performed by institutional entrepreneurs emerges. Although when we talk about institutional pressures and organizational responses we often rely on macro analysis, institutional work is conducted by individuals and so, it is fundamental to conduct researches that focus on “how institutions operate through the influence and agency of individuals” (Suddaby, 2010, p. 17). Logically, an institutional change, as for example the universities’ entrepreneurial turn, would not result from only one institutional entrepreneur, nor an individual neither a single organization/university, but rather, from collective institutional work performed by several actors who contribute individually with their own skills (Greenwood & Suddaby, 2006). Therefore, it is useful to look at the individual actions to understand collective achieved institutional changes

As a consequence, “A field constructs a social universe in which all participants are at once producers and consumers, caught in a complex web of social, political and cultural relations that they themselves have woven and continue to weave.” (Ferguson, 1998, pp. 598). Therefore, in order to understand why some universities behave the way they do, while others behave differently when it comes to acting entrepreneurially, we need to look at the recursive interplay between universities and their institutional environments (Gibson & Foss, 2017)

because this historical dynamics is what shapes both collective and individual pressures and responses, in accordance to what Padgett and Powell (2012) and also Scott (2014) point out: “In the short run, actors create relations; in the long run, relations create actors.” (Padgett & Powell, 2012, pp. 2) and “In the short run, actors create and modify meanings; in the long run, meanings create actors, both organizational and individual identities.” (Scott, 2014, pp. 223)

Although one may argue that Resource Dependence Theory (Pfeffer & Salancik, 2003) could also offer sufficient support for this study, I consider that its perspective on the the relation between organizations and their contexts, is much more centered on the contextual constraints the organizations face, imposed by those players that have power over them.

Our perspective of analysis, otherwise, focus on the historical dynamics of the recursive interplay between institutional pressures and institutional work. In other words, following what has been presented, Institutional Theory is specially adequate to address the phenomena involved in the development of universities’s entrepreneurial turn, because it allows the focus on the process rather than on the results.

With this study I aim to contribute to the advancement of two research fields: the institutional theory field and the triple helix of innovation field, through the connection of both, providing insights on how the universities’ entrepreneurial turn evolves as a result of institutional processes and most importantly, emphasizing the institutional work performed by institutional entrepreneurs in this process.

We decided to have Stanford University, located in the Silicon Valley, California, United States as the empirical context for this research, due to the fact that it is considered one of the best universities in the world and, specifically, it is considered the most entrepreneurial university in the country.

The next sub items present the research's general and specific goals, as well as the practical and theoretical justifications and overall propositions. After that is the theoretical framework of the research, followed by the methodological procedures, data presentation and analysis, conclusion and the references.

1.1. GENERAL AND SPECIFIC RESEARCH GOALS

Having as a theoretical background the institutional perspective, emphasizing the institutional work, along with the researches on the triple helix systems of innovation, and taking Stanford as the empirical context, my general research goal is **to comprehend the development of Stanford's entrepreneurial turn by means of the historical dynamics of the recursive interplay between institutional pressures and institutional work.**

In order to achieve this goal, I propose:

1. Identifying regulative, normative and cultural-cognitive pressures related to the university's entrepreneurial turn, that were fundamental to shape the institutional environment in which the university is embedded.
2. Identifying the university's responses to these institutional pressures, emphasizing the institutional work performed by institutional entrepreneurs.
3. Comprehending the relation between the institutional pressures and the university's responses in shaping the development of this university's entrepreneurial turn.

1.2. PRACTICAL AND THEORETICAL JUSTIFICATIONS AND PROPOSITIONS

1.2.1. Practical justifications and overall proposition

The importance of large and renowned universities for the development of the locations where they operate is overt and subject of study by many researchers, especially due to the economic impact they have on these areas. In regions that have the characteristic of innovation, the so called "entrepreneurial university" has an even greater impact (Etzkowitz & Klofsten, 2005).

The choice to take Stanford University as the empirical context for this research rests on its strong and close relation with the Silicon Valley development (Adams, 2005), mainly due to its high quality and its entrepreneurial nature.

Regarding to the quality issue, according to Garcia *et al.* (2014), this is what encourages the university-industry interactions the most, because "The research groups that have better academic performance are better able to meet the demands of businesses, especially when their R & D efforts are closer to the frontier of knowledge" (p. 143, author's translation).

In addition to that, Etzkowitz (2008) highlights that entrepreneurial universities have as a core mission the capitalization of knowledge "[…] linking universities to users of knowledge more tightly and establishing the university as an economic actor in its own right" (p. 27). The entrepreneurial university, according to Etzkowitz (2008) have four special characteristics that distinguish it from others:

> Academic leadership able to formulate and implement a strategic vision; legal control over academic resources, including physical property such as university buildings and intellectual property emanating from research; organizational capacity to transfer technology through patenting, licensing, and incubation; and an entrepreneurial ethos among administrators, faculty, and students (p.27).

But being an entrepreneurial university differs significantly if we take into consideration the set of institutional elements that, indeed, is what shapes the universities' entrepreneurial turn. This way, my overall practical proposition is: **trying to replicate an entrepreneurial university model may prove to be useless, because different institutional environments are determinant in shaping what the role of universities must be, how the universities should pursue its goals, under what regulative systems they operate and how the actors, mainly institutional entrepreneurs, perceive all the stimuli.**

1.2.2. Theoretical justifications and overall proposition

In this research I aim to contribute to the advancement of two research fields: the institutional theory field (Scott, 2014) and the triple helix systems of innovation field (Etzkowitz, 2008), by connecting both while explaining the historical contextual dynamics that led to this university's entrepreneurial turn.

I start presenting my overall theoretical proposition: **universities' entrepreneurial turn is contingent on institutional work and may be understood as a result of a confluence of inward and outward forces that are shaped through a historical and recursive interplay between regulative, normative and cultural-cognitive pressures,**

derived from each actor of the triple helix, that is, the state, the industry - or society in a broader sense - and the university.

"Institutions comprise regulative, normative and cultural-cognitive elements that, together with associated activities and resources, provides stability and meaning to social life." (Scott, 2014, pp. 56) Starting with this broad definition of institutions, we can think of the uncountable processes through which each individual, and consequently each organization, is affected by them in such a deep level that they not only make possible the understanding of social reality but also make possible the continuous construction of this reality.

The regulative pressures tells the actors what the regulations they are subject to are. The normative pressures tells them what the goals are and how they should pursue them. And, finally, the cultural-cognitive pressures defines how actors perceive all the stimuli, which is a very fundamental issue. Having all these institutional pressures affecting their daily choices, behaviors and actions, actors contribute to the perpetuation of institutions. Paradoxically, this is exactly what allows institutional change, because actors are simultaneously embedded in multiple fields and so, subject to many institutional pressures and end up transposing logics of action from one different institutional context to another (Boxenbaum & Battilana, 2005). Thus, the social actors, individual and organizations, are both products and producers of institutional logics (Bjerregaard & Jonasson, 2014), once their responses to institutional pressures keep feeding the institutional environment in a complex recursive relational dynamic over time.

Moving on to the other theoretical field that forms the basis of the present study, innovation has become a key topic in organizational studies in recent times (Schmidt, Balestrin, Engelman, & Bohnenberger, 2016; Agune & Carlos, 2017; Plonski, 2017; Arbix &

Miranda, 2017). According to Etzkowitz (2008), in knowledge-based societies, innovation arises from triple helix relations, that is, from the interaction between universities, industries and the government.

> The Triple Helix thesis is that the potential for innovation and economic development in a Knowledge Society lies in a more prominent role for the university and in the hybridization of elements from university, industry and government to generate new institutional and social formats for the production, transfer and application of knowledge (Ranga & Etzkowitz, 2013, pp. 238).

Having the university a more prominent role in the knowledge society given its research potential, we can state that central to the creation of innovation is the universities' entrepreneurial turn. However, as we have just discussed about the institutional forces, universities just do not come out of nothing to take this turn into a more entrepreneurial direction. This turn is taken as a result of a complex set of pressures, that can be synthesized as regulative, normative and cultural-cognitive, derived from each one of the elements of the helix, that is, the state, the industry (society, in a broader sense), and the university itself. As the universities take a more entrepreneurial turn, this behavior also influences the institutional environment back, allowing that continuous cycle to happen.

According to Lawrence and Suddaby (2006), looking at institutional work helps analyzing the interactive elements and moments of institutions production, and thus, it can be identified different forms of institutional work related to each goal, that is, creating, maintaining and disrupting institutions. Regarding the creation of institutions, in summary, the efforts are dedicated to mobilize political and regulatory support; construct rule systems and

structures; construct identities; change associations between practices and moral and cultural foundations; facilitate the adoption of practices by associating them with taken-for-granted practices; and educating actors according to the new institution in order to support it. When it comes to maintaining institutions the institutional work involved is dedicated to ensure adherence to rule systems, and at the same time, guaranteeing the reproduction of existing norms and belief systems. Finally, the forms of work applied for the disruption of institutions, has to do with "attacking or undermining the mechanisms that lead members to comply with institutions" (Lawrence & Suddaby, 2006, p. 235).

Returning to the concept of the triple helix, Ranga and Etzkowitz (2013) also acknowledge the relevant role of individual innovators in the processes involved in generating innovation through the triple helix. They describe the work of entrepreneurial scientists and the innovation organizers. The former balance academic and business interests exploring both theoretical and practical opportunities of knowledge. And the latter is a person

> who typically occupies a key institutional position, enunciates a vision for knowledge-based development and has sufficient respect and authority to exercise convening power to bring the leadership of the institutional spheres together….Innovation organizers can come from any institutional sphere. They coordinate a mix of top-down and bottom-up processes and innovation stakeholders from different organizational backgrounds and perspectives, who come together to build a platform for new ideas, promote economic and social development and ensure agreement and support for their realization. A process of 'cross-institutional entrepreneurship' spanning the Triple Helix spheres is thus initiated for improving the conditions for knowledge-based development (Ranga & Etzkowitz, 2013, pp. 242-243).

Therefore, the role of institutional work performed by institutional entrepreneurs becomes evident not only when it comes to the development of universities' entrepreneurial turn, but also to the development of triple helix relations as a whole.

Based on what has been shown, the development of universities' entrepreneurial turn

can be fruitfully explained through a perspective that combines Institutional Pressures and Institutional Work, having as a background the Triple Helix of Innovation.

Our theoretical overall proposition is derived, although different, from Etzkowitz (2008) balanced triple helix model (see Figure 6, item "d" presented ahead), where the intersection of the three spheres make possible trilateral networks and hybrid organizations to exist.

However, when it comes to innovation creation in the knowledge society, I believe that the boundaries between the three spheres, that is, the dividing lines between state, university and industry/society, as well as the three configurations of institutional pressures, that is, regulative, normative and cultural cognitive, can not be clearly observable and distinguishable, when the three spheres start to overlap. Thus, my model is better demonstrated through a color gamut, due to the blurred boundaries that this Figure represents.

In a color gamut there are RGB - red, green and blue interactions that create a whole new set of colors according to the intensity of the participation of each RGB color, as it can be seen in Figure 1.

Both images showed in Figure 1 are the same. The difference is that the one in the left is a simplification of the one in the right side, which is more complex and accurate according to the reality. The interactions showed in the left image show clear boundaries between the three colors, while in the right image, the boundaries are blurred and it is much more difficult to identify the exact point where one color begins and where it ends.

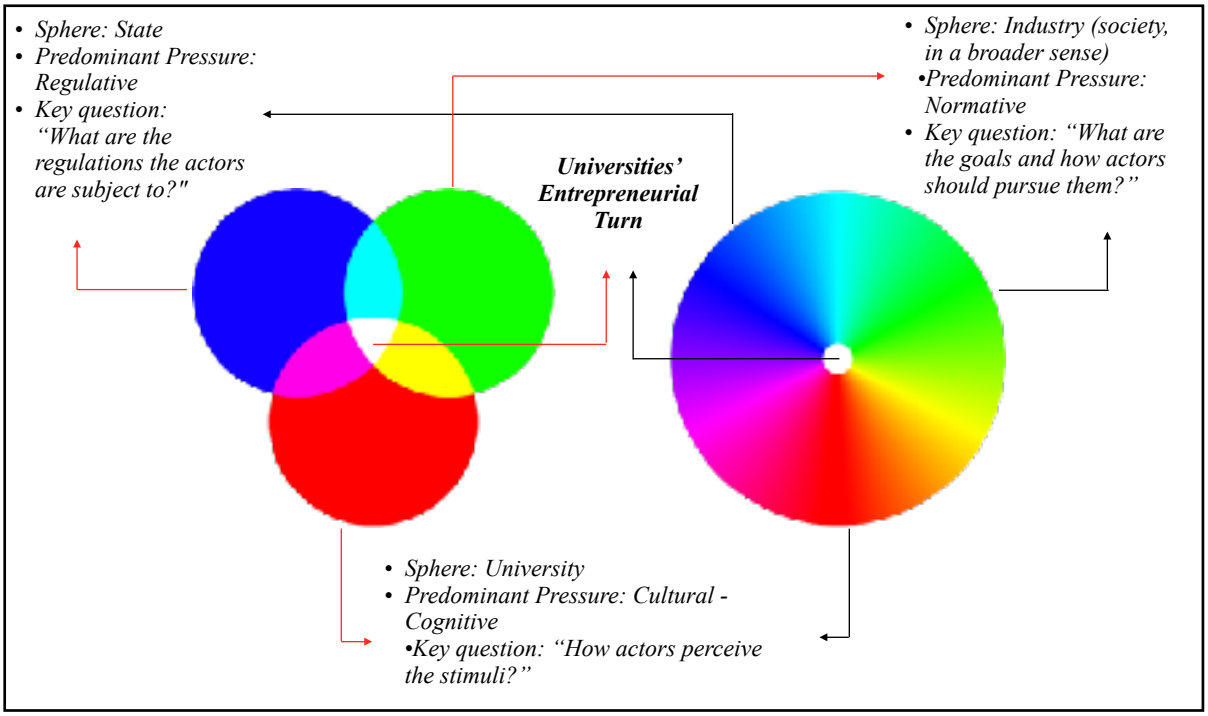

Figure 1: Simplified Vs. complex representation of institutional pressures and the three spheres of the triple helix of innovation shaping universities' entrepreneurial turn
Source: The Author.

The same happens when institutional entrepreneurs from the state, the industry/society and the university work institutionally, both individually and collectively and favor the innovation creation, many times promoting the emergence of hybrid innovators.

This graphic representation of my thesis also illustrates better the recursive interplay between the institutional pressures that shape universities' entrepreneurial turn. More than just being in contact, the institutional pressures simultaneously transform and shape one another, in a continuous process resultant from the institutional work performed by institutional entrepreneurs.

And finally, my figure also sheds light to the central position of universities' entrepreneurial turn in the process of creating innovations. Being at the epicenter of all institutional pressures coming from a multitude of actors of the three spheres, highlights the contingent nature of universities' entrepreneurial turn and, above all, reinforces the absolute

relevance of the institutional work performed by institutional entrepreneurs in shaping its development.

Our main theoretical contributions, or the novelty of my thesis, consist on: a) placing the universities' entrepreneurial turn at the epicenter of all the competing institutional pressures and logics when it comes to innovation creation; b) characterizing the universities' entrepreneurial turn as a result of the recursive interplay between regulative, normative and cultural-cognitive pressures, derived from each actor of the triple helix; and c) stressing the fundamental role of the institutional work performed by institutional entrepreneurs in the process of developing the universities' entrepreneurial turn.

Thus, this thesis is in line with what argue Greenwood, Hinings and Whetten (2014), that is, there is a lack of studies which apply institutional theory to explain and understand organizations, how they are structured and managed, rather than focus on the comprehension of the institutions themselves.

2. THEORETICAL FRAMEWORK

2.1. UNIVERSITIES' MISSIONS

Universities serve a multitude of purposes guided by different interests from also different actors. What I call "universities' three missions" represent the core role that they are expected to perform, in order to satisfy its multiple demands. According to Krause (2009),

> the lack of stability in the configuration of higher education institutions and their roles - as a result of constant changes in national policies, market forces, globalization, third-mission imperatives and technological advances - means that academic workers face challenging times, as they seek to come to terms with their role in this volatile environment (p. 414).

Teaching, researching and the wide range of activities that represent universities' "third mission" are closely connected to each other, with blurred boundaries (Krause, 2009), forming a continuous cycle where one mission is at the same time the foundation and the result of the other missions. The need to discover leads to the mission of researching. The need to learn what is already discovered leads to the mission of teaching. And the need to engage in meeting society's needs leads to the third mission, which involves the development of an entrepreneurial character, as demonstrated by many studies (Dias & Silveira Porto, 2013; Rosa & Frega, 2017; Almeida *et al*, 2016; Audy, 2017; Mello & Sepúlveda, 2017; Rodrigues & Gava, 2016).

Teaching is probably the first mission that comes to our minds when we think about the role universities have in society. Students start pursuing their careers when choosing the university where they want to study and then choosing their majors. So on the one hand, higher education teaching represents a shift in the students' lives through an in-depth learning experience and, on the other hand, it serves the society as a whole, providing prepared workforce.

Research is the foundation of teaching. According to Brew (2009) "there is not a single aspect of contemporary daily life which has not been informed in some way by academic research in one form or another" (p. 474). However, researching is a contested arena, because it can serve a multitude of interests, most of the times conflicting, arising from the government, the industry, the media and the academics themselves (Brew, 2009).

Government investments in research tend to be directed to researches that can potentially benefit the country. But the government misconceptions about the activity of making science, sometimes lead to unreal expectations, for example, expecting that it is possible to "manage" research predicting its results and how long it will take to achieve them (Brew, 2009).

Industry also plays an important role when it comes to funding, and this is specially true when their field of activity is based on high technology and innovation, due to important contributions of universities in this respect. But as pointed out by Jacob (2009), reducing the role of higher education by evaluating it in terms of the value added to some specific users, creates a democratic deficit and reinforces misconceptions about education and research in a sense that they only deserve funding when there are clear and well-defined results.

According to Brew (2009) some kinds of research, especially those that calls people's attention, also holds a kind of allure that the media knows how to explore to attract audience. The exposition of a research being conducted can have positive or even negative consequences to the researchers involved, but it seems undeniable that, institutionally, when a university is mentioned or cited as the "home" of cutting edge science by the media, it increases its prestige.

Finally, we need to remember the influence of the academic themselves while choosing what they are willing to research. This choice, as pointed out by Brew (2009), reflects both the researcher's intrinsic interests in the topic and also the "extrinsic rewards" that have to do with funding from the government, research councils or industry. Thus "It is the individual academics who are having to do a balancing act between what they would most like to do and what is possible to do, given the levels of, and competition for, funding" (Brew, 2009, p. 477).

However, it can not be neglected that in order to make science, universities need financial support. High quality research groups demand resources to be invested in talented researchers (Lenoir, 2014) and needed materials, as well as a whole institutional support able to create the connection between the academic knowledge generated by these groups and the people who could potentially be benefited by it. As a means to avoid the risk of having a unique source of funds, which may include, lack of resources or some kind of pressure or even a disguised control of what is being developed by researchers, financial sources diversification is something to be recommended.

In accordance to that, the resultant document from UNESCO'S 2009 World Conference on Higher Education, entitled The New Dynamics of Higher Education and Research For Societal Change and Development (UNESCO, 2009), states that: "Given the

need for increasing funding for research and development in many countries, institutions should seek new ways of increasing research and innovation, through multi-stakeholder public-private partnerships including with small and medium enterprises" (p.6).

Once I have briefly defined teaching and researching, I am going to focus on the third mission, which is the basis of the universities' entrepreneurial turn, core of this study. The third mission embraces a wide range of activities that represent universities' commitment to engage in attending society's needs in more direct ways such as: extension courses; services to benefit the local community, and informal or formal relationships with industry. "[…] concerned with the generation, use, application and exploitation of knowledge and other university capabilities outside academic environments. In other words, the Third Stream is about the interactions between universities and the rest of society." (Mollas-Gallart, Salter, Patel, Scott, & Duran, 2002, pp. iii-iv)

The idea of a third mission is closely linked to civic engagement. Despite the existing civic roots of universities, some questions emerge when it comes to what these institutions need to do in order to make a difference in their contexts, that is, to be civic engaged. These questions are:

> How can the university contribute to society, both locally and beyond? What is the most appropriate way to serve the society, be it through preparing knowledgeable and engaged citizens, performing direct service and application of knowledge to society's problems, or simply through performing basic research and other knowledge that may indirectly help society? […] What are the best ways to engage communities in the knowledge-creation process, and how can this be done in light of power differentials between large institutions and individuals? How can a university overcome the legacy

> of neglect and paternalism in their past relationships with their communities? (Hartley & Soo, 2009, p. 406).

Much of the research outcomes, to achieve their full potential and literally have a positive impact in people's lives, depend on third parties involvement. For example, given that universities are not expected to literally produce as a factory, some of the discoveries that emerge from academic research demand partnerships with industry to become a reality, and that is when the universities' third mission acquires an entrepreneurial characteristic.

The academic entrepreneurship is better understood as a process and not as a single activity. In this sense, Wood (2011), based on the literature, draw a multistage model to represent this phenomenon. The first stage is the innovation disclosure and the intellectual property protection; after that, comes the awareness and securing industry partnerships stage; then, there is the commercialization mechanism selection stage, which may include technology licensing agreements and/or creating spin-off ventures; and the final stage is the commercialization itself.

This proximity between university and industry is often seen in the field of life sciences and it has consequences on the image of the researchers themselves. According to Powell and Owen-Smith (2002), the representation of the life scientist is being replaced from the one who was motivated by passion, disinterestedness and the search for truth, to the one who is better known as the scientist-entrepreneur "[…] who balances university responsibilities and corporate activities in the development of new compounds and devices designed to improve human health and garner market returns for the investigator, the institution, and investors" (p.108).

We may believe that such transformation has led to a reality in which there are only two possible types of faculty responses regarding the changing institutional environment: the responses given by the so called scientist entrepreneurs or by the ivory-tower traditionalists, but as pointed out by Owen-Smith and Powell (2001), every research university has a wide array of faculty responses to institutional changes.

This happens because universities are probably the best example of complex organizations, where divergence is a basic characteristic. They face their three missions competition (Etzioni, 1973); they are a type of organized anarchies, marked by the lack of control over their members and the emergence of autonomous decisions (Cohen, March & Olsen, 1972); they represent loosely coupled systems, which means that the decisions emerge from semiautonomous power units (Weick, 1976); they are strongly susceptible to external influences (Baldridge, 1983); and they are professional bureaucracies, in which the key part of the organization is the operative core at the same time (Mintzberg, 1995).

As a consequence of this complexity, universities' strategies on their entrepreneurial turn tend to be not consensual, but rather negotiated, bargained and resultant from internal and external political processes.

In an attempt to comprehend the phenomenon of knowledge capitalization from the academics perspective, Dzisah (2012) conducted a survey at the University of Saskatchewan, in Canada, where the respondents were from diverse departments were researches conducted with industrial partners were common. The results indicate that the academics who received funding from industrial partners "have relatively more positive views about university-industry relations than those who do not receive such funds" (Dzisah, 2012, p. 284).

Although the author made it clear that the results could not be conclusive on whether intellectual autonomy is being threatened by the industrial funding or not, I can argue that the

academics point of view are precedent to the funding and not the contrary, that is, once they believed that these partnerships were something positive, they engaged in such activities and then eventually received funding. In other words, it is not possible to suppose that the financial incentives made them change their minds.

Dzisah (2012) concludes that the emergence of the age of knowledge has caused shocks within university, due to incongruences between the traditional view of science and a more economically engaged one. As there are possible positive and negative outcomes from the approximation between universities and industry, it is of fundamental importance debating this issue in order to minimize the contradictions.

It is important to highlight that not even a single individual is free from possible dilemmas about disclosing or not an invention. Owen-Smith and Powell (2001) argue that this decision is shaped by: the perception the researcher has about the benefits of patent protection; the perception about the interacting costs when dealing with technology transfer offices and licensing professionals; and the perception about how the institutional environment reacts to the simultaneous pursuit of academic and commercial goals, that is, whether it is supportive or not.

In accordance with this study, Ambos, Mäkelä, Birkinshaw and D'Este (2008) concluded that the tensions between academic and commercial demands were stronger at the individual researcher level, rather than institutionally, at the level of the organization. And Sauermann and Stephan's (2013) study suggests that

> the ideal types of "academic logic" and "commercial logic" overstate differences between industrial and academic science while ignoring important heterogeneity within

> each sector. As such, although ideal types can be very useful in serving as reference points…they are less useful for descriptive purposes. (p. 904)

Despite all the diverse point of views regarding the shifts caused by the age of knowledge within universities, the nature of academic work have been arguably transformed in recent years. As pointed out by Currie and Vidovich (2009) "economic-driven agendas and neo-liberal ideologies underpinning privatisation, marketisation, instrumentalism, managerialism and internationalisation have reshaped the higher education landscape" (p. 441).

Gourley and Brennan (2006) list three factors that somehow represent obstacles to the researchers' community engagement. The first factor is that researches need funding to succeed and a great part of the community problems to be solved are not considered priorities by funding actors, such as agencies, private businesses and the universities themselves. The second factor is related to the concept of disinterestedness. Universities need to balance their research agendas trying to address important community issues and simultaneously assure that there is enough room and resources, of course, for the researchers who want to perform blue-sky research. This is important because disinterested research, as noted by the authors, "has led to some of the more spectacular breakthroughs in human knowledge" (p. 48). And finally, the third factor is that community real problems demand multidisciplinary approach to be solved, because they involve a multitude of aspects of daily life, not being separately in disciplines.

It is important that universities be aware of these obstacles to community engagement and try to minimize them, creating policies that can incentive these interactions between

researchers and their surrounding communities, which can happen through many different ways and many different purposes.

According to Schoen *et al* (2006) third mission activities can be gathered around eight dimensions, four economic and four societal, as universities have both kind of roles, so "the economic dimension focuses on human resources, intellectual property, spin-offs and contracts with industry, while the societal dimension deals with public understanding of science, involvement in social and cultural life, participation in policy-making and contracts with public bodies" (p. 130).

Laredo (2007, p.447-448) builds a table based on the work of Schoen *et al* (2006), where he summarizes the focus, the main indicators and descriptors of the third mission dimensions. It allows to draw some considerations about the nature of third mission activities.

The preparation of qualified human resources, specially PhDs, that then go to industries or even the government, maybe represents the primary way in which universities contribute to the development of the regions where they operate. And of course, the economic outcome depends on the performance of these alumni.

When it comes to intellectual property management, spin-offs and contracts with industry, the entrepreneurial characteristic of the universities become more evident. Patents can be owned by the university or only by the inventors themselves, and it is important to mention that the intellectual property management processes demand a lot of resources, including money, specialists professionals and time, but there is absolutely no guarantees that the inventions will eventually pay off.

Spin-offs have to do with the knowledge transfer through entrepreneurship. There are many possible spin-off configurations. As it can be seen in Figure 2 , according to a typology provided by Fryges and Wright (2014), it basically depends on the context it emerged,

university or commercial, and also on the circumstances of its origin, that is, whether it is a new firm or a derivation of an existing activity.

		Environmental context	
		University context	Commercial context
Firm level – spin-off mode	New firm	QUADRANT 1 Alumni start-up Academic spin-off (pure) Academic spin-off (hybrid)	QUADRANT 2 Corporate spin-off (use of intellectual property/assets) Employee spin-off (no direct use of intellectual property/assets)
	Existing activity	QUADRANT 3 Privatization buyout/buy-in of university research agency/station	QUADRANT 4 Management buyout of division Management buyin of division

Figure 2: Typology of spin-offs
Source: Fryges and Wright (2014, p.6).

Contracts with industry are probably the maximum expression of all the allure universities have among other economic actors in the age of knowledge. Diverse types of connections can emerge from these relations, from less to more involvement, for exemple, from consultancy to R&D projects.

Moving on to the societal dimensions of universities' third stream activities, contracts with public bodies can represent a immediate societal contribution to the public sphere through services, as for exemple a university hospital that treats people from neighbor communities, or it can be something that do not have a immediate impact on people`s lives, such as for example, partnerships to perform military co-research.

Participation in policy making is the actual involvement of universities in shaping or implementing policies, both locally, regionally or on a national level. Faculty or other management members of universities can participate of these processes both individually and institutionally, both directly, that is, compounding the policy tables, or indirectly, for example through the preparation of policy studies and so on.

Other fundamental societal dimension of universities' third mission is the involvement in the social and cultural life of the city and the region that embraces it. It encompasses a wide range of possibilities, such as owning museums, facilities open to the community, as libraries and sport places and may others.

And the last, but not less important dimension of the third stream of universities is the interaction with society with the clear purpose of influencing positively the public understanding of science. Strategies applied to this end may vary from simply keeping a complete and updated website, to creating opportunities to show the routines of academic work, such as open days, scientific fairs and so on.

It is important to highlight that all these activities that constitute the third stream demand efforts to be accomplished, and some may argue that these efforts are being subtracted from teaching and researching to privilege the third mission. However, as pointed out by Vorley and Nelles (2008) when the third mission is not isolated, that is, when it is integrated to the general institutional strategy, something achieved through a well planned university leadership and management, it "presents an opportunity for institutional development beyond third stream activities, allowing universities to (re)define themselves as well as consolidate the (core) missions of teaching and research" (p. 13).

Much of the criticism that emerge regarding the academic entrepreneurship is based on a more traditional perspective according to which universities engage in academic entrepreneurship having as the main focus generating direct financial returns. In contrast to this idea, an emerging perspective relies on a wider view and highlights all the social and economic benefits to the whole university ecosystem when it comes to acting entrepreneurially (Siegel & Wright, 2015). Figure 3 addresses the fundamental diferences between both perspectives.

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'

Figure 3: Traditional and Emerging Perspectives on Academic Entrepreneurship.
Source: Siegel and Wright (2015, p. 12).

In short, universities' three missions represent the core role they are expected to perform, and include, teaching, researching and the wide range of activities that form the third mission. All three missions need to be connected so that the universities achieve their goals. The third mission is "[…] concerned with the generation, use, application and exploitation of knowledge and other university capabilities outside academic environments. In other words, the Third Stream is about the interactions between universities and the rest of society." (Mollas-Gallart, Salter, Patel, Scott, & Duran, 2002, pp. iii-iv). The concept of academic entrepreneurship derives from the third mission and can be better understood if taken as a process that includes: the innovation disclosure and the intellectual property protection; the awareness and securing industry partnerships stage; the commercialization mechanism selection stage, which may include technology licensing agreements and/or creating spin-off ventures; and the finally, the commercialization itself (Wood, 2011).

2.1.1. Entrepreneurial university, entrepreneurial architecture and entrepreneurial turn: definitions and characteristics

Following what has been presented about the three missions of universities, specially focusing on the third mission, this session aims at exploring some definitions and characteristics of three fundamental concepts for this study: “entrepreneurial university”, “entrepreneurial architecture” and “entrepreneurial turn”. As these concepts are closely linked to each other, their explanation will occur in a very organic format.

According to Clark (1998) the entrepreneurial university refers to a

> characteristic of social systems; that is, of entire universities and their internal departments, research centres, faculties and schools.The concept carries the overtone of “enterprise” - a willful effort in institution-building that requires much special activity and energy. Taking risks when initiating new practices whose outcome is in doubt is a major factor. An entrepreneurial university, on its own, actively seeks to shift in organizational character so as to arrive at a more promising posture for the future. Entrepreneurial universities seek to become “stand-up” universities that are significant actors on their own terms. Institutional entrepreneurship can be seen as both process and outcome (p. 3-4).

The diffusion of entrepreneurial universities worldwide is not something that is occurring by chance. As they are naturally knowledge producers, they are presumed to assume a very important role in their regions and countries economies, due to the prominence

knowledge acquires in today's economies. This way, "nations and regions are pressuring their universities to stimulate job and wealth creation" (Foss & Gibson, 2015b, p. 1).

As a result, some universities are developing what can be called an entrepreneurial architecture. Based on the work of Burns (2005), who coined this term applied to the corporate context, Nelles and Vorley (2010) developed the concept of the entrepreneurial architecture applied to the academic sphere. According to these authors, the entrepreneurial architecture consists of five mutually supportive institutional elements that together shape the entrepreneurial capacity of the university, thus allowing the realization of the third mission. The five elements: structures, systems, strategies, leadership and culture, have the same importance in helping the university follow an entrepreneurial agenda, and thus are expected to interact with one another. The next paragraphs will present the definition and examples of each of these elements, according to Nelles and Vorley (2010).

Structures refers to the formal offices or departments designed to knowledge exchange. While the most common example is the technology transfer office, other structures have also a fundamental role, such as incubators, technology parks, industrial liaison offices, and departments of continuing education and professional development. It is important to highlight, however, as already mentioned, that all the elements, including structures, are a necessary but not sufficient condition to realize the third stream goals (Nelles & Vorley, 2010).

Systems are the networks of communication and coordination that link structures and the other elements of the entrepreneurial architecture, and "also describe norms of interaction between researchers and entrepreneurial structures as well as the relationships among teaching, research and entrepreneurial activities. These systems determine how information is transmitted between and among those persons involved in knowledge exchange" (Nelles &

Vorley, pp. 170-171). This way, according to the authors, these systems show the embeddedness degree of the third mission structures in the institutional environment.

According to Nelles and Vorley (2010), institutional leadership can occur at different levels within universities and it refers to the key people who act in order to shape and modify structures and processes, as well as to the strategic vision that provides organizational orientation. Administrators, department heads and famous scientists, often known as the universities' stars, are considered key influencers.

Strategies are expressed in institutional planning documents and they are oriented toward third mission objectives and prescriptions about how they should be accomplished. They need to be closely connected to the institutional context, otherwise, they will probably fail. This way, just copying third mission strategies of successful universities is unfruitful.

And finally, culture "informs institutional design and strategic orientation and determines collective attitudes towards the Third Mission. Culture also reflects the attitudes of individuals within the organization, the value they place on innovation, and their propensity for entrepreneurial engagement" (Nelles & Vorley, 2010, p. 172). Therefore, it is useful to reflect about the conditions that lead to a favorable culture when it comes to the third mission. For example, what can be done to incentive an entrepreneurial behavior? And going deeper, do the strategies used to encourage entrepreneurship represent real cultural change or only an opportunistic behavior by the university members? How is it possible to make the entrepreneurial norms culturally embedded? (Nelles & Vorley, 2010).

Once I have presented the definitions and characteristics of the entrepreneurial university and the entrepreneurial architecture, it is possible to move forward and approach the concept of the entrepreneurial turn.

According to Foss and Gibson (2015b) universities have been taking an entrepreneurial turn, which is identified by them as a transition beyond their first and second missions, marked by increasing emphasis on actions like: research commercialization, university spin-offs, new technologies licensing, the approximation with industry and the creation of entrepreneurship programs.

Goldstein (2010), on the other hand, adopts a broader perspective of the entrepreneurial turn, one that includes not only the entrepreneurial practices themselves, but also the internal processes that actually lead to these practices. Under this point of view, the entrepreneurial turn comprises of:

> (1) the active involvement of universities—as institutions—in the development and commercialization of technology stemming from university-based research; and (2) changing the internal regulations, rewards and incentives, norms of behavior, and governance of universities to remove barriers to individual faculty, other researchers, and research centers/institutes engaging in behavior that leads to the commercialization of university-generated knowledge (p.84).

Some signs that universities have been taking this entrepreneurial turn can be observed through the increasing number of technology transfer offices, as well as the enlargement of the existing ones; the increasing number of patents, licenses and inventions disclosures within the academic context; and even broader transformations such as changes in mission statements and in faculty careers criteria (Goldstein, 2010).

The study conducted by O'Shea, Allen, Morse, O'Gorman and Roche (2007), about the MIT - Massachusetts Institute of Technology successful case, indicates that there are four

basic attributes of universities that help supporting the emergence and sustainability of spin-offs, which are a great indicator of the entrepreneurial orientation of universities. The first factor is being a research-intensive university, focusing specially on areas such engineering. The second factor is closely related to the first and refers to the ability of conducting high quality research. The third factor is having a management real committed to supporting spin-off activity. And the fourth factor is having a spread entrepreneurial culture, or orientation, within the whole institution. Besides these four factors, the authors also discovered that the present spin-off activity is also influenced by previous spin-off activities, revealing a path-dependent process, and also that the context plays an important role determining the level of spin-off activity of a university.

From the analysis of the MIT case, the authors could draw some conclusions about what factors, practices or characteristics could be recreated by other universities in order to develop entrepreneurially and those that could not. History needs to be built over time, and thus, not created; the influence of the geographical context is also predetermined, specially if considered the short run; culture can be changed but the process takes a long time; the same can be said about the research portfolio, that can change, however in a slow pace; it is also possible to improve the quality of research, hiring high skilled faculty and changing promotion policies; and finally, the commitment of the management team can also be created, and more important, it needs to be visible in practices (O'Shea *et al,* 2007).

While not every factor or characteristic can be reproduced by other universities in different contexts, there are some practices identified by Boh, De-Haan, and Strom (2016) independent of the offices of technology transfer of some of the most successful entrepreneurial universities, that could be implemented by some other institutions, such as: 1) project-based classes on technology commercialization; 2) mentoring programs; 3)

accelerator/incubator programs; 4) business plan competitions; 5) entrepreneurship education for students; and 6) entrepreneurship education for faculty.

In short, when universities take an entrepreneurial turn, translating it into a societal norm, they are acting entrepreneurially in an institutional way (Clark, 1998). Aiming at increasing their entrepreneurial capacity, some universities adopt an entrepreneurial architecture which comprises the development of five mutually supportive elements: structures, systems, strategies, leadership and culture (Nelles & Vorley, 2010). And finally, according to Goldstein (2010) the so called entrepreneurial turn has to do with an active institutional commitment of universities in order to develop and commercialize technology derived from their research groups, which involves all sort of necessary changes in regulations, practices, norms and governance structures aiming at overcoming obstacles that may negatively influence the "[…] behavior that leads to the commercialization of university-generated knowledge (p.84).

2.1.2. The triple helix systems of innovation

In knowledge-based societies innovation and, consequently, economic development arise from triple helix relations, that is, from the interaction between universities, industries and the government, that together create conditions for the production, transfer and application of knowledge (Etzkowitz, 2008; Ranga & Etzkowitz, 2013). Therefore, "the triple helix is mainly a model for analyzing innovation in a knowledge-based economy" (Leydesdorff & Etzkowitz, 1998, p. 198).

The triple helix model comprises three basic elements, that are: a) a more prominent role of the university; b) innovation policy being increasingly an outcome of the collaborative

relationships among the triple helix elements, instead of being prescript by one of them; and c) all the three elements of the triple helix taking the role of each other while also carrying out their original roles (Etzkowitz, 2008; Etzkowitz, Ranga, Benner, Guaranys, Maculan & Kneller, 2008)

Figure 4 presents the evolution of innovation systems, showing the ways how the three spheres, university, state and industry interact to each other.

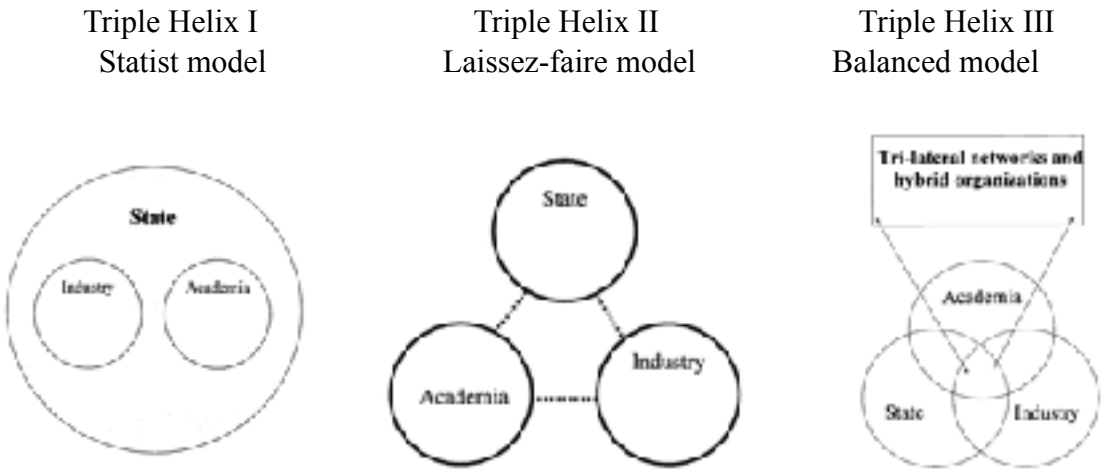

Figure 4: Triple Helix configurations
Source: Etzkowitz and Leydesdorff (2000); Ranga and Etzkowitz (2013).

The first image represents the Triple Helix I, and it is a state-ruled model in which the nation state directs the relations between the university and the industry (Etzkowitz & Leydesdorff, 2000). In this configuration the government plays the leading role, and thus, at the same time it drives the other two spheres, it also limits their capacity.

The second image, the Triple Helix II, a laissez-faire model of university-industry-government relations shows the institutional spheres separately with highly limited interactions. And finally, the third configuration, the Triple Helix III shows the balanced model, where there are tri-lateral networks and hybrid organizations (Etzkowitz &

Leydesdorff, 2000). In this configuration, not rarely, universities lead joint initiatives with the other two spheres in the production of innovation. "The most favorable environments for innovation are created at the intersections of the spheres" (Ranga & Etzkowitz, 2013, p. 239).

Triple Helix I is largely viewed as a failed developmental model. With too little room for ''bottom up'' initiatives, innovation was discouraged rather than encouraged. Triple Helix II entails a laissez-faire policy, nowadays also advocated as shock therapy to reduce the role of the state in Triple Helix I. In one form or another, most countries and regions are presently trying to attain some form of Triple Helix III. The common objective is to realize an innovative environment consisting of university spin-off firms, tri-lateral initiatives for knowledge-based economic development, and strategic alliances among firms (large and small, operating in different areas, and with different levels of technology), government laboratories, and academic research groups (Etzkowitz & Leydesdorff, 2000, pp. 111-112).

Ranga and Etzkowitz (2013) introduced the concept of the "Triple Helix Systems of Innovation" to understand better the components, relationships and functions that take part in the construction of knowledge-based development, and thus, innovation. Figure 5 shows the synthetic representation of the triple helix systems.

Figure 5: A synthetic representation of Triple Helix systems.
Source: Ranga and Etzkowitz (2013, p. 241).

As we can see, the main function of the triple helix systems consists on the articulation of the knowledge, innovation and consensus spaces aiming at the generation, diffusion and use of knowledge and innovation.

The authors emphasize that the components need to be seen beyond the “blocks” of university, industry and government, that is, they need to be understood in a more detailed way, thus considering "(a) individual and institutional innovators; (b) R&D and non-R&D innovators; and (c) ‘single-sphere’ and ‘multi-sphere’ (hybrid) institutions” (Ranga & Etzkowitz, 2013, p. 241).

The relationships among the system components are also multiple and include not only market-driven interactions, as well as non-market. Therefore it can be technology transfer or acquisition, collaboration and conflict moderation, collaborative leadership, substitution and networking (Ranga & Etzkowitz, 2013).

And finally, the functions of the triple helix systems are the generation, diffusion and use of knowledge and innovation, which are realized through articulation of the knowledge, innovation and consensus spaces, defined according Ranga and Etzkowitz (2013):

> The knowledge space encompasses the competencies of knowledge generation, diffusion and use of the Triple Helix components. The construction of this space is an essential step in the transition to a knowledge society and has the purpose of creating and developing knowledge resources in order to strengthen the local, regional and national knowledge base, to avoid fragmentation and to reduce the duplication of research efforts….The innovation space consists in particular of the competencies of the ‘multi-sphere’ (hybrid) organizations and entrepreneurial individuals and institutions… Its ultimate purpose is the development of local innovative firms, in parallel with the

> attraction of talent and innovative firms from elsewhere, the creation and development of intellectual and entrepreneurial potential, and competitive advantage for the region and the country….The consensus space is the set of competences that bring together the Triple Helix system components to engage in 'blue-sky' thinking, discuss and evaluate proposals for advancement towards a knowledge-based regime. (p. 247)

The formation of these spaces are the outcomes of the interaction between the triple helix spheres that get closer and closer over time to the point they overlap. The space created can be understood as a "stem cell space" that within time will differentiate and evolve to knowledge, innovation and consensus spaces. This differentiation takes place through the combination of determined components, relationships, resources and through the creation of new institutional formats. All of these being under the influence of environmental specificities, such as, local or regional needs, resources and assets. Figure 6 presents the evolution of the interaction of the triple helix spheres.

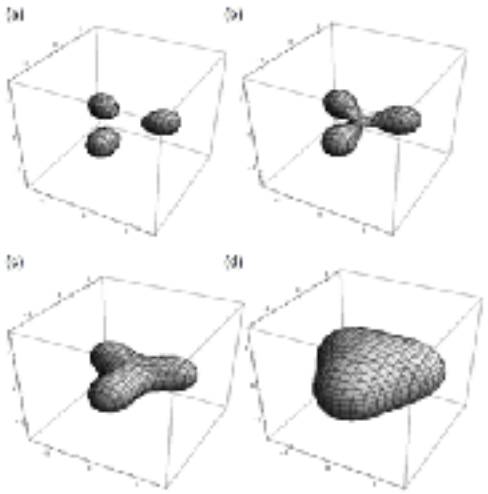

Figure 6: Interaction between the Triple Helix institutional spheres in the formation of a space: (a) institutional spheres apart – a *laissez-faire* regime; (b) institutional spheres getting closer together and starting to interact; (c) institutional spheres increasingly overlapping; and (d) institutional spheres overlapping in a balanced regime – formation of a 'stem cell space'.
Source: Ranga and Etzkowitz (2013, p. 252).

The authors emphasize, however, that this is a simplification of what happens in real life, where all the spheres do not perform the same way, that is, they do not contribute equal to the creation of these spaces.

According to Ranga and Etzkowitz (2013), there are some mechanisms that work for the differentiation of this stem cell space and lead to the creation of the knowledge, innovation and consensus spaces. Figure 7 summarizes these mechanisms.

Knowledge space	Innovation space	Consensus space
Dispersal of some national public research resources from more research-intensive regions to less research-intensive ones	Creation of a university in a region without higher education capacity, as a means of raising the technological level of existing clusters or as a source of new ones	Creation or transformation of an organization to provide a home for brainstorming, analysis of problems and formulation of plans
Relocation and aggregation of existing research resources	Building an integrated environment for university technology transfer and entrepreneurship	Provision of access to the resources required to implement a project;
Attraction of leading researchers through the foundation of a science-based university	Relocation of artists to declining urban districts to stimulate arts/ technology-based economic renewal.	Providing solutions to conflict or crisis situations, such as socio-economic crises caused by loss of manufacturing industries and failure to create alternative industries, financial and social crises and the like.
Creation of new university resources to support the development of new industries or raise existing ones to a higher level		
Virtual congregation of geographically dispersed groups from university and industry around common research themes, with government support		
Networking of existing knowledge-based organizations and creation of new ones through collaboration among existing players, in order to become internationally competitive		

Figure 7: Mechanisms for the creation of knowledge, innovation and consensus spaces.
Source: Adapted from Ranga and Etzkowitz (2013, p. 248-251).

To sum up, although one may argue that innovation may occur even in harsh environments, it is a fact that it emerges easier from less hostile contexts which may be deliberately created by a more intense relationship among the academy, the industry and the government. Indeed, "the most favorable environments for innovation are created at the intersections of the spheres" (Ranga & Etzkowitz, 2013, p. 239).

2.1.3 The impact of the entrepreneurial university on regional development

How does an innovating region emerges? Drawing on a Swedish region, Etzkowitz and Klofsten (2005), presented a model for knowledge-based regional development and discovered that the fundamental event is the creation of an entrepreneurial university, which can be a completely new one, or the transformation of an existing one into an entrepreneurial institution. Four stages of region development were identified: inception, implementation, consolidation or adjustment and renewal. All these stages are resultant of the interaction of the three spheres of the triple helix, which may have a greater or lesser participation, depending on the circumstances of the stage, creating a cyclic movement from one innovation wave to the next.

But sometimes it is difficult achieving the traceability of the impact an university had on the creation of new businesses, for example. Shah and Pahnke (2014), demonstrates that when analyzing the influence a university has on a firm, it needs to be taken into consideration two axes: the source of the entrepreneurial knowledge and the source of innovative knowledge. Founders of "Spinouts-Type 1" got both types of knowledge from the university, while founders of "Offshoots" got only the entrepreneurial education from the university and got the innovative knowledge from other source. Founders of "Spinouts-Type 2" had access to the

innovative knowledge from the university, but the entrepreneurial education from elsewhere. And finally, there are also founders of businesses who got both the innovative knowledge and the entrepreneurial education outside the academic environment, but the university also played an important role on their achievements making them aware of possibilities that helped them be what they are.

As we have seen previously, society expects university to have a growing leading role in solving much of the problems afflicting the community, specially economic issues, which are expected to be addressed under universities' third mission agendas, in a knowledge-based economy, which is defined by Powell and Snellman (2004)

> as production and services based on knowledge-intensive activities that contribute to an accelerated pace of technological and scientific advance as well as equally rapid obsolescence. The key components of a knowledge economy include a greater reliance on intellectual capabilities than on physical inputs or natural resources, combined with efforts to integrate improvements in every stage of the production process, from the R&D lab to the factory floor to the interface with customers (p.201).

But according to Lendel, Allen and Feldman (2009) "universities are necessary but not sufficient for positive regional economic outcomes" (p. 381). Based on the literature, the authors found two major hypothesized systems that connect the role of universities in regional growth: "(1) mechanisms of knowledge spillovers due to agglomeration economies of scale, and (2) specific economic environments where the knowledge spillover occur" (p. 393)

This conclusion strengthens the thesis of the triple helix systems of innovation, that is, the most favorable circumstances to create innovation depend on the active participation of

universities, state and industries, which are realized through articulation of the knowledge, innovation and consensus spaces (Ranga & Etzkowitz, 2013, p. 239).

The expected economic impact of entrepreneurial universities on the regions they are embedded has some wider dimensions, which include the land development and social problems reduction. Although most of the American universities failed in accomplishing these expectations, O'Mara (2012) argues that "the education of students, rather than community service programs or economic spillovers, has been the university activity with perhaps the biggest ''public service'' impact by far" (p.248).

The success of some "cities of knowledge", as the region of the Silicon Valley, is partially explained, according to O'Mara (2005), because they made high-tech development an end and not the means. Economic and social goals are not always connected and universities need to be aware of the trade-offs involving them. In order to illustrate this assertion, the author points out that "the places that used science-based economic development as a tool by which to 'save the city' or present the right public image on racial issues were less successful" (O'Mara, 2005, p. 230).

Related to that, Zahra and Wright (2015) propose the development of five pillars that could enhance the social role of entrepreneurship, they are: connecting entrepreneurial activities to other societal efforts aimed at improving the quality of life, achieving progress, and enriching human existence; identifying ways to reduce the dysfunctional effects of entrepreneurial activities on stakeholders; redefining the scope of entrepreneurial activities as a scholarly arena; recognizing entrepreneurship's social multiplier; and pursuing blended value at the organizational level, centering on balancing the creation of financial, social and environmental wealth.

Some concluding remarks may be drawn at this point: the first is that universities alone can do too little to promote regional development. As we have seen, conjoint efforts involving the government and the industry, along with universities achieve better results. The second is that although economic and social outcomes are not necessarily connected, it is important trying to blend both types of goals when taking an entrepreneurial turn. And the third is that the kind of impact the entrepreneurial university will have on its region will ultimately depend on the region itself, that is, what its demands are. As an example, a very impoverished community surrounding a university may exert a strong influence on the nature of the entrepreneurial activities that this university performs. On the other hand, when the region is not lacking in many resources, the university can concentrate its research efforts on global themes that maybe has little impact on its surroundings.

2.2.THE ENTREPRENEURIAL TURN EXPLAINED THROUGH THE CONVERGENCE BETWEEN THE TRIPLE HELIX AND INSTITUTIONAL THEORY

I start my argumentation presenting again the figure that illustrates my theoretical overall proposition

There has been many research initiatives that deal with the innovation issue through the lens of the Triple Helix (Leydesdorff & Park, 2014; Havas, 2015; Luengo & Obeso, 2013; Petersen, Rotolo, & Leydesdorff, 2016; Pinto, 2017; Etzkowitz & Zhou, 2017) and even others that combine this theoretical stream with institutional theory, such as those presented in the book entitled “The entrepreneurial university: context and institutional change” edited by Foss and Gibson (2015), and others like, Machado, Sartori and Crubellate (2017) and Gibson and Foss (2017).

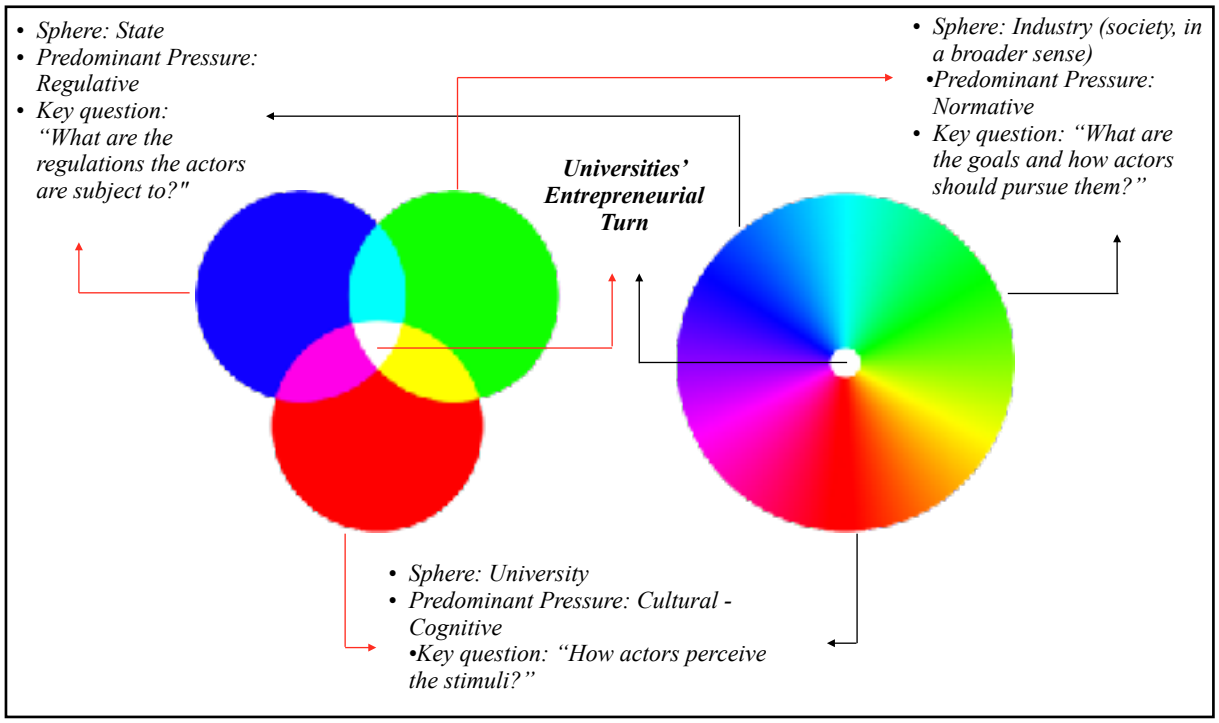

Figure 8: Simplified Vs. complex representation of institutional pressures and the three spheres of the triple helix of innovation shaping universities' entrepreneurial turn
Source: The Author.

The novelty of my thesis, as stated previously, consists on consist on: a) placing the universities' entrepreneurial turn at the epicenter of all the competing institutional pressures and logics when it comes to innovation creation; b) characterizing the universities' entrepreneurial turn as a result of the recursive interplay between regulative, normative and cultural-cognitive pressures, derived from each actor of the triple helix; and c) stressing the fundamental role of the institutional work performed by institutional entrepreneurs in the process of developing the universities' entrepreneurial turn.

Our thesis has its roots on the assumption that institutional pressures are resultant from bidirectional forces, that is, top-down and bottom-up dynamics between the actor and the structure (Smets, Morris & Greenwood, 2012; Gray, Purdy & Ansari, 2015) and also from multilateral dynamics between different institutional logics (Boxenbaum & Battilana, 2005; Colyvas & Powell, 2007; Bjerregaard & Jonasson, 2014.

With an intent to make my thesis clearer, I am going to describe it in more detail in the following paragraphs and also in the next subitems.

Starting with my first assumption, when I claim that the entrepreneurial turn is at the epicenter of all the competing pressures and logics when it comes to innovation creation, I base my argument on the following. In knowledge based societies what is considered an innovation truly depends on research in order to emerge. We can think of research as being the real locus of innovation and this is especially true if we mean technological innovation. And research, in turn, depends on universities to exist, both directly and indirectly. Although one may claim that there are research centers outside universities, we need to remember that all the human capital involved in creating innovations in these centers, the entrepreneur scientists, are fruits of universities' efforts, most of them which had once decided to take an entrepreneurial turn and promote entrepreneurial thinking among its faculty, researchers and students.

Focusing on the idea that in knowledge-based societies innovation arises from triple helix relations, that is, from the interaction between universities, industries and the government and that it demands a more prominent role of universities (Etzkowitz, 2008), it is appropriate to think about the universities' entrepreneurial turn (Goldstein, 2010) as a decisive direction they take, assembling efforts, without which the promotion of innovation would not be something systematized and thus, would be rarer and happen at a slower pace.

Therefore it seems suitable to consider the entrepreneurial turn as the ultimate means that leads to the promotion of innovation. And as it is expected, its responsibility does not come out of a vacuum, but is rather a result of inward and outward forces, that can be understood as institutional pressures and organizational responses to the environment, that are

shaped through a historical recursive interplay between regulative, normative and cultural-cognitive forces derived from each actor of the triple helix.

And this drives me to a further refined detailing on my thesis' second assertion, that consists of characterizing the universities' entrepreneurial turn as a result of the recursive interplay between regulative, normative and cultural-cognitive pressures, derived from each actor of the triple helix.

The next subitem will focus on understanding the emergence and nature of regulative, normative and cultural-cognitive institutional pressures, stressing the existing dynamics between these pressures and organizational responses. After that, the last topic on the theoretical framework will present the fundamental role played by institutional work performed by institutional entrepreneurs in shaping the institutional environment.

2.2.1. Regulative, normative and cultural cognitive pressures: understanding their nature and emergence

As pointed out by Foss and Gibson (2015a), the context in which the university is embedded, has a profound impact on how the entrepreneurial architecture will be built, in other words, the speed and depth of development of each dimension, namely the structures, strategies, systems, leadership and culture. And, according to my thesis, simultaneously to that, the university entrepreneurial architecture also impacts its context.

Regarding to the regulative pressures, according to Scott (2014, p 62) "Individuals craft laws and rules that they believe will advance their interests, and individuals conform to laws and rules because they seek the attendant rewards or wish to avoid sanctions".

Government regulations at the same time restrict and enable individual and organizational behaviors and the emergence of a regulation is not a synonym for a top-down process. The way through which laws or other kind of regulations emerge reflects political processes which involve interests deriving from diverse groups of interests in society.

Despite its well-known top-down character, regulative pressures can also be an outcome of bottom-up pressures. This is a result of institutional entrepreneurship (Leca, Battilana & Boxenbaum, 2006). Some universities create, for example, Institutional Relations Departments with the intent of influencing systematically institutional players, especially those at the regulative sphere which is determinant when it comes to universities' realm (Amarante, Crubellate, & Meyer Jr., 2017).

This bottom-up characteristic of legislation is quite clear in some countries, for example, the first amendment of the Constitution of the United States of America guarantees the right of society to intervene in the policy making process. "Congress shall make no law… abridging…the right of the people peaceably to assemble, and to petition the Government for a redress of grievances" (U.S. Const. amend. I).

Since interest groups have always exerted pressure on regulative processes, lobby is, therefore, a legal activity in the country. However, as noted by Schattschneider (1975) lobby is predominantly performed by businesses, whose power "challenges the supremacy of government"(p. 116).

Regarding the third mission of universities, most regulations have to do with the ways through which they can engage in research commercially, and when it comes to this issue, the Bayh-Dole Act is regarded to be one of the major changes that occurred in the U.S. context. According to Loise and Stevens (2010, p.1) "Bayh-Dole gave ownership of inventions back to

the universities that created them and gave universities the freedom to negotiate whatever license terms would best encourage development of the technology".

Powerful universities such as Stanford, University of California and Harvard lobbied to the passage of the bill (Mowery, 2005). This demonstrates that even regulative pressures are not simply given, but rather a result of a construction that involves both government and groups of interests that exert pressure over the policy making process.

It is important to make a final remark about the nature of regulative pressures. As it was mentioned before, government regulations at the same time restrict and enable individual and organizational behaviors. Thus, regulations must be understood in a broader way that also embraces budgetary decisions that directed funds to university laboratories as part of strategic decisions of the U.S. federal government during wartime. According to Saxenian (1994)

> The Second World War and the ensuing Cold War recast the economic landscape of the United States. The federal government spurred the growth of new industries and regions by channeling resources to university labs to develop war-related technologies. Researchers at the Massachusetts Institute of Technology (MIT) and Stanford University, as leading beneficiaries of defense and aerospace contracts, spearheaded the economic transformation of Eastern Massachusetts and Northern California. Their pioneering research in radar, solid state electronics, and computing created localized pools of technical skill and suppliers that attracted stablished corporations and supported the formation of new enterprises. Fueled initially by federal funds, the process of entrepreneurship and technology advance became self-sustaining by the early 1970s and ensured the position of Route 128 and Silicon Valley as the nation's leading centers of electronics innovation and production. (p.11)

As we can see, state has played a fundamental role in the development of Stanford's entrepreneurial turn and, as a consequence, also in the creation of Silicon Valley economy. But the development of universities' entrepreneurial turn is also dependent of other kind of pressure that emerges from industry, or society in a broader sense. This kind of pressure sets the goals and the ways through which actors should pursue them.

The normative rules are responsible for the prescriptive, obligatory and evaluative character of social life. Normative systems encompasses values and norms. Values refer to "conceptions of the preferred or the desirable together with the construction of standards to which existing structures or behaviors can be compared and assessed. Norms specify how things should be done; they define legitimate means to pursue valued ends" (Scott, 2014, p. 64).

The notion of role derives from the normative systems, as some values and norms are applicable to some specific actors (Scott, 2014). If we take universities as an example, it is possible to see that their role has changed over time. "Far from being ivory towers, today universities have come to be regarded as important engines of economic growth and social change" (Vorley, 2015, xxiv). Nowadays society relies more and more on universities to generate innovation capable of transforming the reality of nearby communities and even the world as a whole.

If some universities' behaviors were once considered disruptive when they started taking an entrepreneurial turn, the reality for these universities is nowadays quite different, that is, there has been created an expectation for them to act entrepreneurially. This shift in what their roles are, represents changes in society's values and norms, which are in turn, influenced by diverse institutional pressures, among which some universities' entrepreneurial

turn can be highlighted. In other words, the entrepreneurial experience of some leading universities has contributed to changes in the way society perceives the universities' role. And this helps demonstrating how the recursive interplay between the institutional pressures is in charge of shaping these pressures themselves.

In other words, as society relies on universities more and more as the main driving force to innovation and therefore development, there is a continuous pressure over universities for them to develop entrepreneurially. On the other hand, as leading top universities start developing themselves entrepreneurially, this movement reinforces society's demands and creates new standards for other universities to follow if they want to be legitimated. As we can note, this creates a typically cyclic movement.

Cultural - cognitive pressures are also determinant when it comes to the development of the entrepreneurial turn of universities. As it was presented previously, the cultural-cognitive aspect of social life determines how actors perceive all the institutional stimuli. "Mediating between the external world of stimuli and the response of the individual organism is a collection of internalized symbolic representations of the world….Internal interpretive processes are shaped by external cultural frameworks" (Scott, 2014, p. 67).

Usual indicators of the cultural-cognitive pillar of institutions are common beliefs, shared logics of action, and isomorphism, while the basis of compliance are taken-for-grantedness and shared understanding. Although human cognition is an internal interpretive process, its foundations rest mostly on external cultural frameworks, and so, it constitutes an institutional pressure, evidencing its origin through recursive relational dynamics (Scott, 2014).

According to Hofstede (1991, p. 4) culture functions as the "software of the mind", which means it provides patterns for acting and mainly feeling and thinking. As we can see, it

brings meaning to human action. Related to this idea, Berger and Kellner (1981) emphasize the nature of human institutions.

> Every human institution is, as it were, a sedimentation of meanings, or, to vary the image, a crystallization of meanings in objective forms. As meanings become objectivated, institutionalised, in this manner, they become common reference points for the meaningful actions of countless individuals, even from one generation to the next. (Berger & Kellner, 1981, p. 31)

Universities constitute one of the best example of complex organizations and therefore face inherent conflictual situations motivated by its loosely coupled character (Weick, 1976) and also by the lack of control and the emergence of autonomous decisions by its members, what allows them to be regarded as organized anarchies (Cohen, March, & Olsen, 1972). As a consequence, universities' strategies on their entrepreneurial turn tend to be not consensual, but rather negotiated, bargained and resultant from internal and external political processes.

As we can see, the cultural-cognitive pressures are inherently resultant from a recursive interplay between the world and the actor. Following what these authors claim, cultural frames affect cognition and, therefore, organizational decisions. If we think of institutional entrepreneurs such as Frederick Terman, considered by many as the father of Silicon Valley (Gillmor, 2004) due to his remarkable work at Stanford University, we can assume that these individuals who play fundamental roles in leading great institutional changes, somehow translate the world of institutional stimuli under their own internalized symbolic representations of the world and then share the meanings, through actual leadership, to the

point they become objectivated and institutionalized, guiding other people actions throughout time.

This leads us to my final theoretical contribution, which is connected to this idea and stresses the fundamental role of the institutional work performed by institutional entrepreneurs in the process of developing the universities' entrepreneurial turn and further, how it affects the social world of institutions. The next subitem is dedicated to this topic.

2.2.2. The fundamental role played by institutional work performed by institutional entrepreneurs in shaping the institutional environment

In order to provide a fully comprehension on the concept of institutional work, it is necessary to define institutions, that is, the object of transformation of the referred work. According to Jepperson (1991, p. 143-145), institutions can be understood as the intentional or not intentional result of purposive action, being "an organized, established procedure" reflecting "standardized interaction sequences". Under this perspective, institutions "are the product of specific actions taken to reproduce, alter and destroy them" (Lawrence & Suddaby, 2006, p. 216).

The concept of institutional work, therefore, can be understood as "the sets of practices through which individual and collective actors create, maintain and disrupt the institutions of organizational fields" (Lawrence & Suddaby, 2006, p. 220). This definition sheds light on reflexive and goal-oriented agents who are at the center of the institutional dynamics. The main focus, thus, is trying to understand the interrelations between structure and agency (Battilana, Leca & Boxenbaum, 2009).

DiMaggio (1988) introduced the notion of institutional entrepreneurship, which expresses the agency of institutional entrepreneurs as they arrange the resources in order to create and empower institutions, according to their interests. This notion is not apart from the traditional notion of commercial entrepreneurship (Phillips & Tracey, 2007).

This dynamic between structure and agents is what allows institutional innovations, but is important to highlight that "the practices which might lead to institutional innovations are themselves institutionally embedded and so, rely on sets of resources and skills that are specific to the field or fields in which they occur" (Lawrence & Suddaby, 2006, p. 220).

Institutional entrepreneurs, can also be defined as "change agents who, whether or not they initially intended to change their institutional environment, initiate, and actively participate in the implementation of changes that diverge from existing institutions" (Battilana, Leca & Boxenbaum, 2009, p. 70)

Tolbert, David and Sine (2011) complement arguing that on the one hand, the way entrepreneurs perceive opportunities as well as the way they explore them are shaped by institutions. And on the other hand, entrepreneurs are themselves crucial to the processes that institutionalize new practices, forms and structures, thus shaping the institutional world.

Relating to that, Suddaby (2010) critiques the absence of individual analysis on institutional research given the importance of individual agency. He states:

> Institutional work, of course, is conducted by individuals and it is somewhat surprising to me how individuals often disappear from institutional research….if we take seriously the notion that institutions are powerful instruments of cognition, there must be some opportunity in conducting research on how institutional logics are understood and influence at the individual level of analysis….Yet I am surprised at how little effort has

> been expended by institutional researchers to understand how institutions operate through the influence and agency of individuals. This is, I think, an area of high opportunity for future inquiry. (p. 17)

But the type of institutional work performed is dependent on whether the intention is to create, maintain or disrupt institutions. Lawrence and Suddaby (2006), after conducting an extensive theoretical research identified ten different types of practices performed by actors that resulted in the creation of institutions, other six types dedicated to maintain institutions and three that disrupted institutions. Figure 9 sums up these practices.

As we can see, according to Lawrence and Suddaby (2006), looking at institutional work helps analyzing the interactive elements and moments of institutions production, and thus, it can be identified different forms of institutional work related to each goal, that is, creating, maintaining and disrupting institutions.

Regarding the creation of institutions, in summary, the efforts are dedicated to mobilize political and regulatory support; construct rule systems and structures; construct identities; change associations between practices and moral and cultural foundations; facilitate the adoption of practices by associating them with taken-for-granted practices; and educating actors according to the new institution in order to support it. When it comes to maintaining institutions the institutional work involved is dedicated to ensure adherence to rule systems, and at the same time, guaranteeing the reproduction of existing norms and belief systems. Finally, the forms of work applied for the disruption of institutions, has to do with "attacking or undermining the mechanisms that lead members to comply with institutions" (Lawrence & Suddaby, 2006, p. 235).

CREATING INSTITUTIONS	
Forms of institutional work	**Definition**
Advocacy	The mobilization of political and regulatory support through direct and deliberate techniques of social suasion
Defining	The construction of rule systems that confer status or identity, define boundaries of membership or create status hierarchies within a field
Vesting	The creation of rule structures that confer property rights
Constructing identities	Defining the relationship between an actor and the field in which that actor operates
Changing normative associations	Re-making the connections between sets of practices and the moral and cultural foundations for those practices
Constructing normative networks	Constructing of interorganizational connections through which practices become normatively sanctioned and which form the relevant peer group with respect to compliance, monitoring and evaluation
Mimicry	Associating new practices with existing sets of taken-for-granted practices, technologies and rules in order to ease adoption
Theorizing	The development and specification of abstract categories and the elaboration of chains of cause and effect
Educating	The educating of actors in skills and knowledge necessary to support the new institution
MAINTAINING INSTITUTIONS	
Forms of institutional work	**Definition**
Enabling work	The creation of rules that facilitate, supplement and support institutions, such as the creation of authorizing agents or diverting resources
Policing	Ensuring compliance through enforcement, auditing and monitoring
Deterring	Establishing coercive barriers to institutional change
Valorizing and Demonizing	Providing for public consumption positive and negative examples that illustrates the normative foundations of an institution
Mythologizing	Preserving the normative underpinnings of an institution by creating and sustaining myths regarding its history
Embedding and routinizing	Actively infusing the normative foundations of an institution into the participants' day to day routines and organizational practices
DISRUPTING INSTITUTIONS	
Forms of institutional work	**Definition**
Disconnecting sanctions	Working through state apparatus to disconnect rewards and sanctions from some set of practices, technologies or rules
Disassociating moral foundations	Disassociating the practice, rule or technology from its moral foundation as appropriate within a specific cultural context
Undermining assumptions and beliefs	Decreasing the perceived risks of innovation and differentiation by undermining core assumptions and beliefs

Figure 9: Forms of Institutional Work.
Source: Adapted form Lawrence and Suddaby (2006, p. 221-235)

Reay et al (2013) conducted a study to comprehend how the processes of accepting, adopting and institutionalizing new practices in the workplace occur. Their findings highlight

the fundamental role played by managers. According to the authors, "To summarize, we propose that managers attempted to transform new organizational ideas into new practices at the front line through: (1) micro-level theorizing, (2) encouraging 'trying it', and (3) facilitating collective meaning-making" (Reay *et al,* 2013, p. 985). Their model, as shown in Figure 10, reveals these three phases involved in institutionalizing new practices.

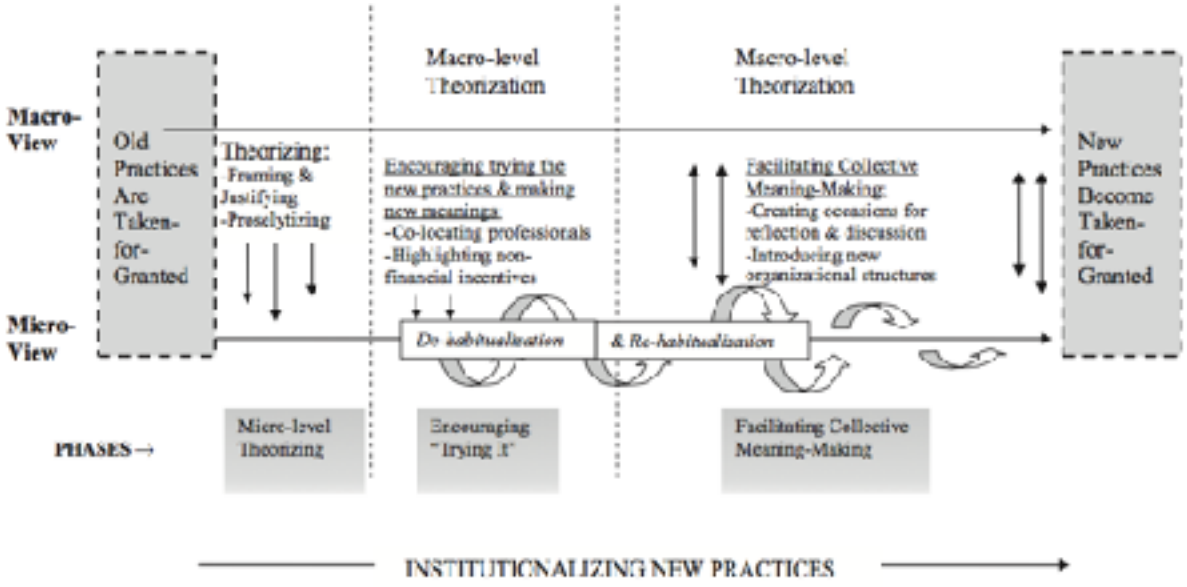

Figure 10: Transforming ideas into new practices.
Source: Reay *et al* (2013, p. 984).

Their perspective is based on the assumption that both macro and micro level processes are interdependent and thus needed to explain how new practices become institutionalized. The managers in their study, translated ideas from the macro to the micro level through framing and justifying new practices considering the local specificities. They also adopted proselytizing behaviors in order to convince people that those new practices should be adopted because they were appropriate and valuable. The so called micro-level theorizing thus shows its importance to encourage people to change (Reay *et al,* 2013).

Following this phase, the researchers found a second stage in which managers took a step forward and induced people to actually try the new practices and also make new

meanings from them, in an individual level. This was possible through the co-location of professionals in interdisciplinary work arrangements and a major focus on non-financial incentives (Reay *et al,* 2013).

And finally, to facilitate collective meaning-making, managers created occasions for reflection and engaged discussion, as well as introduced new organizational structures. This made possible to reconnect micro-level practices and the larger organizational context (Reay *et al,* 2013).

There are several studies about institutional work that tried to unveil the diverse processes involved in institutional maintenance and change. Some of them, as for example the work conducted by Harmon, Green Jr. and Goodnight (2015), emphasized the role played by communication and cognition in the processes of legitimation. Their framework helps to understand how institutions constrain and enable social actors simultaneously. In sum, according to the authors, intrafield rhetoric tends to constrain social actors, while interfield rhetoric enables them to change institutions, once they get freer from institutional bonds.

Some studies even take one step back and are dedicated to the comprehension of the differences in the capacity of apprehending institutional contradictions by individuals (Voronov & Yorks, 2015). The relevance of this kind of study resides on the fact that the way individuals apprehend institutional complexity, defines whether and how they will be change agents or not.

Connected to this idea, Mutch (2007) demonstrates that investigating an individual's biography, such as diverse personal and educational experiences may be useful to understand their propensity to be institutional entrepreneurs.

After Alvesson's paper "Organizations as rhetoric: knowledge-intensive firms and the struggle with ambiguity" published in 1993, a whole new body of researches has developed within institutional theory, the rhetorical institutionalism, that consists on "the deployment of

linguistic approaches in general and rhetorical insights in particular to explain how institutions both constrain and enable agency" (Green Jr. & Li, 2011).

Under this perspective, institutional entrepreneurs use rhetoric to produce contradictions decreasing the level of taken-for-grantedness and increasing the openness to change. "Institutional entrepreneurs reinterpret current institutional arrangements as inconsistent or incoherent by rearticulating motives from one institutional context and comparing or contrasting them with the motives of another" (Green Jr. & Li, 2011, p.1.677).

Battilana, Leca and Boxenbaum (2009) propose a model to explain how institutional entrepreneurship occurs, delineating the phases of the process from the emergence of the entrepreneur until the institutional change itself.

> Institutional entrepreneurs, because they initiate changes that break with existing institutions, face specific challenges arising from other actors' institutional embeddedness as well as potential political opposition. How institutional entrepreneurs manage the process of divergent change implementation is influenced by both field characteristics and actors' social positions. Divergent change might then diffuse throughout the field. If it does, the resulting institutional change will likely ultimately affect field characteristics and, thereby, possibly actors' social position (Battilana, Leca & Boxenbaum, 2009, p. 86).

As we can see from this excerpt, and from the perspectives presented previously in this session of the text, institutional entrepreneurship emphasizes the idea of the recursive interplay between institutional pressures and responses, admitting that today's actions may become tomorrow's pressures, to put in a very simple perspective. It also helps to understand

the enduring, yet by no means permanent nor unchangeable, nature of institutional pressures, which are a product of human construction and thus, subject to human agency.

The embedded nature of agency is also a fundamental aspect in order to understand how actors change institutions. As synthesized by Thornton and Ocasio (2008, p.103) “the interests, identities, values, and assumptions of individuals and organizations are embedded within prevailing institutional logics”. What individuals and organizations seek and the means they apply to achieve it, are directly dependent of prevailing institutional logics (Giddens, 1984).

Therefore, although the term "institutional" implies the idea of collectivity, it is also true that every collectivity is constituted, at its most basic level, by individuals. Ultimately individual cognition of the agents is the locus where all the different pressures deriving from all the diverse spheres of the institutional world meet and are processed, making it possible entrepreneurial initiatives to exist, such as the combination of distinct and or alien logics considering the institutional context.

And least but by no means less important, we need to be aware that “as its core, institutional theory is a theory of communication….institutions are formed by, maintained, and changed by communication” (Suddaby, 2011, p. 188).

The next item of this study will demonstrate the methodological procedures adopted in order to achieve my general research goal.

3. METHODOLOGICAL PROCEDURES

Theoretical-methodological alignment is a *sine qua non* condition for any scientific research. The adequate method is the one that fits the problem the best, or in other words, the set of procedures that lead to the accomplishment of the research goal.

Institutional Theory does not demand specific methods to be employed in order to access research problems within its theoretical tradition. The researcher can count on a good level of autonomy in choosing the methodological procedures (Tolbert & Zucker, 2010).

According to Scott (2016, p.4) "…the whole weight of institutional theory is about trying to look at the importance of the process, the surrounding context within which events unfold". With that in mind, and considering my general research goal, that is **to comprehend the development of Stanford's entrepreneurial turn by means of the historical dynamics of the recursive interplay between institutional pressures and institutional work**, my research can be classified as qualitative and descriptive, which employed a case study as a research strategy to address the problem.

At this point, it is important to graphically represent the relations between some fundamental variables of my model, as showed in Figure 11.

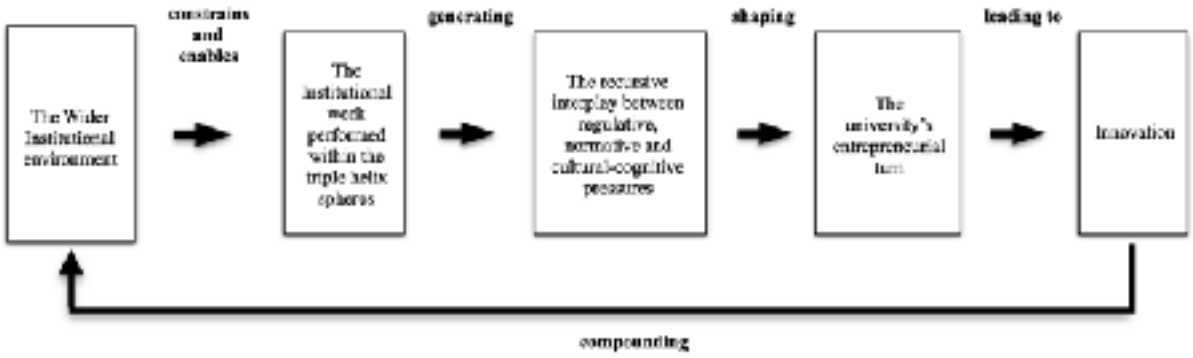

Figure 11: Relations between some fundamental variables of my model
Source: The Author.

Our model is based on the idea that the wider institutional environment in which agents are embedded, simultaneously constrains and enables them. Some of these agents will become active institutional workers within the triple helix spheres, and their work is what generates the recursive interplay between regulative, normative and cultural-cognitive pressures. The university's entrepreneurial turn emerges, thus, embedded in that context and leads to innovation.

The innovation that is resultant from this series of events does not only refer to new products arising from academic research, but also it refers to new ways through which universities' roles are legitimated. The results of this series of events compound the wider institutional environment and allows this cycle to restart, creating new institutional pressures, influencing other individuals and contributing to other universities' entrepreneurial development.

A qualitative approach is more appropriate due to the nature of the studied phenomena, which is not quantifiable, since the goal is focused on the explanation of processes involved in the development of the entrepreneurial turn of the university. As pointed out by Vieira (2006) a qualitative research is generally based on good evidence descriptions and also explanations of processes in local contexts, and thus, case studies (Yin, 2005; Stake, 2005) are a particularly relevant qualitative research strategy.

> Case study research consists of a detailed investigation, often with data collected over a period of time, of phenomena, within their context. The aim is to provide an analysis of the context and processes which illuminate the theoretical issues being studied. The phenomenon is not isolated from its context (as in, say, laboratory research) but is of

> interest precisely because the aim is to understand how behavior and/or processes are influenced by, and influence context. (Hartley, 2004, p.325)

In order to do this case study, it was used both primary and secondary data to address the phenomenon. Due to the historical character of my research goal, the secondary sources of data played a more relevant role in this study. I understand that the main limitation of my study consisted on not having the opportunity to interview the actors directly involved in the phenomenon which took place more than fifty years ago. However, I believe I could overcome this limitation due to the fact that Stanford University has been studied along decades by a multitude of researchers and there is plenty of scientific publications, both books and articles, along with other sources of non-scientific data, such as interview recording, and other institutional documents that provided sufficient information for this research and made possible this study. Figure 12 brings the list of the 40 sources of secondary data used to support the analysis.

Having such an abundance of publications about my empirical object, each one of them approaching Stanford's third mission from distinct point of views, allowed this story to be told from different perspectives and this made my case study richer, as suggested by Hartley (2004, p. 330) "The careful checking of constructs and theory against various sources of evidence helps prevent being biased by early impressions".

Source	References
Books	1. Berman, E P. (2012a). Creating the Market University: how academic science became an economic engine. Princeton: Princeton University Press. 2. Gibbons, J. F. (2000). The role of Stanford University: a Dean's reflections. In C-M. Lee, W. F. Miller, M. G. Hancock, & H.S. Rowen (Eds.). *The Silicon Valley Edge: a habitat for innovation and entrepreneurship.* (Chap. 10, pp. 200-217). Stanford: Stanford University Press. 3. Gillmor, C. S. (2004). *Fred Terman at Stanford: building a discipline, a university, and Silicon Valley.* Stanford: Stanford University Press. 4. Kvamme, E. F. (2000). Life in Silicon Valley: A first-hand view of the region's growth. In C-M. Lee, W. F. Miller, M. G. Hancock, & H.S. Rowen (Eds.). *The Silicon Valley Edge: a habitat for innovation and entrepreneurship.* (Chap. 4, pp. 59-80). Stanford: Stanford University Press. 5. Lenoir, T. (2014). Inventing the entrepreneurial university: Stanford and the co-evolution of Silicon Valley. In T. J. Allen, & R. P. O'Shea (Eds.). *Building Technology Transfer within Research Universities: an entrepreneurial approach* (Chap. 5, pp. 88- 128.). Cambridge: Cambridge University Press. 6. Mowery, D. C. (2005). The Bayh-Dole Act and high-technology entrepreneurship in U. S. Universities: chicken, egg, or something else? In Gary D. Libecap (Ed.). *University Entrepreneurship and Technology Transfer:* process, design and intellectual property. Advances in the Study of Entrepreneurship, Innovation & Economic Growth, Volume 16. (Chap. 2, pp. 39-68). Oxford: Elsevier. 7. Mowery, D. C., & Ziedonis, A. A. (2000). Numbers, quality, and entry: How has the Bayh-Dole Act affected US university patenting and licensing?In A.B. Jaffe, J. Lerner, & S. Stern. (Eds.). *Innovation Policy and the Economy*, volume 1. (Chap. 6, pp. 187-220.). Cambridge: The MIT Press. 8. O'Mara, M. P. (2005). *Cities of Knowledge: cold war science and the search for the next Silicon Valley.* Princeton: Princeton University Press. 9. Rowen, H. S. (2000). Serendipity or strategy: how technology and markets come to favor silicon valley. In C-M. Lee, W. F. Miller, M. G. Hancock, & H.S. Rowen (Eds.). *The Silicon Valley Edge: a habitat for innovation and entrepreneurship.* (Chap. 9, pp. 184-199). Stanford: Stanford University Press. 10. Saxenian, A. (1994). *Regional Advantage: culture and competition in Silicon Valley and Route 128.* Cambridge, MA: Harvard University Press.
Scientific articles	1. Berman, E. P. (2012b). Explaining the move toward the market in US academic science: how institutional logics can change without institutional entrepreneurs. *Theory and Society 41*(3)*,* 261-299. 2. Berman, E. P. (2008). Why did universities start patenting? Institution-Building and the Road to the Bayh-Dole Act. *Social Studies of Science 38*(6), 835-871. 3. Colyvas, J. A., & Powell, W. W. (2006). Roads to institutionalization: the remaking of boundaries between public and private science. *Research in Organizational Behavior 27,* 305-353. 4. Etzkowitz, H. (2013). Silicon Valley at risk? Sustainability of a global innovation icon: an introduction to the special issue. *Social Science Information 52*(4), 515-538. 5. Lécuyer, C. (2005). What do universities really owe industry? the case of solid state electronics at Stanford. *Minerva 43*(1), 51-71. 6. Loise, V. & Stevens, A. J. (2010). The Bayh-Dole Act Turns 30. *Science Translational Medicine 2*(52), 1-5. 7. Lowen, R. (1992). Exploiting a Wonderful Opportunity: The Patronage of Scientific Research at Stanford University, 1937-1965. *Minerva 30*(3), 391-421. 8. Ranga, M., & Etzkowitz, H. (2013). Triple Helix systems: an analytical framework for innovation policy and practice in the knowledge society. *Industry & Higher Education 27*(3), 237-262. 9. Stevens, A. J. (2004). The Enactment of Bayh-Dole. *Journal of Technology Transfer, 29*(1), 93-99. Retrieved in Jan. 18, 2017, from: https://link.springer.com/content/pdf/10.1023%2FB%3AJOTT.0000011183.40867.52.pdf

Non-scientific articles / documents	1. Barrett, P. M. (1980). Harvard fears congress may not pass patent bill. *The Harvard Crimson*, October 7. Retrieved in Jan. 10, 2017, from: http://www.thecrimson.com/article/1980/10/7/harvard-fears-congress-may-not-pass/?utm_source=thecrimson&utm_medium=web_primary&utm_campaign=recommend_sidebar 2. Bush, V. (1945). *Science, the endless frontier:* A report to the President. Retrieved in Jun. 12, 2017, from: https://www.nsf.gov/od/lpa/nsf50/vbush1945.htm 3. Economist, T. (2002). *Innovation's golden goose.* Retrieved in Apr. 5, 2017, from: http://www.economist.com/node/1476653 4. NFS - National Science Foundation. (2017). *Fact sheet.* Retrieved in May 30, 2017, from: https://www.nsf.gov/news/news_summ.jsp?cntn_id=100595 5. OSTP - The White House Office of Science and Technology Policy. (2017). Retrieved in Dec. 29, 2017, from https://www.whitehouse.gov/ostp/ 6. Science. (2016). *Science in the Oval Office: 1933–2016.* Retrieved in Nov. 30, 2016, from: http://www.sciencemag.org/news/2016/10/science-oval-office-1933-2016 7. SRI International. (2017). *About us.* Retrieved in Oct. 12, 2017, from: https://www.sri.com/about 8. The Administration. (2018). *Executive Offices.* Retrieved in Jan. 15th, 2018, from: https://www.whitehouse.gov/the-trump-administration/
Stanford Documents	1. DoResearch. (2013). *9.1 Inventions, Patents, and Licensing.* Retrieved in May, 14, 2016, from: https://doresearch.stanford.edu/policies/research-policy-handbook/intellectual-property/inventions-patents-and-licensing . 2. ICO - Industry Contracts Office. (2017). *ICO supports Stanford research by negotiating agreements that balance university and industry interests.* Retrieved in: Oct, 10, 2017, from: https://sites.stanford.edu/ico/ . 3. OTL. Office of Technology Licensing. (2017c). *Inventor's Guide.*Retrieved in: Oct, 12, 2017, from: https://otl.stanford.edu/documents/OTLinventorsguide.pdf . 4. OTL - Office of Technology Licensing. (2017a). *Life of a Stanford Invention.* Retrieved in: Oct, 10, 2017, from: http://otl.stanford.edu/documents/OTL_overview.pdf. 5. OTL - Office of Technology Licensing. (2014). *Risky Business - Office of Technology Licensing annual report 2013/2014.* Retrieved in: May, 1, 2016, from: https://otl.stanford.edu/documents/otlar14.pdf . 6. OTL - Office of Technology Licensing. (2017b). *The technology transfer process at a glance* 7. Retrieved in: Oct, 10, 2017, from: http://otl.stanford.edu/documents/process.pdf 8. Reimers, Niels J. (2015). Oral History. Stanford Historical Society Oral History Program Interviews (SC0932). Department of Special Collections & University Archives, Stanford University Libraries, Stanford, Calif. Retrieved in Jan. 10, 2018, from: https://purl.stanford.edu/sk314qb9448 9. SLAC - National Accelerator Laboratory. (2017). *About SLAC.* Retrieved in Dec. 28, 2017, from: https://www6.slac.stanford.edu/about 10. Stanford University (2017c). *Administrative Guide.* Retrieved in Aug. 15, 2017, from: https://adminguide.stanford.edu/chapter-9/subchapter-2/policy-9-2-1 11. Stanford University. (2017b). *A History of Stanford.* Retrieved in Jun. 22, 2016, from: https://www.stanford.edu/about/history/ 12. Stanford University. (2017a). *Stanford Facts 2017 - A look at Stanford University Today.* Retrieved in Dec. 28, 2017, from: http://facts.stanford.edu/pdf/StanfordFacts_2017.pdf 13. Stanford University. (2016). *Stanford Stories From The Archives.* Retrieved in Dec. 28, 2017, from: https://exhibits.stanford.edu/stanford-stories/feature/1910s

Figure 12: The secondary data
Source: The Author.

The primary data consisted of four interviews conducted with key members of the Stanford Office of Technology Licensing - OTL. These interviews happened in May, 2016, and had the intent to better understand the role of OTL, the risks and obstacles of its activity,

and how the entrepreneurial atmosphere is spread throughout the university. It contributed mainly to a deeper understanding of Stanford as an entrepreneurial university at the present time, giving information that helped to draw a picture of its entrepreneurial architecture, and thus comprehend the development of its entrepreneurial turn.

The semistructured interview script is in Appendix A at the end of this document. It is important to emphasize that the university keeps detailed records of all the formal information about its departments and units, and so it happens to OTL. Therefore, I decided to use the opportunity to talk to the interviewees about subjects that were not covered by these formal publications, but were equally important to my research. Figure 13 brings some details about the interviews.

Interviewees ID	Interviewee's position at OTL	Date	Interview length
A	Licensing Assistant	May, 6, 2016	44'57"
I	Senior Licensing Associate	May, 11, 2016	26'25"
S	Stanford Innovation Project Administrator at OTL	May, 16, 2016	23'08"
X	Senior Associate	May, 16, 2016	20'58"

Figure 13: The interviews
Source: The Author.

All the interviewees were previously contacted via e-mail and agreed to participate in this research. Although the content of the interviews was basically public information, the participants were told that no names would be published, so they could feel more comfortable in sharing facts with the researcher.

The decision to do only four interviews came after I noticed that no new information were emerging from the interviews. And also because understanding the functioning of OTL and Stanford entrepreneurial nature nowadays were not the central point of this study, which is more focused on how the entrepreneurial turn developed in the past.

The data collection from primary and secondary sources took place in 2016, within February and June of that year, while the author had the opportunity to be a visiting student researcher at the Graduate School of Education at Stanford University. Although the data collection happened within a short period of time, about four months, the data collected can be traced back historically to the beginning of the university, focusing specifically the period of time when its entrepreneurial turn began.

The data were later analyzed qualitatively in a process inspired by Bardin (1977) content analysis, except for the statistical examination proposed by the author, and by the process suggested by Hartley (2004) for case studies analysis.

Traditionally, as proposed by Bardin (1977), content analysis is developed through a three stage process: pre analysis, material exploration and results treatment and interpretations. Excluding the statistical examination of the data, which was not applied, Bardin's model was very useful to my purposes.

Another important contribution for my analysis was proposed by Hartley (2004), a way for analyzing data resultant from case studies. The author recommends a process that starts with a

> …careful description of the data and the development of categories in which to place behaviors or processes. The data may be organized around certain topics, key themes or central questions. Then the data need to be examined to see how far they fit or fail to fit the expected categories. Use of tables to search for patterns, or grouping of similar topics may help to examine certain types of data. Initial interrogations of the data may lead to unexpected or unusual results which may mean that the categories need refining or that events need to be interpreted differently. (p. 329)

Item 3.1 shows the correspondence of each research goal to each methodological procedure adopted. The specific goals were turned into research questions which made clearer the analysis variables I needed to investigate in order to answer the questions. Then, each variable was defined constitutively and operationally (Vieira,2006), allowing to choose what type of data, what type of data collection and what type of analysis I needed to employ in order to achieve my goals.

3.1 THE CORRESPONDENCE OF EACH RESEARCH GOAL TO EACH METHODOLOGICAL PROCEDURE ADOPTED.

3.1.1 First specific research goal

Identifying regulative, normative and cultural-cognitive pressures related to the university's entrepreneurial turn, that were fundamental to shape the institutional environment in which the university is embedded.

- Related research question: What were the main regulative, normative and cultural-cognitive pressures related to the university's entrepreneurial turn, that were fundamental to shape the institutional environment in which the university is embedded?

Figure 14 expresses the constitutive and operational definition of each analysis variables related to the first specific research goal.

Analysis Variables	Constitutive and Operational Definitions
Regulative institutional pressures	**Constitutive Definition** The regulative pressures tells the actors what the regulations they are subject to are. According to Scott (2014, p 62) "Individuals craft laws and rules that they believe will advance their interests, and individuals conform to laws and rules because they seek the attendant rewards or wish to avoid sanctions".
	Operational Definition This variable was addressed through researches in scientific and non scientific publications that dealt with the American regulatory system concerning the entrepreneurial turn of universities. I focused my attention on three major policies: The first was the creation of the National Science Foundation (NSF), the second the creation of the White House Office of Science and Technology Policy, and the third the Bayh-Dole Act. These secondary data were later analyzed qualitatively based on Bardin (1977) and Hartley (2004).
Normative institutional pressures	**Constitutive Definition** The normative pressures tells the actors what the goals are and how they should pursue them. The normative rules are responsible for the prescriptive, obligatory and evaluative character of social life. Normative systems encompasses values and norms. Values refer to "conceptions of the preferred or the desirable together with the construction of standards to which existing structures or behaviors can be compared and assessed. Norms specify how things should be done; they define legitimate means to pursue valued ends" (Scott, 2014, p. 64).
	Operational Definition This variable was addressed through researches in scientific and non scientific publications that dealt with the expected role of Stanford University concerning specifically its entrepreneurial agenda, that is, how actors both inside and outside Stanford expected the university to behave? These secondary data were later analyzed qualitatively based on Bardin (1977) and Hartley (2004).
Cultural-Cognitive institutional pressures	**Constitutive Definition** They determine how actors perceive all the institutional stimuli. "Mediating between the external world of stimuli and the response of the individual organism is a collection of internalized symbolic representations of the world….Internal interpretive processes are shaped by external cultural frameworks" (Scott, 2014, p. 67). Usual indicators of the cultural-cognitive pillar of institutions are common beliefs, shared logics of action, and isomorphism, while the basis of compliance are taken-for-grantedness and shared understanding. Although human cognition is an internal interpretive process, its foundations rest mostly on external cultural frameworks, and so, it constitutes an institutional pressure, evidencing its origin through recursive relational dynamics (Scott, 2014).
	Operational Definition This variable is also based on secondary data, and it was addressed through researches in scientific and non scientific publications that presented cultural-cognitive indicators, such as, common beliefs, shared logics of action and isomorphism related to how universities developed their third mission, focusing specially at how Stanford University developed its entrepreneurial turn over time. These secondary data were later analyzed qualitatively based on Bardin (1977) and Hartley (2004).

Analysis Variables	Constitutive and Operational Definitions
Institutional Environment	**Constitutive Definition** The institutional environment considered by this study is formed by regulative, normative and cultural-cognitive pressures related to the three spheres of the triple helix of innovation, that is, state, industry (or society, in a broader sense) and the university itself. I believe that individuals and organizations are at the same time producers and products of the institutional environment (Bjerregaard & Jonasson, 2014; Ferguson, 1998; Machado-da-Silva, Fonseca & Crubellate, 2005).
	Operational Definition This variable was addressed through researches in scientific and non scientific publications that dealt with the emergence of entrepreneurial universities, specially Stanford, and made clear the forces that compound the environment of their emergence. These secondary data were later analyzed qualitatively based on Bardin (1977) and Hartley (2004).
The triple helix systems of innovation components	**Constitutive Definition** The components need to be seen beyond the “blocks” of university, industry and government, that is, they need to be understood in a more detailed way, thus considering "(a) individual and institutional innovators; (b) R&D and non-R&D innovators; and (c) ‘single-sphere’ and ‘multi-sphere’ (hybrid) institutions” (Ranga & Etzkowitz, 2013, p. 241).
	Operational Definition In this study, I identified the components of the triple helix through researches in scientific and non scientific publications that dealt with the emergence of entrepreneurial universities, specially Stanford, and made clear the components involved in innovation creation, for exemple: Stanford's Presidents, Fred Terman, the Federal Government and the U.S. Military forces. These secondary data were later analyzed qualitatively based on Bardin (1977) and Hartley (2004).
The triple helix systems of innovation relationships	**Constitutive Definition** The relationships among the system components are also multiple and include not only market-driven interactions, as well as non-market. Therefore it can be technology transfer or acquisition, collaboration and conflict moderation, collaborative leadership, substitution and networking (Ranga & Etzkowitz, 2013).
	Operational Definition In this study, I identified the relationships of the triple helix components through researches in scientific and non scientific publications that dealt with the emergence of entrepreneurial universities, specially Stanford, and made clear the relationships involved in innovation creation. I focused on the institutional work performed by Fred Terman as a central piece of the engine, capable of binding together different expectations and interests of actors from all the three spheres of the helix. These secondary data were later analyzed qualitatively based on Bardin (1977) and Hartley (2004).
The triple helix systems of innovation functions	**Constitutive Definition** The functions of the triple helix systems are the generation, diffusion and use of knowledge and innovation, which are realized through articulation of the knowledge, innovation and consensus spaces (Ranga & Etzkowitz, 2013).
	Operational Definition In this study, I identified the functions of the triple helix systems through researches in scientific and non scientific publications that dealt with the emergence of entrepreneurial universities, specially Stanford, and made clear the functions involved in innovation creation. I focused on the ways through which Stanford, alongside with industry and government, have been able to generate, diffuse and use knowledge to create innovation. I observed the roles of each sphere in this process. These secondary data were later analyzed qualitatively based on Bardin (1977) and Hartley (2004).

Analysis Variables	Constitutive and Operational Definitions
The triple helix systems of innovation spaces	**Constitutive Definition** The formation of these spaces are the outcomes of the interaction between the triple helix spheres that get closer and closer over time to the point they overlap. The space created can be understood as a "stem cell space" that through the time will differentiate and evolve to knowledge, innovation and consensus spaces. This differentiation takes place through the combination of determined components, relationships, resources and through the creation of new institutional formats. All of these being under the influence of environmental specificities, such as, local or regional needs, resources and assets (Ranga & Etzkowitz, 2013). > The knowledge space encompasses the competencies of knowledge generation, diffusion and use of the Triple Helix components. The construction of this space is an essential step in the transition to a knowledge society and has the purpose of creating and developing knowledge resources in order to strengthen the local, regional and national knowledge base, to avoid fragmentation and to reduce the duplication of research efforts….The innovation space consists in particular of the competencies of the 'multi-sphere' (hybrid) organizations and entrepreneurial individuals and institutions… Its ultimate purpose is the development of local innovative firms, in parallel with the attraction of talent and innovative firms from elsewhere, the creation and development of intellectual and entrepreneurial potential, and competitive advantage for the region and the country….The consensus space is the set of competences that bring together the Triple Helix system components to engage in 'blue-sky' thinking, discuss and evaluate proposals for advancement towards a knowledge-based regime. (Ranga & Etzkowitz, 2013, p. 247).
	Operational Definition In this study, I identified the spaces of the triple helix systems of innovation through researches in scientific and non scientific publications that dealt with the emergence of entrepreneurial universities, specially Stanford, and observed the dynamics involved in the creation of theses spaces, as for exemple, the creation of the industrial park. These secondary data were later analyzed qualitatively based on Bardin (1977) and Hartley (2004).
Stanford University's Entrepreneurial Turn	**Constitutive Definition** According to Goldstein (2010), the entrepreneurial turn includes: > 1) the active involvement of universities—as institutions—in the development and commercialization of technology stemming from university-based research; and; 2) changing the internal regulations, rewards and incentives, norms of behavior, and governance of universities to remove barriers to individual faculty, other researchers, and research centers/institutes engaging in behavior that leads to the commercialization of university-generated knowledge. (pp. 84)
	Operational Definition Considering that my general research goal is "to comprehend the development of Stanford's entrepreneurial turn by means of the historical dynamics of the recursive interplay between institutional pressures and institutional work", I focus my analysis on this "turn" specifically, that is, the processes that made Stanford an entrepreneurial university. This way, the data collected includes secondary historical data containing information from the past, such as scientific articles and books that tell how this story developed throughout time, and also more current data that help to understand where the university has been taken due to this turn, such as semistructured interviews with members of Stanford OTL - Office of Technology Licensing. The interviews conducted with OTL members played a fundamental role improving my comprehension of the phenomenon from a contemporary perspective. These primary and secondary data were later analyzed qualitatively based on Bardin (1977) and Hartley (2004).

Figure 14: My methodological framework concerning the first specific research goal.
Source: The Author.

3.1.2 Second specific research goal

Identifying the university's responses to these institutional pressures, emphasizing the institutional work performed by institutional entrepreneurs.

- Related research question: What were the main university's responses to these institutional pressures, emphasizing the institutional work performed by institutional entrepreneurs?

Figure 15 expresses the constitutive and operational definition of each analysis variables related to the second specific research goal.

Analysis Variables	Constitutive and Operational Definitions
Institutional Work	**Constitutive Definition** "The sets of practices through which individual and collective actors create, maintain and disrupt the institutions of organizational fields" (Lawrence & Suddaby, 2006, p. 220). This definition sheds light on reflexive and goal-oriented agents who are at the center of the institutional dynamics. According to Lawrence and Suddaby (2006), looking at institutional work helps analyzing the interactive elements and moments of institutions production, and thus, it can be identified different forms of institutional work related to each goal, that is, creating, maintaining and disrupting institutions.
	Operational Definition This variable is also based on secondary data, and it was addressed through researches in scientific and non scientific publications which present examples of institutional work, relating specially to how Stanford University developed its entrepreneurial turn over time. I searched for examples of actions and discourses by members of Stanford - as well as by external actors - that were relevant to the development of its entrepreneurial turn. These secondary data were later analyzed qualitatively based on Bardin (1977) and Hartley (2004).
Institutional Entrepreneurs	**Constitutive Definition** "Change agents who, whether or not they initially intended to change their institutional environment, initiate, and actively participate in the implementation of changes that diverge from existing institutions" (Battilana, Leca & Boxenbaum, 2009, p. 70)
	Operational Definition We considered institutional entrepreneurs the individuals who performed institutional work and had a fundamental role in shaping the institutional environment in which Stanford entrepreneurial turn evolved. It is important to highlight that people outside Stanford could also be considered. This variable was also based on secondary data, and was later analyzed qualitatively based on Bardin (1977) and Hartley (2004).

Figure 15: My methodological framework concerning the second specific research goal.
Source: The Author.

3.1.3 Third specific research goal

Comprehending the relation between the institutional pressures and the university's responses in shaping the development of this university's entrepreneurial turn.

- Related research question: How the institutional pressures and the university's responses in shaping the development of this university's entrepreneurial turn can be related?

Figure 16 expresses the constitutive and operational definition of the analysis variable related to the third specific research goal.

Analysis Variable	Constitutive and Operational Definitions
The historical dynamics of the recursive interplay between regulative, normative and cultural-cognitive pressures	**Constitutive Definition** "A field constructs a social universe in which all participants are at once producers and consumers, caught in a complex web of social, political and cultural relations that they themselves have woven and continue to weave." (Ferguson, 1998, pp. 598). Therefore, in order to understand why some universities behave the way they do, while others behave differently when it comes to acting entrepreneurially, we need to look at the recursive interplay between universities and their institutional environments, mediated by institutional entrepreneurs, because this historical dynamics is what shapes both collective and individual pressures and responses, in accordance to what Padgett and Powell (2012) and also Scott (2014) point out: "In the short run, actors create relations; in the long run, relations create actors." (Padgett & Powell, 2012, pp. 2) and "In the short run, actors create and modify meanings; in the long run, meanings create actors, both organizational and individual identities." (Scott, 2014, pp. 223)
	Operational Definition This historical dynamics was also addressed through secondary data from scientific and non scientific publications that dealt with the processes involved in the development of Stanford entrepreneurial turn over time. These data were later analyzed qualitatively based on Bardin (1977) and Hartley (2004).

Figure 16: My methodological framework concerning the third specific research goal.
Source: The Author.

As we can see, these methodological frameworks presented by figures 14, 15 and 16 summarize the methodological procedures and allows having a holistic comprehension on how I have decided to address the studied phenomenon.

In the next item the data will be presented and the analysis conducted.

4. DATA PRESENTATION AND ANALYSIS

As it was mentioned before, the phenomenon of Stanford's entrepreneurial turn is, actually, a fact that is better comprehended if we look to the past, thus, the majority of my data is secondary. However, it is of highly importance that first of all I characterize the university I an studying, in order to understand, from a contemporary perspective, where it has been taken due to its entrepreneurial turn.

4.1 CURRENT GENERAL STANFORD UNIVERSITY FACTS AT A GLANCE

Figure 17 summarizes current general facts about Stanford University, and although it is a self explaining table, I would like to highlight some of the information presented in it that are directly connected to my research goal.

As it was previously stated in this study, entrepreneurial universities have great quality in common (Garcia *et al* 2014), and one way to assure that is by strong investments in a high quality faculty plenty of star scientists able to influence others into a more entrepreneurial direction (Vorley & Nelles, 2008). Stanford clearly does this both qualitatively and quantitatively, given the impressive student to faculty ratio.

Other point that deserves more attention is its focus on research, which can be demonstrated by the majority of students from this level of study. Cutting edge science is more likely to emerge from graduate teams and this, favors the university's image (Brew, 2009), contributing to its legitimation among the general public and more important, among the industry and the state, its main investors.

Type of organization	Private non-profit
Location	Stanford - California's Bay Area - USA
Campus	Single Campus 8,180 contiguous acres (aprox. 33 square km.) Nearly 700 major buildings 97% of undergraduates live on campus
Opened in Years since opening (as of 2018)	1891 127
Faculty	2,180 faculty members 19 Nobel laureates are currently members of the Stanford community 4:1 student to faculty ratio
Number of undergrad. students (as of 2017)	7,032 in 70 programs of study
Number of grad. students (as of 2017)	9,304 in 60 departments and programs
Schools	7 schools: Business, Earth Sciences, Education, Engineering, Humanities and Sciences, Law and Medicine
Research (as of 2016-2017)	6,000+ externally sponsored projects $1.6 billion total budget (81% of this is sponsored by the U.S. Federal Government)
Budget Sources (as of 2016-2017)	US$ 5.9 billion total budget 20% endowment income 20% health care services 18% sponsored research 15% student income 10% SLAC National Accelerator Laboratory 9% other income 6% expendable gifts and net assets released 2% other investment income
Expenditures (as of 2016-2017)	59% in salaries and benefits 37% in operating expenses 4% debt service
Endowments in Dollars (as of Aug. 31, 2016)	$22.4 billion
Office of technology (as of 2015-2016)	In 2015–16 OTL concluded 141 new licenses.
Innovation facts (as of 2015-2016)	In 2015–16 Stanford received $94.22 million in gross royalty revenue from 779 technologies. Forty-eight of the inventions generated $100,000 or more in royalties. Seven inventions generated $1 million or more.

Figure 17: Current general Stanford University facts at a glance
Source: Stanford University (2017a).

Specifically about investments in research, it calls my attention the fact that more than 80% of the total sponsored research budget comes from the U.S. Federal Government. That is,

even being a private entrepreneurial university, the State still plays the major role when it comes to research funding.

The close relation between Stanford and the U.S. government can also be seen at the SLAC National Accelerator Laboratory that belongs to the U.S. government, more specifically to the Department of Energy (DOE), and is operated by Stanford University. It started its activities in 1962 and it owns the longest particle accelerator of the world. Its advanced research facilities attract scientists from all over the world, where they can work on the creation of many things, such as new drugs, materials for electronics and clean energy alternatives. “Six scientists have been awarded Nobel prizes for work done at SLAC, and more than 1,000 scientific papers are published each year based on research at the lab” (SLAC, 2017).

Stanford has some crucial characteristics that makes the difference when it comes to facilitate innovation creation, and it is way beyond its one of a kind strategic location in the heart of Silicon Valley, its high research budget and its outstanding faculty.

The first thing that can be observed among research groups, faculty and students is the valorization of interdisciplinarity. Thinking across disciplines seems to be a key feature to create novelty, and this kind of exchange between different areas is encouraged at Stanford, if we observe for example the CV of scientists, or even OTL members, with their BA, Master's degree and PhD in different areas. This characteristic reflects the wider nature of academic courses in the U.S. if compared with other countries such as Brazil, where the student starts his or her university life within a predeterminate course with a closed curricula and a single possible graduation title.

Secondly, Stanford has a wide array of entrepreneurial related opportunities for those in the academic community who are interested in that. From courses to mentorship programs[1] and even seed funding, as stated by interviewee "S":

> *There's a lot of things going on here. We have several courses about entrepreneurship, creativity and innovation for undergraduate and graduate students; we have Ifarm; Startup Garage; Stanford Ignite; Stanford Venture Studio; we have STVP, which is the… the Stanford Technology Venture Program, the entrepreneurship center at the School of Engineering; there is Spark at Med School; seed funding opportunities, such as the Stanford Bio-X Interdisciplinary Initiatives Seed Grant Program… There's also StartX, I don't know if you are familiar with, but StartX is an accelerator which is actually our partner, focused on Stanford entrepreneurs… so, I mean, there is a very strong environment over here* (S. 2016).

In third place, I need to mention Stanford's mastery over its own entrepreneurial architecture (Vorley & Nelles, 2008). It has succeeded, both on more concrete and more abstract aspects that together has shaped its entrepreneurial agenda as we know. A special element from its entrepreneurial architecture that needs to be emphasized, because it surpasses

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[1] As the focus of this study is not to describe how all of these current entrepreneurial programs work, for additional information please visit the websites listed below:

- Stanford Ignite: https://www.gsb.stanford.edu/programs/stanford-ignite
- Stanford Ifarm: https://web.stanford.edu/group/ifarmteams/
- Stanford Venture Studio: https://www.gsb.stanford.edu/stanford-community/entrepreneurship/venture-studio
- Startup Garage: https://www.gsb.stanford.edu/stanford-gsb-experience/learning/entrepreneurship/startup-garage
- STVP- Stanford Technologies Venture Program: http://stvp.stanford.edu/
- Stanford Bio-X seed grants: https://biox.stanford.edu/research/seed-grants
- Spark translational research program at Stanford Medicine: http://med.stanford.edu/sparkmed.html
- StartX (which is not a Stanford unit, but an accelerator and a direct partner of the university entrepreneurial agenda): https://startx.com/

other universities, is the culture. As pointed out by interviewee "A" *"the culture at Stanford, I'm sure you know, is very like…everyone wants to have a startup"* (A. 2016).

The next item will present Stanford's OTL - Office of Technology Licensing and how the innovation cycle happens at the university.

4.2 STANFORD'S OTL - OFFICE OF TECHNOLOGY LICENSING

Stanford's OTL was created in 1970 and "is responsible for the formal transfer of patents, copyrights and other technology through license agreements [having as its mission] to promote the transfer of Stanford technology for society's use and benefit while generating unrestricted income to support research and education" (OTL, 2017a). According to interviewee "I": "Our office is a facilitator to help the invention to move from the bench to the market. We're facilitators" (I. 2016).

Its results are impressive: 141 new licenses concluded in 2015-16 and more than 3,600 cumulative licenses; as a result of license agreements, Stanford holds equity in 149 companies, as of August 31, 2016; 469 new disclosures in 2016 and 11,331 cumulative disclosures; some of the most notable Stanford inventions include, FM Sound Synthesis in 1971, Functional Antibodies in 1984, and Improved Hypertext Searching - Google™ in 1996 (OTL, 2017a).

It is important to highlight that although OTL generated almost $95 million in 2015-16 as royalties revenue, as it can be seen in Figure 16, this sum still represents a very small part of the total invested in research at Stanford, which is nearly 17 times bigger than that. In other words, the university does not depend financially on the OTL outcomes. However, its main role to the university, seems to be motivating the whole academic community to engage in

researches with high potential to have a practical impact in people's lives. OTL paves the roads that connect researchers on one side and the society on the other side.

Related to that, when questioned if there was still room for scientists who produce blue sky science at Stanford, all the interviewees were emphatic that the entrepreneurial disposition of the university currently coexists peacefully with the liberal arts agenda. Some areas neither have the vocation nor the willingness to create applicable knowledge capable of being put into market, and that is totally fine, because these areas are as important to the university and to the development of the students and society as the other areas.

> *Some researchers here are purely academic and don't care about commercializing technologies. You know…maybe there are still small universities that consider patent activity for tenure track positions or something. But this is not a criteria by any means here at Stanford, our main goal is researching, publication and knowledge for the public. And if something is able to be commercialized, that's great! But I don't believe that this is a main focus here at Stanford (S. 2016).*

In addition, as it was stated by interviewee "X", applied science usually does not publish so well. Considering that nowadays the faculty face strong competition to not only build but also keep their careers, publication in top journals is mandatory. Therefore they need to focus on high science level researches, that most of the times, do not turn out to be marketable.

> *If the scientists are interested in their careers, and believe me, to be at Stanford, to get grants to do a scientific research, it's very competitive nowadays, so they need to*

publish very well. Applied science usually does not publish that well so they do need to do blue ski science. If they don't publish, they don't get grants, and if they don't get grants they're out. Unless they've already…they have a very mature career, well stablished, and by that time they may have some secure funding sources, so they don't need to worry so much. But early stage career scientists they need to focus on their career, they need to focus on publication (X. 2016).

Drawing on a broader perspective about the balanced importance of universities' each mission, interviewee "I" considers that, in fact, technology transfer is a secondary goal of universities and that their real greatness consists on doing research and then make it public. However, sometimes their researches may have a greater impact in society if, for example, they are translated into market products. In this cases, offices of technology support researchers throughout these translational processes which demand experienced professionals such as analysts and lawyers to guarantee the compliance with regulations, always in search of what is better for the invention, and many times with the active involvement of the inventor in the process.

The main goal of a university is, in my view, to do research and then to publish, so what we do is secondary, is not the main goal of a university. But many times they have inventions that could benefit the public so our office has the mission to help putting them on the market, this way generating products that the public can use and then in return generate income that fund back university research… and the majority of researchers, professors, students are very interested in putting forward disclosures and even becoming part of companies to take forward their innovation… a lot of them are

> *interested in helping this happen. So with the inventor involvement is easier to put the invention in the market* (I. 2016).

Considering that the entrepreneurial culture is something surely spread around the campus, thanks to all those university courses and programs, and the Silicon valley ecosystem as a whole, OTL nowadays does not need much effort to attract researchers and their inventions. As stated by interviewee "I":

> *Mostly they [the inventors] come to us. But it depends on the university. Some universities are not so lucky to be in Silicon Valley, so for many of them you need to do that, you need to educate, you have to make them aware, you have to provide incentives. You have to do what is right for your environment. This is such an entrepreneurial environment, we do not have to dig too deep, but you may have to do that in other places. Compared with the past when all of this started, people's awareness at Stanford is definitely higher.*

But how the innovation cycle happens at Stanford with the intermediation of OTL? Figure 18 is a representation of its nine-stage continuous process, which include: research, invention disclosure, assessment, intellectual property, marketing to find a licensee, selecting a licensee, licensing, commercialization and royalties.

Figure 18: The technology transfer process at Stanford through OTL
Source: OTL (2017c, p. 7-9).

As we can see, it all starts with the research being conducted at the university by the faculty and students from all levels of study. The majority of research funds come from the Federal Government, but there is also industry-sponsored researches. In these cases, when a

company makes the first move and is interested in setting a partnership with a researcher or research group, for example, OTL has a unit specialized in mediating these partnerships, in order to balance university and industry interests. It is the ICO - Industrial Contracts Office. This office is responsible for negotiating and signing agreements on behalf of Stanford when researches involve interactions with industry or funding from industry or even research materials from laboratories located outside the university (ICO, 2017). Regarding ICO, interviewee "I" commented on the interaction with OTL: *"The industrial contracts office facilitate the sponsorship of companies, industries, to a particular project. If an invention come out of this project and if the company is interested, then the OTL participate"* (I. 2016).

The second stage is the invention disclosure. Stanford scientists are strongly recommended to tell OTL about inventions they have made as results of their researches before publicly describing the invention both for scientific and non scientific audiences. This is a way to preserve potential patent rights when applicable (OTL, 2017c).

The third stage is critical, because there is no possibility to invest time, work and mainly the needed amount of money on each and every disclosure that is presented to OTL. Rather, the licensing teams have to decide which inventions can make an impact on the market. According to interviewee "I", the operation of an office such as OTL is expensive, so the university needs to have conditions to support this activity:

> *What we bring in today is something that we've planted maybe ten years ago. So you need patience, I mean, you have to have a university that has the patience, the belief, the investments, the ability and the will and the wish to do it, because if you have a short term horizon this is not gonna work. It takes a really long time to get inventions from university to the market. It's not quick. So any university that doesn't have a long term*

> *horizon probably will not see the fruit. The income we get today is some of what we invested probably over many other years in the past. To start an office of technology transfer the university needs to believe that it is worth it, because initially there is an investment, mostly in patenting, that is very expensive. The whole operation is expensive. So today we plant the seeds for two years, five years, ten years…and maybe one day it will become a fruit, but you don't know* (I. 2016).

Following the stages, before marketing the technologies OTL guarantees that the invention has its intellectual property properly protected. This is expensive and many times inventions don't pay off. *"It's a portfolio approach. They invest in many and one it's gonna make it big"* (X. 2016). There is an example:

> In 2004 researchers disclosed an invention that could potentially reduce the risk of a patient having a heart attack…several companies expressed interest…however by 2007 we had not concluded any negotiation…by 2009 after OTL spent over $90,000 on patent expenses, the company was not interested in these patents and we decided to abandon all of them (OTL, 2014, p. 9).

According to the interviewees, as mentioned before, when the inventors help preparing marketing materials and finding potential licensees, the chances of success are higher. So during stages 5 and 6 the participation of the inventor is particularly important. There are also times when the licensee is a faculty and/or students spin-off. And when this happens, OTL has a special attention to do a conflict of interests review, once the university can not use public funds and its own resources for the personal gain of few people. As stated by interviewee "X":

One big concern is if the company is being incubated at the researcher's lab. The researcher could be using PhD students or postdocs that are trying to develop a career… they could be using them for his company or her company and the researchers have a lot of power over the PhD students. We don't want that. The PhD students should be working on projects of high scientific value, not developing projects for the researchers companies, they're not employees. So there is a process of separation. At one point there is a separation at which the project needs to go out, leave the university, because we can't use university resources for personal gains. The conflict of interests manager discusses with the researcher about a separation plan for the work of the company from the work at the university.

All of the processes performed by OTL comply with stablished regulations and are free of any vicious procedure. So there is no preferable company to be the licensee of a technology. Being smaller or bigger company does not make any difference, since all the probable licensees are asked to prepare a development plan. The decision whether to license or not the invention to a company is based on this plan.

We would choose smaller companies that have the resources to focus on this technology than bigger companies that would put this in the bottom and kind of just sit on it. Actually we don't prefer smaller companies, but if they have a plan…we just wanna do what is best for bringing the invention to market for public use. We don't favor anyone but we will choose smaller companies if they have better plans (A. 2016).

The same is true when comparing local or foreign companies. The required development plans must also be in accordance with regulations that present several conditions for research that is funded by the Federal Government, for example, that the products are manufactured substantially in the US, and according to interviewee "X": "*If a foreign company is willing to manufacture substantially in the U.S. we can licensing to the foreign company*" (X. 2016).

All OTL interviewees considered that it is quite difficult to make Scientific and Industry interests meet, because the technologies produced by research teams are usually very early stage and for that reason, they may not be interesting for industry. Interviewee "I", thus, highlights the important role of all the Stanford's entrepreneurial programs mentioned before in this study.

> *The main hurdle is that industry mostly likes proven technology, but our technology is very early, so in the lab you don't have so much validation. Sometimes you have, but they want more validation. And this is not the role of university, as I said, industries are worried about the risk…so we have lots of programs around campus that are entrepreneurial and their major goal is to translate early stage research, that is very early, so you need to translate it to overcome what we call the valley of death, so you can overcome the challenge, the risks and then it will be more licensable. What these programs do is just to give a boost to early stage technologies to move them over the threshold, because when they are so early stage, they may not be interesting for industry.* (I. 2016).

Signing a license agreement is just the beginning of a long term relationship between the university and the licensee, because usually the company needs to continue investing in

the development of the technology until the risks involved in the commercialization to its final public are lower. There are some foreseen performance milestones in licenses, and if the licensee does not reach what was agreed previously, the agreement may be terminated and OTL can pursue other company to be a new licensee (OTL, 2017c).

Thus, the criticism that some may have that companies are benefiting from public money in order to make profits does not make sense. In fact, companies assume practically all the risk when investing in a innovation and, without their commitment, these innovations would had never achieve their full potential to contribute to the development of society, as many inventions already had. “A dollar's worth of academic invention or discovery requires upwards of $10,000 of private capital to bring to market. Far from getting a free lunch, companies that license ideas from universities wind up paying over 99% of the innovation's final cost” (Economist, 2002).

If the licensed technology succeed, Stanford receives royalties, both in cash and/or equity in return. It's distribution follows Stanford’s internal policies, summarized in Figure 19.

1. Cash Royalties A deduction of 15% to cover the administrative overhead of OTL is taken from gross royalty income, followed by a deduction for any directly assignable expenses, typically patent filing fees. After deductions, royalty income is divided one third to the inventor, one third to the inventor's department (as designated by the inventor), and one third to the inventor's school. In the case of Independent Laboratories and Independent Research Centers or Institutes, which report directly to the Vice Provost and Dean of Research (who is the cognizant Dean for these research units), the inventor may assign to his or her Independent Laboratory, Center or Institute the department's third of the royalty income or a part thereof, based on support of the work. In these cases, the School's portion goes to the Dean of Research. Similarly, when more than one department is involved, the inventor shall designate the distribution of the department and school thirds based on support of the work. Disagreements involving royalty distribution will be reviewed and resolved by OTL; involved parties may appeal the OTL resolution to the Dean of Research.	**2. Equity** Stanford may at times accept equity as part of the license issue fee. Net equity, i.e., the value of the equity after the deduction of 15% to cover OTL administrative costs, will be shared between the Inventor(s) and the University, with the University share going to the OTL Research and Fellowship Fund. The University's share of equity will be managed by the Stanford Management Company, and the OTL Research and Fellowship Fund is administered by the Vice Provost and Dean of Research. (All other cash payments, including royalties based on sales, will be distributed in accordance with the provisions of (1) Cash Royalties.

Figure 19: Stanford’s Internal Policies for Royalties distributions resultant from licensing.
Source: DoResearch (2013).

Finally, the last stage is constituted by reinvestments in research and education, feeding the continuity of the innovation cycle. As cited before, the amount of money that is generated by the commercialization of Stanford scientific discoveries, still represents very little if compared to the amount of money that is invested in research at the university. However, the financial rewards of all the work performed by OTL along with the inventors are just a minimal part of the real outcomes that are generated through this process. The main importance of what is done seems to be the internal and external legitimation of a strong entrepreneurial architecture that has contributed to create and keep Stanford's remarkable commitment to its third mission, that is, to engage in attending society's needs in more direct ways. As a result, more talented and motivated people are attracted to the university, more companies seek for partnerships with its research teams, more investments are made, more discoveries emerge and so on in a continuous and self sustained cycle.

4.3 STANFORD'S ENTREPRENEURIAL TURN DEVELOPMENT: AN ANALYSIS OF THE RECURSIVE INTERPLAY BETWEEN INSTITUTIONAL PRESSURES AND UNIVERSITY RESPONSES AS A RESULT OF INSTITUTIONAL WORK

Although I have subdivided my general research goal in three specific goals, I must admit that this effort aimed only at facilitating the comprehension of the dimensions I was going to investigate throughout this study.

In practice, if I am to believe in my own theoretical assumptions, which I am, there is no such a thing as a separation between institutional pressures and an organization's responses, because my main variable is precisely the historical dynamics of the recursive interplay between regulative, normative and cultural-cognitive pressures alongside with the

institutional work performed by institutional entrepreneurs. This way, it would not make sense trying to deliver a somehow truncated analysis.

Therefore, having in mind the Constitutive and Operational Definitions presented in Figures 13, 14 and 15, this item is dedicated to address my general research goal: **to comprehend the development of Stanford's entrepreneurial turn by means of the historical dynamics of the recursive interplay between institutional pressures and institutional work.**

After reflecting much on how I should present all the information I needed in order to construct my analysis and build my argument, I have come to the conclusion that the best way was telling a story.

The story I am going to tell is about the development of Stanford's entrepreneurial turn. And the way I am going to tell this story is focusing on the historical dynamics of the recursive interplay between institutional pressures and institutional work that were fundamental for shaping it.

As we are going to see, the story of Stanford entrepreneurial turn is multifaceted and, thus, have lots of forces and variables involved as well as turning points throughout it. But my choice was to tell this story within a single and uninterrupted flow, therefore, there won't be other subdivisions in this analysis from now on.

Stanford University was founded in 1885 as a memorial in honor of the only child, who died due to typhoid, at an early age, only 15 years old, of California Senator and former Governor, also railroad magnate, Leland Stanford and his wife, Jane Lathrop Stanford. This is the reason the legal name of Stanford is Leland Stanford Junior University. On October, 1st, 1891 the university was officially open in an area of approximately 33 Square Kilometers,

which had previously been their family farm, that is why the nickname of the university is "The Farm" (Stanford, 2017b).

The couple Leland and Jane, together with the university's first president, David Starr Jordan, "aimed for their new university to be nonsectarian, co-educational and affordable, to produce cultured and useful graduates, and to teach both the traditional liberal arts and the technology and engineering that were already changing America" (Stanford, 2017b). So as we can see, from its beginning Stanford vocation covered a wide range of knowledge areas. It was not meant to be neither a pure liberal arts, nor a pure technological space. It is rather a balanced space.

As we can see, the relationship between Stanford, the Government and the industry dates back to its crib. Leland Stanford, its founder, was himself the personification of the triple helix, that is, he was a politician and thus, representative of the public sphere, being former California Governor and then Senator; he was a successful entrepreneur, railroad magnate that had helped to connect west and east coasts; and finally, he was responsible for the creation of a university that from its beginning is committed to being useful for the nation development.

Under the presidency of Wilbur, Stanford's third president, in office from 1916 to 1943, Stanford went through some major administrative changes, such as: the institution of undergraduate tuition fees in 1919; a series of fund raising efforts from 1922 on; and new ways to invest the university's endowments (Gillmor, 2004).

It was Herbert Hoover, Stanford Alumnus from its Pioneer Class in 1895, and future president of the United States, the one who led the discussion at the board of trustees that decided for the institution of tuition. Hoover was elected in 1912 to compound the board of trustees, role that allowed him to help the Administration of the University directly, beyond

being a benefactor, which he actively was. He “professionalized university operations in the 1920s and helped to put Stanford on a sound financial footing. He founded an institute to collect global political material – today’s Hoover Institution Library and Archives – and led the creation of the Graduate School of Business" (Stanford, 2017b).

This way, outside funding started playing a fundamental role developing the university as a whole, improving, “faculty salaries and benefits, teaching and research facilities, scholarships, library and scientific collections, student housing, and even the water supply” (Gillmor, 2004, p. 39).

As many other researchers that were attracted by the University that was standing out in the West, the researcher Lewis Terman, the father of Fred Terman, arrived at Stanford in 1910, when the university was still less than 20 years old, but had already built a some reputation in the biological sciences, engineering and geology (Gillmor, 2004).

His son, Fred Terman, had the opportunity of living on campus during childhood and as a teenager, interacting with other faculty kids that also lived there. This interaction was very fruitful and even helped the young Terman to develop one of his hobbies as a teen, the amateur radio, which at that time, was the passion of many other youngsters in Palo Alto, most of them, kids of Stanford Faculty. After graduating from Palo Alto High School, just across the street from Stanford, he passed the exames and entered Stanford in January 1917, now as an undergraduate student (Gillmor, 2004).

Fred’s first years in college were during the World War I, a time when the president

> Wilbur was inclined to believe that an important step had been made in government acknowledgment of the role of American higher education, particularly in technical fields. At the very last, Stanford’s faculty had felt a revitalization of the university’s

philosophy of direct usefulness and service while providing an important opportunity to build and test their technical expertise (Gillmor, 2004, p. 35).

In 1917 when the U.S entered World War I, Stanford organized the first student volunteer ambulance unit that would then travel to Europe and help who needed. Stanford was also one of the American Universities which participated from the Government project named Student Army Training Corps - SATC. This project aimed at strengthening U.S army through the creation of militar units within universities campuses around the country that would be co responsible, together with the government, for the training of their students that would later be sent to the battlefields. Figure 20 shows Student Army Training Corps (S.A.T.C.) performing drills in the Quad (Stanford, 2016).

Figure 20: Photograph of soldiers on campus during World War I (1917-1918) - Student Army Training Corps (S.A.T.C.) performing drills in the Quad.
Source: Stanford (2016).

After the years of war, lots of young men had returned to U.S and there was growing interest in the field of electrical engineering, because some of them had acquired experience with radio use during war.

> The boom in interest in radio transmission and radio as a new consumer market influenced enrollments and course offerings in electrical engineering departments around the country during and just following the war … Equally important were renewed industry connections between the department and the Federal Telegraph Company of Palo Alto [that] not only grew to worldwide reputation and, in turn, hired yet more Stanford graduates (Gillmor, 2004, p. 46).

After the years as an undergraduate student at Stanford, Fred Terman then started his graduate Engineer degree at the same university, from 1920 to 1922. He then applied for a doctoral position at the Massachusetts Institute of Technology- MIT and went to the East Coast in the same year to begin his studies there. He awarded the Degree of Doctor of Science in the field of electrical engineering in June of 1924. Terman was awarded the eighth doctoral degree in electrical engineering by MIT (Gillmor, 2004).

Terman's advisor at MIT was Vannevar Bush, considered by many as the Patron Saint of American Science. Beyond being an outstanding scientist, Bush was the responsible for the creation of the National Science Foundation and institutionalizing the union between science and the government, emphasizing that the country needed to rely on science. "Scientific progress is one essential key to our security as a nation, to our better health, to more jobs, to a higher standard of living, and to our cultural progress" (Bush, 1945). President Roosevelt had written Dr. Bush a letter in 1944 asking him recommendations on basically how science could help the country development concerning defense and health, as well as how the government could help science development and endurance over time. Eight months later, in 1945, Dr. Bush sent a full report to the U.S. presidency, entitled, "Science The Endless Frontier" where he strongly advocated the important of science to the future of the country and gave detailed

recommendations about how the government should promote science development. One of the recommendations was the creation of the National Science Foundation (Bush, 1945).

Surely Bush was a strong influence to Terman on this matter of the interaction between the university, the government and the industry in promoting innovation. And while Terman was returning to Stanford after WWII, as a dean, Bush was nourishing the soil where science would flourish at the post war and in the beginning of the Cold War.

After his time at the MIT as a graduate student, returning to visit his family at Stanford, Fred got tuberculosis and his condition worsened to the point he needed a whole year until he would be totally recovered. Throughout this entire period, both Stanford and MIT were interested in having him as part of their faculty, given the name he had built during his academic career as an outstanding student and researcher. He ended up staying at Stanford and by 1925 was a professor there (Gillmor, 2004).

Terman's work at Stanford during his early years there was marked by a commitment that went beyond the classroom. In addition of being considered an excellent teacher, he wrote books, strengthened the Electrical Engineering department, conducted his own research, applied for various patents, was a consultant for West Coast engineering companies and build a strong bond with his students and alumni working hard to find employment for them during the crisis of the 30s (Gibbons, 2000).

As part of these efforts,

> He developed and maintained a growing network of alumni friends through correspondence and personal visits. Students later considered to be among Terman's "stars" - William Hewlett, David Packard, Bernard Oliver, Edward Ginzton, and Joseph Pettit - would be success stories not only because of their career accomplishments but

for their strong commitment to Stanford University and its students, a commitment instilled in them by Fred Terman (Gillmor, 2004, pp. 70-71).

Maybe the most famous story is his personal mentorship offered to Hewlett and Packard - HP He strongly encouraged both to start a company together in 1939 and not only this, but he showed the way and was also an angel investor providing $500 as seed capital (Gibbons, 2000). HP's first client was Walt Disney Company which acquired eight oscillators in the early 1940's in order to have advanced sound systems for the movie Fantasia (O'Mara, 2005).

According to Gillmor (2004), concerning the patent policy at Stanford, Terman was also a key part of how the university developed around this issue over time. In the beginning, as the patent cases were scarce, Stanford did not have a structured policy to deal with it. So, the approach was to deal with each individual case as it would arouse. In 1937 the board of trustees created a policy "in which all patents related to a faculty member's 'line of research or teaching' belonged to the university, and those on 'unrelated lines' belonged to the inventor… The board's new policy was immediately criticized by a number of influential faculty members." (Gillmor, 2004, pp. 152-153).

Therefore, President Wilbur, later that year, appointed a committee of five faculty, among them was Fred Terman, to develop better Stanford's patent policy. Coincidently, Stanford was receiving the visit of MIT electrical Engineer Edward L. Bowles, who later played an important role developing radar for USA military forces during World War II. Bowles was then questioned about the MIT patent policy so that Stanford could get some advice. Years later, the committee developed a new policy that guaranteed the placement of the rights in the hands of the faculty, staff and students whenever it was possible. This policy was later developed further in 1970, after Terman's retirement, by Niels J. Reimers, who

credited Terman and Wallace Sterling as the architects of this revolution in the university's patent policy (Gillmor, 2004).

Fred was dean of the School of Engineering at Stanford from 1944 to 1958 and also university provost from 1955 to 1965. To better understand the hierarchical relations between the different administrative positions occupied by Terman, Figure 21 presents Stanford's Organization Chart.

Figure 21: Stanford's Organization Chart
Source: Stanford (2017c)

The Provost is the chief academic and budget officer, he or she is responsible for administrating the academic program including instruction and research as well as university services that support the academic program, such as, student affairs, libraries and so on. The Deans and administrators report to the Provost, as showed in Figure 20 (Stanford, 2017c).

Terman had an important role not only at Stanford, but also outside the university's frontiers, being an active member of American Institute of Electrical Engineers - AIEE and later of the Institute of Radio Engineers - IRE, where he eventually became president in 1941, while he took a year sabbatical from Stanford to dedicate himself to the demands of this new position (Gillmor, 2004).

His work at the IRE as a president was a great opportunity for him to show that he was more than a scientist and also had strong management skills. During this time, “he had both a wide knowledge of radio engineering technology and of the pool of engineers and physicists available for the war effort” (Gillmor, 2004, p. 186).

So in 1942, following his return to Stanford, Fred was selected by the Federal Government to head a secret project to develop radar countermeasures during World War II. He then moved to Cambridge with his family and lived there for four years serving as the director of the Radio Research Laboratory - RRL at Harvard University,

> Planning, managing, and expediting the work of more than eight hundred employees, as well as overseeing a budget larger than Stanford’s, did not completely divert his attention from Stanford, however. In 1946, he would bring back to the campus new management skills, valuable advice, new contracts across the country, and plans to revitalize Stanford’s School of Engineering (Gillmor, 2004, p. 186).

Given that Radar is regarded to be the invention that made possible the victory in World War II, it is comprehendible the importance and the amount of investments that the RRL received, as well as the secret character of this project. “By the war’s end, the U.S. military had ordered more than $150 million worth equipment based on RRL design, and had an equal amount under consideration (and canceled at the end of hostilities)” (Gillmor, 2004, p. 247).

Just to have an approximated idea of the newness involved in this project, 606 invention disclosures were made by the RRL lab staff within this four years of activity. With the war’s end, in 1945 the lab closed, but Terman wanted to make sure that his talented staff would find good job opportunities. So he personally recommended his men and women both to universities, companies and even government research units, sending hundreds of letters. He also kept records of those who received job offers, this way enriching even more his network across the three spheres, that is, university, government and industry (Gillmor, 2004).

Other important thing that he did while the RRL operations were coming to an end, was to publicize to a broad audience, both scientific and non scientific, what were the accomplishments of the lab during war times. He called a press conference in November 1945 that would last the whole day, so that RRL staff could demonstrate their contributions to a broad audience. This was relevant as it helped to legitimate the importance of science, bringing people closer to what is done in a research lab (Gillmor, 2004).

As a result of the outstanding work he had done those years, Terman was appointed dean of engineering at Stanford even while still directing the RRL, although he would only be at Stanford in 1946 (Gillmor, 2004).

During the years that Fred was in Cambridge serving as the director of the RRL, Stanford’s main job throughout the war was to teach American soldiers as requested by the Federal government. “The wartime university ran twelve months of the year, night and

day" (Gillmor, 2004, p. 257). Many of the faculty were in demand. Some of them were in military service, others working on the atomic bomb, or working for the government in other services as was Fred. A group formed by the engineering dean Samuel Morris and other Stanford administrators during 1940 and 1941 fought to sign military research contracts to the University, but was not very successful, if compared to other stablished universities such as Harvard, Berkeley and Caltech. Later, other influent Stanford professors were sent to Washington DC to promote the university's interests in signing contracts with the government, but still, Stanford was no match for other universities. Terman helped when he could, introducing his Stanford colleagues to military (Gillmor, 2004).

As a dean, Fred Terman built a twenty-year plan to Stanford at least be equal or, better yet, excel Caltech in the physical sciences and technology. So, he believed that it would be important to create a technical institute that could include engineering in all its areas with other physical sciences. A technical institute, for Terman, would be the key to promote Stanford among the industry, that is, the future employers of Stanford alumni. Having good Stanford people in industry or teaching in other Schools, would attract more people to the university and so on, creating a virtuous circle that would certainly benefit fund-raising efforts as well. According to Gillmor (2004, p. 255)

> Stanford should increasingly concentrate resources on the fields that were of interest to large numbers of students or were particularly important to the western states. for example, the oil industry was very important to the western economy, and therefore Stanford should be strong in all things relating to oil, including geology, heat transfer, and chemical engineering.

This demonstrates that the university captained by Terman was responding to normative pressures coming from the industry and also from the society as a whole, as the students were willing to graduate from this areas. Complying with what was expected, showed to be a good bet.

Terman had a powerful asset as a dean: he had a very influential network that was formed during wartime. He took advantage of that to expand Stanford's influence and get more research contracts with the Federal sphere. Terman strongly advocated for the government-sponsored research, as he knew that only tuition would not be sufficient to finance the university development (Gillmor, 2004).

One of his most remarkable accomplishments relating to enhancing the connection with industry and, at the same time, increasing Stanford's financial return, so that the university could hire more faculty, offer better salaries for them, train more grad students and strengthen local companies, was the creation of Honors Co-operative Program in Engineering (Saxenian, 1994). Industries were encouraged to pay their employees's tuition plus an equal sum to the university. This program started back in 1945 and grew up considerably. In 1957 there were 243 employees of local companies that were part-time graduate students enrolled in the program (Gillmor, 2004).

Since 1944 Stanford was operating at deficit and could not pay salaries to its scientists that were at least competitive with industry or even other neighbor research universities such as Berkeley. Stanford Research Institute - SRI that was created aiming at attracting investments had also proved that it was, otherwise, making the situation even worse. In late 1947 it had a deficit of $50.000. So, considering this situation, Terman was a powerful advocate of federal government investments in the University and, between 1946 and 1947 he wrote letters to Tressider, then Stanford's President - who was opposed to federal involvement

in private businesses - arguing on the benefits the university would get if it accepted support from the federal government. Tressider ended up accepting some researchers' negotiations with the public sphere and therefore, Stanford administrators started pressuring scientists to rely on the patrons of research. Although later this initiative would prove to be the right decision, this process was conflictual "between those willing to abandon tradition for institutional and professional advantages, and those who believed that change posed a serious threat to professional autonomy" (Lowen, 1992, p. 392).

In 1945 President Tressider hired a lobbyist named Thomas Sprangens to give Stanford a full-time presence in Washington and thus favor the university's national status, while winning government contracts and building new ones. This was important because the more the university was connected to the government through great projects, the better was its image among private corporations. "Stanford administrators understood from the beginning that government contracting was not an end in itself, but rather a means by which to achieve commercial ends" (O'Mara, 2005, p. 109).

SRI that was created in 1946, as a nonprofit institution, moved from Stanford campus to Menlo Park in 1947. In 1970 it became independent from Stanford, and in 1977 it changed its name to SRI international. Until nowadays, this research center "works with clients to take the most advanced R&D from the laboratory to the marketplace. Serving government and industry, we collaborate across technical and scientific disciplines to generate real innovation and create high value for our clients" (SRI International, 2017). However, Terman had little to do with SRI constitution (Gillmor, 2004).

The Stanford's Industrial Park was created serving to many purposes. The first was to create revenue for the university that owned a great and valuable amount of land beyond the portion needed for the development of its academic activities. The second reason was that

having those technology companies around campus would enhance the connections between the university and the companies, thus promoting a continuous exchange between faculty, students and employees. And the third reason was that it would benefit the industry itself. Terman was a strong advocate on knowledge exchange between university and industry (Gillmor, 2004).

O'Mara (2005) otherwise highlights that reputation was a critical motivation to the creation of the Industrial park. According to her, promoting the economic development of the region around campus helped to strengthen Stanford's status as a top research university not only locally, but nationally.

The board of trustees decided designating 80 acres for the industrial park and 50 acres for Stanford Shopping Center and by March 1951, Varian Associates had become the first tenant of the Industrial park, with an approved ninety-nine-year lease by the board of trustees (Gillmor, 2004).

As O'Mara (2005) emphasizes, much of the power of Stanford that allowed the creation of a city of knowledge around it, came from the land the university owned from its very beginning as an endowment from Stanford's family. Stanford had, and surely still has, control over the land in the right location.

> In Silicon Valley, the city of knowledge succeeded not simply because of Stanford's suburban location (although that had a huge amount to do with it) but because the university and its administrators had the *power* - deriving in large part from Stanford's great land endowment - to turn their vision of a community of science into a reality. This power often allowed the school to dominate local and political affairs and to enjoy a close, clubby relationship with Bay Area power brokers (O'Mara, 2005, p. 221).

The region that later would be internationally known as Silicon Valley received this nickname only in the 70's, but began to flourish much earlier as mainly a result of Terman's frustration because of the lack of job opportunities for Stanford's alumni, specially those from the graduate school of engineering. He knew that to have engineering as a great and renowned discipline in the U.S., and later in the whole world, it would be necessary to have a great university structure in terms of finances, physical infrastructure, faculty and students. And for this to happen, Stanford could not be isolated from those who could give it appropriate support, both public and private players. This support was way beyond financial investments, which were, and continue to be the primary basis for excellence, but much more related to the rich connections that emerged from a close relationship between the three spheres, university, industry and the state. Having such propitious surroundings for any research university is as crucial as sunlight for plant's photosynthesis. Stanford and Silicon Valley both feed one another (Gibbons, 2000) in a continuous and recursive interplay that guarantees the survival of both. But this once had a starting point that was a result of much institutional work, not only from one man, but a collective of actors that was guided to the same direction.

It is important to highlight that this relation between Stanford and industry was mutually beneficial. At the same time that the industry could develop from the university brilliant brains, the university transformed some of its research and teaching programs aiming at responding to industry and society needs in a more efficient way. This way, it is mistaken thinking that academic science and engineering were shaped exclusively by Cold War pressures. Industry pressures were also important (Lécuyer, 2005).

The years passed by and Terman became the Provost of the University in 1955, working with president Sterling. In this position he had been given the opportunity to work making headway for a stronger university as a whole, and not only engineering. It was Fred's idea to leave budget decisions on the hands of the deans and not the administration. This autonomy, many believe, was what made the entrepreneurship so vivid among the faculty (Gillmor, 2004).

The next citation, although long, summarizes what Terman did for Stanford, assuring autonomy for the departments and at the same time, gathering the funds they needed, that later as we know, would have an impact not only at the university itself, but also in the economy of the Bay Area as a whole.

> He did not have to fawn on military and corporate contractors, but rather sought to attract support from an array of sources and to apply such funds creatively to build on university strengths. He did not force contracts on faculty, but expedited faculty research and student teaching by helping to find them the funding they needed. Nor was he at work alone, somehow single-mindedly driving Stanford toward government dependence, but was part of a hard-working team whose aim was to dramatically improve Stanford's financial base. As a result, between 1946 and 1965, Stanford not only substantially increased its project-related funding but also attracted funding for new facilities and buildings, faculty salaries, and student fellowships, and dramatically increased the financial base of its endowment. Such funds came less from military and civilian government contracts, than from large, and in some cases landmark, grants from private and corporate granting agencies, and from major gifts of alumni and other benefactors (Gillmor, 2004, pp. 501-502).

Although some “faculty in the humanities did not always appreciate Terman’s penchant for measurable results and some thought he lacked empathy with their own goals and methods” (Gillmor, 2004, p. 419), Terman considered all Stannford’s departments important and hoped to help each one of them to achieve its full development. He studied hard to understand other scientific areas’ needs and as part of his efforts, he always kept the door open for humanities people come and talk. He knew that to build a top university all areas should be strong, and what he saw in 1955 looking at the School of Humanities and Sciences was “an amorphous operation, lacking coherence, discipline, and guidance” (Gillmor, 2004, p. 400).

Alongside with president Sterling, Terman helped the fund-raising campaign named PACE - A Plan for Action for a Challenging Era that aimed to raise $100 millions within three years. Terman worked actively traveling to the whole country for special meetings with potential donors, both corporate and wealthy individual. The campaign started in 1961 and by 1964 had achieved the mark of $114 millions (Gillmor, 2004).

Terman retired as provost in 1965, due to the university’s policy of mandatory retirement when the employee had achieved 65 years old. But after his retirement he worked actively for more 10 years.“His consulting work for educational institutions, governments, and private firms continued and, in some ways, increased after retirement” (Gillmor, 2004, p. 436). Figure 22 shows a picture of himself in his retirement from Stanford. He died in 1982 at the age of 82 in his home at Stanford.

Figure 22: Fred Terman at retirement, 1965. Courtesy of Stanford News Service.
Source: Gillmor (2004, p. 252).

Federal spending on science from 1945 on during the Cold War, transformed the role of universities into political and economic actors; it increased and developed the technological capacity of the industry, which had a great impact on people's daily lives; and it helped legitimating the importance of the science and of the scientist for the country development in an era when the economy was more and more dependent on technology innovation (O'Mara, 2005).

There is enough evidence that the ascension of Stanford as a renowned research university as well as the development of the Silicon Valley were not a result of the tireless work of a hero, or even a handful of them. Rather, I understand that there were favorable external institutional forces and that "Terman and other Stanford administrators were able to capitalize on these conditions in a way that, for the time, showed an unprecedented awareness

of the capacity of research universities to spur certain kinds of economic development" (O'Mara, 2005, p. 107).

According to Etzkowitz (2013), Silicon Valley's development can be summarized in five major stages as demonstrated in Figure 23.

Origin	developing the capacity to create high tech firms through knowledge and technology transfer, university–industry interactions and research
Aggregation	grouping these high-tech firms into a significant cluster with open lateral networks
Expansion	growth of some cluster firms into large hierarchical organizations in parallel with large domestic and foreign technology firms from elsewhere establishing R&D units in the Valley, along with a growing start-up dynamic
Efflorescence	a continuation of the above phases and emergence of multiple interacting hightech platforms in the region, at various growth stages, along with an influx of technology and entrepreneurs
Renewal	moving from one technological paradigm to another as the cluster declines, beginning the start-up process over again with triple helix interactions emerging to solve problems and taking regional development forward

Figure 23: A five-phase model of Silicon Valley's development
Source: Adapted from Etzkowitz (2013, p. 518)

Given the innovative nature of what is created there, "Human-capital development and attraction is the most important factor for Silicon Valley's success" (Etzkowitz, 2013, p. 534). Therefore, Stanford University not only played a fundamental role during the constitution of the world's most famous innovation hub, but also keeps nurturing it with what it needs the most.

Despite the enormous effort that some key players such as Terman, Tressider, Sterling, Bush and many others had done, it was not until the late 70's that the innovation issue started gaining real attention from policymakers. It is hard to believe that science and technology would only be regarded as an engine of economic development so recently in U.S. history (Berman, 2012a).

Figure 24 summarizes each of the last thirteen[2] U.S. Presidents' policies concerning science from 1933 to 2016. It also shows the main events that marked their administrations to give an idea of what was happening.

Franklin Roosevelt
1933–45
Events: Great Depression, World War II

- **Policies:**
- Top-secret Manhattan project to build the atom bomb
- Rural electrification through the Tennessee Valley Authority and a national network of hydroelectric dams
- Asks science adviser Vannevar Bush for a report, Science: The Endless Frontier, that enshrines principle of government support for academic research and training
- Signs legislation creating the National Cancer Institute

Harry Truman
1945–53
Events: Start of the Cold War, Korean War

- **Policies:**
- Orders dropping of two atomic bombs on Japan and the development and testing of the thermonuclear (hydrogen) bomb
- Signs laws creating the Atomic Energy Commission, National Science Foundation (NSF) and Office of Naval Research

Dwight Eisenhower
1953–61
Events: Sputnik

- **Policies:**
- Signs legislation creating NASA
- Catalyzes creation of the Defense Advanced Research Projects Agency (DARPA)
- Signs international treaty preserving Antarctica as a neutral site for scientific exploration, a follow-up to the International Geophysical Year
- Oversees post-Sputnik funding boom to support research and advanced scientific training
- Creates mechanism for providing science advice to the president and federal agencies

John Kennedy
1961–63
Events: Cuban missile crisis

- **Policies:**
- Proposes space program to build heavy launch rockets capable of landing humans on the moon
- Signs Limited Nuclear Test Ban Treaty to end underwater and atmospheric explosions and limit underground testing
- Signs legislation enabling firms to launch commercial communications satellites

Lyndon Johnson
1963–69
Events: Vietnam War buildup

- **Policies:**
- Backs funding for Apollo program to send astronauts to the moon
- DARPA's support for computer science leads to ARPA Network, precursor of the internet
- Authorizes extensive use of defoliant Agent Orange as an offensive weapon in Vietnam

[2] This publication precedes President Trump's administration, that's why his policies were not included.

Richard Nixon
1969–74
Events: End of Vietnam War, oil embargo

- **Policies:**
- Signs major environmental laws, including the Clean Water Act, Clean Air Act, National Environmental Policy Act, Endangered Species Act, and the Marine Mammal Protection Act
- Signs Biological Weapons Convention, prohibiting development, production, and stockpiling
- Negotiates Anti-Ballistic Missile Treaty with Soviet Union limiting each nation to two sites and 100 defensive missiles
- Signs National Cancer Act and declares "war on cancer"
- Begins development of reusable space shuttle to low Earth orbit
- Proposes United States build supersonic passenger aircraft, but Congress kills funding

Gerald Ford
1974–77
Events: Energy crisis, swine flu

- **Policies:**
- Signs law creating White House Office of Science and Technology Policy and new presidential advisory body
- White House backs federal funding for recombinant DNA research after Asilomar conference identifies safe path for such research

Jimmy Carter
1977–81
Events: Energy crisis, Three Mile Island

- **Policies:**
- Promotes energy efficiency and massive program to produce synfuels extracted from oil shale with goal of reducing U.S. dependence on foreign oil
- Creates departments of energy and education
- Signs Bayh-Dole Act, which aims to speed commercialization of government-funded research by allowing academic researchers to claim ownership of intellectual property
- Opposed Clinch River Breeder Reactor Project, in line with stance of many arms control experts that it would create new supplies of plutonium

Ronald Reagan
1981–89
Events: Proxy wars, AIDS epidemic

- **Policies:**
- Proposes Strategic Defense Initiative, which includes space- and land-based lasers for shooting down Soviet nuclear missiles
- Signs Montreal Protocol curbing use of chemicals that destroy the ozone layer
- Backs expansion of Small Business Innovation Research program, begun at NSF, to nurture high-tech startups
- Backs Sematech chip manufacturing consortium to help U.S. companies compete globally
- Proposes Space Station Freedom, which ultimately evolves into the International Space Station
- Backs construction of Superconducting Super Collider (SSC), a giant underground accelerator to study collisions of high-energy subatomic particles

George H. W. Bush
1989–93
Events: Exxon Valdez oil spill in Alaska, first Iraq war, breakup of Soviet Union

- **Policies:**
- Backs major revision of the Clean Air Act aimed at curbing emissions from coal-fired power plants that contribute to acid rain
- Signs legislation funding the Human Genome Project
- Enters negotiations that ultimately produce the 1992 United Nations Framework Convention on Climate Change
- Rejects signing the Convention on Biological Diversity

Bill Clinton
1993–2001
Events: Economic boom, globalization

- **Policies:**
- Signs Kyoto Protocol on climate change
- Congress cancels SSC, the giant accelerator begun under Reagan and backed by Bush, after cost overruns, delays, and technical difficulties
- International Space Station construction begins
- Supports development of high-speed scientific computing network that evolves into internet, and related policies on managing this new way to share information

George W. Bush
2001–09
Events: 9/11 attacks, anthrax letters, begins Iraq and Afghanistan wars

- **Policies:**
- Exit from Anti-Ballistic Missile Treaty
- Limits federal funding for human embryonic stem cell research to about 60 existing cell lines
- Signs America COMPETES Act to update research and education policies for key science agencies
- Backs White House–initiated effort to study research productivity and practices, often called the Science of Science Policy

Barack Obama
2009–16
Events: Global recession, oil spill in Gulf of Mexico, continuation of Iraq and Afghanistan wars

- **Policies:**
- Backs use of ARPA-Energy to accelerate research and development in the field of sustainable energy
- Signs Paris climate agreement and issues numerous regulations aimed at curbing U.S. emissions of greenhouse gases
- Supports massive, short-term funding burst to spur economic recovery from financial collapse, including research and scientific infrastructure
- Expands national network of advanced manufacturing centers to improve the research base for this key industrial sector
- Proposes and implements initiatives on brain and precision medicine research

Figure 24: Science in the Oval Office: 1933–2016
Source: Science (2016).

Although I am not going to discuss each and every one of these policies concerning science, it is important to verify that, as mentioned before, it was only after the 70's that innovation seemed to be taken as a priority by the government and, therefore, crucial policies on this area emerged, such as the Bayh-Dole Act.

Focusing on the entrepreneurial turn of universities, there were three major contributions which I am going to discuss here. The first was the creation of the National Science Foundation (NSF), the second the creation of the White House Office of Science and Technology Policy, and the third the Bayh-Dole Act.

The process that originated the NSF reveals a strong, and above all requested, influence of a scientist into the policymaking process. As cited before, Vannevar Bush recommended President Roosevelt to create this Foundation. NSF is an independent federal agency created in 1950 by the U.S. Congress aiming at the promotion of science's progress, improving the national health and contributing to public welfare and the country's defense in general, among other purposes. The technology-based innovations that NFS has helped to develop, have contributed to the economic activity of the country. The decision about which project should receive funding, is based on a merit review process. The agency is guided by the National Science Board, constituted of 25 members, including scientists from universities and scientists from the industry sector, headed by a Director who is chosen by the President and approved by the Senate.

> [It] supports fundamental research and education across all fields of science and engineering. In fiscal year (FY) 2017, its budget is $7.5 billion. NSF funds reach all 50 states through grants to nearly 2,000 colleges, universities and other institutions. Each year, NSF receives more than 48,000 competitive proposals for funding and makes about 12,000 new funding awards (NFS, 2017).

The white House Office of Science and Technology Policy - OSTP was created in 1976 to

> provide the President and others within the Executive Office of the President with advice on the scientific, engineering, and technological aspects of the economy, national security, homeland security, health, foreign relations, the environment, and the technological recovery and use of resources, among other topics (OSTP, 2017).

The OSTP has the same function of other Executive Offices of the President, such as the Office of Management and Budget; the National Security Council; the Council of Economic Advisers; the Office of National Drug Control Policy; and the Council on Environmental Quality. They all provide the presidency with the necessary support to govern efficiently (The Administration, 2018). By the end of the 70's science has become a priority for the government and thus innovation emerged as a policy frame (Berman, 2012).

The Bayh-Dole Act came after, in 1980, but it would cause a profound impact in the development of universities' entrepreneurial turn and as a consequence, on the Country's innovation system, improving its economy. The Bayh-Dole Act "gave institutions the unambiguous right to claim title to inventions made with federal funding" (Loise & Stevens, 2010, p. 1). Additionally, it also standardized the patent process. Therefore, universities gained more independency and became able to choose the terms of license contracts with industry, in a way that is better for the technology development and for itself.

The right to have ownership over the inventions created by its own scientists, and also allowing that the scientists themselves could have a piece of this cake that they baked, undeniably boosted the level of technology transfer promoted by research universities. But it is necessary to understand under what contextual circumstances the Bayh-Dole Act emerged.

> Remember the technological malaise that befell America in the late 1970s? Japan was busy snuffing out Pittsburgh's steel mills, driving Detroit off the road, and beginning its assault on Silicon Valley. Only a decade later, things were very different. Japanese industry was in retreat. An exhausted Soviet empire threw in the towel. Europe sat up and started investing heavily in America. Why the sudden reversal of fortunes? Across

America, there had been a flowering of innovation unlike anything seen before (Economist, 2002).

According to this passage, it is evident that the Bayh-Dole Act was was a response from the government to the threats posed by foreign industries that motivated the creation of the Act. As a initiative that had a clear purpose to develop U.S. economy against the strength of other competitors, it really fulfilled its economic mission.

In fact, the federal government has helped the American computer industry in mainly three ways: through legislation that benefited this industry, especially the Bayh-Dole Act; as a buyer for its products; and as a financier of research in this area (Rowen, 2000).

The Bayh-Dole Act was resultant from lobbying by U.S. research universities. The technology transfer manager at Purdue University, Norman Latker - who was a close friend of Niels Reimers, the founder of Stanford's OTL - complaint to senator Bayh that the University had made important scientific discoveries with great market potential, but as they had all been funded by grants from the Department of Energy, the government didn't issue Institutional Patent Agreements. Coincidently, Leshowitz, who was from University of Arizona and was on a leave, as an intern on the staff of senator Dole, explained to him that some important scientific discoveries were being kept locked in drawers at the agencies. Once aware of what was going on between universities and public funding, and knowing that the country was in need of a rejuvenating plan for the economy, working together, both senators, Bayh and Dole headed their staff teams and developed the bill that would change this reality (Stevens, 2004).

Until the passage of the bill, which was far from being a unanimity among politicians, a number of research universities, such as Stanford, Harvard, the University of California, and the MIT sent officials to Congress to lobbied for the passage of the bill, and to adjust its

details (Barret, 1980). This demonstrates that even regulative pressures can not be understood under a simply top down perspective.

It is nevertheless true that, according to Mowery and Ziedonis (2000) the Bayh-Dole Act alone could have done little if it weren't for the special institutional structure of the American university system in which the links between the university and industry had already existed a long ago before the passage of the bill.

> The large scale, high levels of institutional autonomy, and diversified source of public and private funding that characterize the U.S. higher education system have long created powerful incentives for faculty and administrators to seek external sources of research support, be these from private firms during the 1920s and 1930s, the Defense Department during the 1950s and 1960s, or industry during the 1980s and 1990s. Among other things, the importance of these other structural factors suggests that. (pp. 214-125).

The argument that regulative pressures are the definite legitimation frontier is therefore fallacious. As pointed out by Berman (2008) the institutionalization process of university patenting occurred through three stages, each one an independent step that helped to routinize and legitimate this role of universities.

The first stage was marked by the strong institutional entrepreneurship of a man called Norman Latker, a young attorney who was hired by the National Institutes of Health - NIH to be the first patent councilor in 1963. He was ideologically committed to the idea that universities and, even faculty, should retain title to their own inventions, even when funded by the federal government. So he advocated and worked for the modernization of the

Institutional Patent Agreements - IPAs in 1968. These agreements were a kind of administrative mechanism that made it easier for universities to patent and then license inventions prior funded by the Department of Health, Education, and Welfare -HEW (Berman, 2008).

The second stage can be considered the formation of a professional community of university patent administrators, that functioned as infrastructure for the dissemination of the practices involved in patenting and licensing at universities (Berman, 2008).

The Bayh-Dole Act development was only the third stage of this process and according to Berman (2008, p. 837) was not a *sine qua non* condition for university patenting institutionalization, "In many ways, though, the use of IPAs and the increasing organization of university patent administrators had already institutionalized university patenting".

From this perspective, the Bayh-Dole Act was less critical, for Stanford, than the active work of institutional entrepreneurs that bridged the gap between the university and the industry in order to promote innovation in early days, and who later lobbied for this bill creation and approval. Indeed, as pointed out by Niels Reimers - the founder of Stanford's OTL - in a 2015 interview, Stanford did not feel the impact of the bill so much because they had been working on patents a long ago before 1980. "The Bayh-Dole bill meant more for the country--all universities as a whole. We had our own deals with different agencies" (Reimers, 2015).

Neither Stanford University, nor Silicon Valley represent a global model suitable for other research universities and regions around the world aiming at becoming more entrepreneurial. This is why it is so difficult to replicate their successful stories in other contexts. In fact, the stories of Stanford's entrepreneurial turn as well as Silicon Valley creation show evidences that their development was resultant from this historical and

recursive interplay between regulative, normative and cultural-cognitive pressures, derived from each actor of the triple helix, and that would not be possible without a strong commitment of people like Fred Terman.

Our research shows that actors from the three spheres of the helix had specific goals that depended on one another to come true, and in pursuit of achieving their goals, each actor managed their assets strategically, be it a powerful network, financial power, control over the land, talented people or whatever it was.

The development of Stanford's entrepreneurial turn came as a response to the university's need of financial returns in order to expand and to be recognized as a large and renowned research university, and to contribute to the employability of the skilled workforce it generated. According to Lenoir (2014, p. 126) “It was important that Stanford-branded ideas, theories, and technologies got out into the marketplace. The enhanced reputation for excellence resulting from this activities would make Stanford more competitive for the next generation of federally funded research, the lifeblood of the university”.

This need was reinforced by what industry expected from the university, that is, what should be the university’s role. Industry needed to increase its competitiveness, what would be possible by its own modernization, be it in their products or in their processes. Therefore, industry needed Stanford’s contribution in order to be innovative.

The state, on the other hand, sought the development of cutting edge technologies that could help U.S. performance during the periods of war, including the Cold War. The government discovered that besides being useful allies during wartime, helping to develop military technologies, universities could also help the rejuvenation of the country's economy through innovation, and for that, it relied on research universities such as Stanford.

The approximation of Stanford, the industry and the government was a consequence of the perception and action of institutional entrepreneurs, especially Fred Terman, but not limited to him. It is important to emphasize that all three spheres had institutional entrepreneurs.

Institutional work applied for the development of Stanford's Entrepreneurial Turn, was the result of: a) identifying and recognizing the environmental forces that could influence the achievement of the university's goals; b) a keen eye for how these forces could work for the university's benefit; c) the existence, expansion and maintenance of a network compatible with what was intended, including people from the three spheres and; d) a strong persuasion power to convince other players to enter the game. This power, however, is far from being something mystical. Rather, this power is a result of a profound knowledge about other actor's needs and interests.

If we look at the iconic Fred Terman, we can see that his previous personal and professional life experiences made him who he was, shaping his cognition, the way he perceived all the stimuli, and the way he responded to them.

It is important to highlight that Stanford's entrepreneurial turn development was the particular case I studied and it does differs from what happened to academic science broadly in the U.S. during the same period of time. While Stanford's case was deeply marked by the role of institutional entrepreneurs, specially Terman, according to Berman (2012b, p. 290) "The case of U.S. academic science thus demonstrates one path through which a new logic can gain significant influence in a field even in the absence of a coherent entrepreneurial project to promote it".

It deserves further attention the fact that the entrepreneurial turn at Stanford became institutionalized way after Fred Terman efforts, and even after the OTL opening in 1970, as a

result of a conflictual process, as clearly demonstrated by Colyvas and Powell (2006) in their analysis that ranged from 1970 to 2000, they say, "The institutionalization process was fraught with disputes, misunderstandings, and some effort at distancing. Legitimacy and taken-for-grantedness increased over time in this particular case, but this trend was neither inevitable nor without debate". (p.342).

The institutionalization of practices concerning the commercial use of the academic science produced at Stanford took many years to come true. In fact, the process started with Fred Terman would need about 20 years more after his retirement to start showing signs of institutionalization. Putting in perspective, even having the best environmental circumstances in terms of time, place and resources, as well as institutional entrepreneurs encouraging triple helix connections to happen, it took a long time, at least 60 years, until academic science would had this identity shift among Stanford community.

Actually, according to Kvamme (2000, p. 74) "During the 1990's the Valley cemented its role as the center of entrepreneurship, attracting unprecedented capital and people. It also extended its reach into state and national politics and set new precedents for technology standards and business models". Therefore, from that decade on, Stanford has consolidated its position as a global leader when it comes to its central role on the triple helix of innovation.

As stated by Gibson and Foss (2017, p. 13) "Developing entrepreneurially is a complex endeavor crossing levels of influence and control while being strongly influenced by broader institutional and organizational environments".

Therefore, following Reay *et al* (2013) three-phased model of how managers institutionalize new practices in organizations, see at figure 10 presented previously, I need to emphasize that the institutional work performed by Terman at Stanford was not a one-man project. Actually it could not be so given the magnitude of it. He surely was the head of the

first and second phases: a) micro-level theorizing and; b) encouraging “trying it”, respectively (as shown in figure 10), but the seed he had planted during his career at the university continued to grow after his retirement and death, by other individuals that took the project of an entrepreneurial university ahead, specially in phase three, when they worked facilitating meaning-making through the introduction of a new organizational structure, the OTL, by Reimers in 1970, in accordance to Reay *et al* (2013) model.

Throughout the story I have told about the development of Stanford’s entrepreneurial turn, we could understand how the institutional work performed by these men and other players from the three spheres of the helix, was what made possible the development of the five mutually supportive elements that together constitute what is called the entrepreneurial architecture (Nelles & Vorley, 2010) and that shaped the entrepreneurial capacity of the university, that is, structures, systems, strategies, leadership and culture. And as a consequence, how this work led to the development of the knowledge, innovation and consensus spaces that characterize Silicon Valley relationships (Ranga & Etzkowitz, 2013).

And finally, although my thesis stresses the recursive interplay between institutional pressures and institutional work caught in a dynamic and continuous cycle, it is possible to conclude that Stanford's entrepreneurial turn is an example of a process that originated from a bottom-up movement, instead of the opposite.

Even though it was the institutional environment, especially the cultural-cognitive pressures, that shaped the beliefs and ideologies of the institutional entrepreneurs, such as Fred Terman, the process of developing the university entrepreneurially, in its very beginning, clearly emerged within the university and not in its external environment.

According to Gibson and Foss (2017) there are many examples around the world of failure top-down government planned initiatives to promote an innovative economy that end

up not accomplishing the creation of jobs, wealth and competitiveness. Thus, I believe that another source of explanation of Stanford's successful story, might be the bottom-up nature of the primary forces that triggered the university's first steps towards an entrepreneurial identity.

The next item will bring a summary of the results of my research.

4.4 SUMMARIZING THE KEY POINTS OF THE RESEARCH FINDINGS

The first thing we need to take into consideration is that Stanford's entrepreneurial turn was a process that took about 60 years to become institutionalized, and thus, it was resultant from the the work of different actors in different periods of time, with different institutional backgrounds, and with different interests.

Prior to its entrepreneurial development, several steps have been taken that were fundamental for the improvement of the university quality as a whole, preparing it to be able to develop its entrepreneurial agenda years later. This steps included: a) attraction and retention of talented faculty; b) attraction of talented students and encouragement for the best of them to enroll in Stanford graduate programs; c) financial development mainly through contracts with public bodies, in special the Military Forces; the institution of undergraduate tuition fees in 1919; a series of fund raising efforts from 1922 on and new ways to invest the money received as endowment; d) the construction and maintenance of a strong reputation nationally, which was a consequence of the previous steps, but also a condition to keep attracting those talents and keep the private and public investments level high.

All these steps, as we could see through many examples, were resultant from active institutional work led by Stanford leaders, but that also depended on external will to happen.

If neither the state sphere nor the industry sphere were interested in what Stanford had to offer for their own benefit, probably this story would follow a different course.

The state sphere was interested in academic research that could help U.S. defense during wartimes and was willing to pay whatever would be necessary to guarantee its supremacy over the enemies. Later on, state's interests on science were related to help U.S. economy. It knew that by encouraging innovation to emerge within universities, as for example through the Bayh-Dole Act, the industry would benefit being more competitive among other countries.

The industry sphere, in turn, needed its workforce to be highly trained and qualified. And so, it knew that Stanford was a fundamental partner in this process. This explains the success of the Honors Co-operative Program in Engineering that dates back to 1945 and the success of the Stanford Industrial Park from the beginning of the 50's. After the establishment of the Park and its first tenants arrival, the region became reinforcing itself, attracting more scientists, industries and students interested in the innovative culture that was being raised there.

Stanford University's earlier interests were basically increasing its financial returns in order to expand and to be recognized as a large and renowned research university, and to contribute to the employability of the skilled workforce it generated. Stanford needed its strong industrial surroundings and worked hard to build that.

Our model presented in figure 8, the complex representation of institutional pressures and the three spheres of the triple helix of innovation shaping universities' entrepreneurial turn, showed appropriate to demonstrate what happened in the case studied.

We discovered that hybrid actors already existed prior to the the formation of this triple helix system studied. Therefore, they can not be understood as a result of the triple helix

sphere's overlapping, but as it seems to be the case, they are a condition that made possible this approximation.

Fred Terman was one of these hybrid actors. His actions surely represented his beliefs on what was best for the university, even when there was not internal consent about it at Stanford. But he was not merely a member of the academic sphere. His biography demonstrates that he defended industry and state interests as well. In fact, he was part of these spheres, if we remember, for example, the period when he was an active member of the American Institute of Electrical Engineers - AIEE and later of the Institute of Radio Engineers - IRE, where he eventually became president in 1941. And also the time when he worked for the U.S Military Forces as the director of the Radio Research Laboratory - RRL at Harvard University for four years.

On the one hand, as he was embedded in multiple institutional contexts, Terman's perception of the institutional pressures made him notice very early that the government was not only the source of regulations but it could be a fundamental investor and a trustworthy client. On the other hand, his internal work as a Professor, teaching undergraduate and graduate students allowed him to see the huge comercial potential of what was being created inside campus. Probably, had he been a mere administrative staff member at the university, he could not see this student and alumni potential and HP could never exist.

His active role in multiple spheres, having as a consequence his powerful personal and professional connections - which he valued the most and kept nourishing during his whole life - in addition to his background, including the strong influence his previous advisor, Vannevar Bush, had in him, made Terman the most important actor involved in the development of Stanford's entrepreneurial turn. Although his plans for Stanford towards an entrepreneurial

direction were not easily accepted at the university, he knew how to use his assets to change previous predominant cultural-cognitive frames and influence the decision of those in charge.

Other important consideration relates to the nature of the university's responses to the institutional pressures. Some of them was an all-in-one kind. For example, if we think about Stanford's lobby within the Federal Government, at the same time it had direct results in increasing the number of contracts with the public sphere, it also boosted Stanford's reputation around the Country and this favored more contracts with industry, more endowments and the like.

And finally, it became evident that the institutional work performed by Stanford institutional entrepreneurs such as Terman, Wilbur, Sterling, or later Reimers, and many others, was not a purely institutional work. It was a concrete and rational work aiming at the accumulation of financial and non-financial resources, that eventually led to the success of Stanford as the most prominent example of an entrepreneurial university. Their work would change the academic landscape for good.

Analyzing this story through the perspective of the recursive interplay between institutional pressures and institutional work, allowed to avoid any simplification that could impoverish the magnitude of the phenomena involved in the development of Stanford's entrepreneurial turn.

5. CONCLUSIONS

In this study I have suggested the following theoretical proposition: universities' entrepreneurial turn is contingent on institutional work and may be understood as a result of a confluence of inward and outward forces that are shaped through a historical and recursive interplay between regulative, normative and cultural-cognitive pressures, derived from each actor of the triple helix, that is, the state, the industry - or society in a broader sense - and the university.

Our main theoretical contributions consists on: a) placing the universities' entrepreneurial turn at the epicenter of all the competing institutional pressures and logics when it comes to innovation creation; b) characterizing the universities' entrepreneurial turn as a result of the recursive interplay between regulative, normative and cultural-cognitive pressures, derived from each actor of the triple helix; and c) stressing the fundamental role of the institutional work performed by institutional entrepreneurs in the process of developing the universities' entrepreneurial turn.

Based on what has been argued throughout this study, it is possible to draw some concluding remarks. The first constitutes a practical implication especially relevant to developing countries, like Brazil, that seek for more competitiveness on technological markets along with a more prominent role of universities in developing the regions where they are embedded. my thesis suggest that the way through which universities develop entrepreneurially does not depend solely on their will.

Actually, universities' entrepreneurial turn is a result of a complex set of institutional processes that is unique to each university over the globe. Therefore, trying to replicate successful models of entrepreneurial universities may prove to be useless due to the

contingent characteristic of the institutional environments in which they operate. The three spheres of the helix must work together to promote innovation.

The theoretical aspect of this study is rooted on the social construction of reality perspective (Berger & Luckmann, 1966), and more specifically, on the recursive interplay between institutional pressures and institutional work, under which individuals and organizations are at the same time producers and products of the institutional environment (Bjerregaard & Jonasson, 2014; Ferguson, 1998; Machado-da-Silva, Fonseca & Crubellate, 2005).

In this sense, it should be recognized that my central model, demonstrated graphically through Figure 1, is representative of broad empirical expectations regarding the emergence of the phenomenon of entrepreneurial universities. It is important to highlight that I consider here the institutional pillars model as differences of explanatory rationality (Scott, 2014). Although it is expected an overlap between the pillars in each one of the Triple Helix spheres, it is possible to predict the predominance of one or another pillar when taking into account each one of the specific spheres.

In other words my expectation is that as the Triple Helix processes develop - in any specific case - to the formation of a stem cell space, as showed through Figure 6 - element "d", those institutional forces and the helical spheres themselves become, recursively, cooperatives. At this more advanced stage of interactions, the helical spheres and institutional forces overlap in a balanced way, which means that the pressures cease to be external to the entrepreneurial university and become organically internalized and legitimated, that is, institutionalized.

Clearly, this recursive sense points to the predominance, in my model, of a cultural-cognitive perspective, emphasizing the expectation of the emergence of university action

templates in search of innovation and relationship with the state and industry, or society in a broader sense, and even the relationship between the multiple inner agents of the sphere here called academy.

In the consensus space, roles, actions, objects and goals become locally legitimated, constituting part of the local system (therefore, organizational system) of beliefs and values, a cultural framework therefore, which diffuses among the participants' performance of - and as a condition of their own performance of - their daily activities, while they seek to meet the requirements of their own identity as actors of the university context.

I believe my model of analysis allows fair comparative studies between two or more universities even if they belong to completely different institutional contexts, once it sheds light to the interplay between each of the universities and its respective institutional environment formed by the three spheres of the triple helix in aggregate, along with a greater emphasis on the institutional work performed by institutional entrepreneurs. This way, I suggest future researches to do this kind of comparative study in order to comprehend how these institutional processes influence universities' entrepreneurial turn over time.

Specifically about the empirical portion of this study, my general goal was **to comprehend the development of Stanford's entrepreneurial turn by means of the historical dynamics of the recursive interplay between institutional pressures and institutional work.**

Based on the case narrative I want to draw special attention to some characteristics of the processes related to the development of Stanford's entrepreneurial turn that corroborate my thesis.

In first place, Stanford's case showed evidences that its entrepreneurial turn is, in fact, at the epicenter of all the competing institutional logics if we are considering the innovation creation flow within the triple helix relations the university is part of.

Secondly, it was possible to confirm that Stanford's entrepreneurial turn is a result of the recursive interplay between regulative, normative and cultural-cognitive pressures, derived from each actor of the triple helix. However, each pressure, be it regulative, normative or cultural-cognitive, is not essentially "pure"; they are product of the interaction between one another, thus making it difficult to point out their source.

And finally, in third place, it became evident the necessary role of the institutional entrepreneurs committed to the development of the university as a means of achieving a better reputation, through the exploitation of its entrepreneurial turn.

REFERENCES

Agune, R., & Carlos, J. A. (2017). Radar da Inovação–O que os governos precisam enxergar. *Estudos Avançados*, *31*(90), 143-157. Retrieved from: http://dx.doi.org/10.1590/s0103-40142017.3190010

Almeida, M., Santos, D., Aragão, L., Nogueira, G., Bonifácio, A., Simões, B., & Terra, B. (2016). Expanding the vision of entrepreneurial universities: a case study of UNIRIO in Brazil. *Triple Helix*, *3*(1), 1-19. Retrieved from: https://doi.org/10.1186/s40604-016-0033-x

Alvesson, M. (1993). Organizations as rhetoric: Knowledge−intensive firms and the struggle with ambiguity. *Journal of Management studies*, *30*(6), 997-1015.

Amarante, J. M., Crubellate, J. M., & Meyer Jr. V. (2017). Estratégias em Universidades: uma análise sob a perspectiva institucional. *Revista GUAL,* 10(1), 190-212.

Ambos, T. C., Mäkelä, K., Birkinshaw, J., & D'Este, P. (2008). When does university research get commercialized? Creating ambidexterity in research institutions. *Journal of Management Studies 45*(8), 1424-1447.

Arbix, G., & Miranda, Z. (2017). Políticas de inovação em nova chave. *Estudos Avançados*, *31*(90), 49-73. Retrieved from: http://dx.doi.org/10.1590/s0103-40142017.3190004

Audy, J. (2017). A inovação, o desenvolvimento e o papel da Universidade. *Estudos Avançados*, *31*(90), 75-87. Retrieved from: http://dx.doi.org/10.1590/s0103-40142017.3190005

Bardin, L. (1977). *Análise de conteúdo*. São Paulo: Livraria Martins Fontes.

Barrett, P. M. (1980). Harvard fears congress may not pass patent bill. *The Harvard Crimson*, October 7. Retrieved in Jan. 10, 2017, from: http://www.thecrimson.com/article/1980/10/7/harvard-fears-congress-may-not-pass/?utm_source=thecrimson&utm_medium=web_primary&utm_campaign=recommend_sidebar

Battilana, J., Leca, B., & Boxenbaum, E. (2009). How actors change institutions: Towards a theory of institutional entrepreneurship. *Academy of Management Annals*, *3*, 65–107.

Berger, P. L., & Kellner, H. (1981). *Sociology reinterpreted:* An essay on method and vocation. Garden City: Doubleday Anchor.

Berger, P., & Luckmann, T. (1966). *The Social Construction of Reality: A Treatise in the Sociology of Knowledge*. Garden City: Doubleday Anchor.

Berman, E P. (2012a). Creating the Market University: how academic science became an economic engine. Princeton: Princeton University Press.

Berman, E. P. (2012b). Explaining the move toward the market in US academic science: how institutional logics can change without institutional entrepreneurs. *Theory and Society 41*(3)*,* 261-299.

Berman, E. P. (2008). Why did universities start patenting? Institution-Building and the Road to the Bayh-Dole Act. *Social Studies of Science 38*(6), 835-871.

Besharov, M. L.; Smith, W. K. (2014). Multiple Institutional Logics in Organizations: explaining their varied nature and implications. *Academy of Management Review,* 39 (3), 364-381.

Bjerregaard, T.; Jonasson, C. (2014). Managing Unstable Institutional Contradictions: The Work of Becoming. *Organization Studies*, 35(10), 1507-1536.

Boh, W. F., De-Haan, U., & Strom, R. (2016). University technology transfer through entrepreneurship: faculty and students in spinoffs. *The Journal of Technology Transfer 41*(4), 651-669.

Boxenbaum, E.; Battilana, J. (2005). Importation as innovation: transposing managerial practices across fields. *Strategic Organization*, 3(4), 355-383.

Brew, A. (2009). Academic Research in Contemporary Society. In M. Tight, K. H. Mok, J. Huisman & C. C. Morphew (Eds.). *The Routledge International Handbook of Higher Education* (Chap. 34, pp. 473-485.). New York: Routledge.

Burns, P. (2005). *Corporate entrepreneurship: Building an entrepreneurial organization.* Basingstoke, England: Palgrave Macmillan.

Bush, V. (1945). *Science, the endless frontier:* A report to the President. Retrieved in Jun. 12, 2017, from: https://www.nsf.gov/od/lpa/nsf50/vbush1945.htm

Capello, R., Olechnicka, A. and Gorzelak, G. (2013). Introduction: cities, regions and universities as knowledge and innovation creators. In: R. Capello, A. Olechnicka and G. Gorzelak. (Eds.). *Universities, cities and regions: loci for knowledge and innovation creation.* (Chap. Introduction, pp. 1-9). New York: Routledge.

Clark, B. R. (1998). *Creating entrepreneurial universities: organizational pathways of transformation.* New York: Pergamon.

Cohen, M., March, J., & Olsen, J. P. (1972). Garbage Can Model of Organizational Choice. *Administrative Science Quarterly 17*(1), 1-25.

Colyvas, J.; Powell, W. W. (2007). From Vulnerable to Venerated: The Institutionalization of Academic Entrepreneurship in the Life Sciences. *Research in the Sociology of Organization* 25: 219-259.

Colyvas, J. A., & Powell, W. W. (2006). Roads to institutionalization: the remaking of boundaries between public and private science. *Research in Organizational Behavior 27,* 305-353.

Currie, J. & Vidovich, L. (2009). The changing nature of academic work. In M. Tight, K. H. Mok, J. Huisman & C. C. Morphew (Eds.). *The Routledge International Handbook of Higher Education* (Chap. 32, pp. 441-452.). New York: Routledge.

de Mello, C. M. (2017). A influência das instituições no processo de construção da confiança interorganizacional. *Organizações & Sociedade*, *24*(81), 343-360. Retrieved from: http://dx.doi.org/10.1590/1984-9230818

Dias, A. A., & Silveira Porto, G. (2013). Gestão de transferência de tecnologia na Inova Unicamp. *RAC-Revista de Administração Contemporânea*, *17*(3), 263-284. Retrieved from: http://dx.doi.org/10.1590/S1415-65552013000300002

DiMaggio, P. J. (1988). Interest and agency in institutional theory. In L. G. Zucker (Ed.), *Institutional patterns and organizations* (pp.3-32). Cambridge, MA: Ballinger.

DoResearch. (2013). *9.1 Inventions, Patents, and Licensing.* Retrieved in May, 14, 2016, from: https://doresearch.stanford.edu/policies/research-policy-handbook/intellectual-property/inventions-patents-and-licensing .

Dzisah, J. (2012). Ideals and contradictions in knowledge capitalization. In J. Dzisah & H. Etzkowitz (Eds.). *The Age of Knowledge: the dynamics of universities, knowledge and society* (Chap. 13, pp. 267-287.). Amersfoort: Brill.

Economist, T. (2002). *Innovation's golden goose.* Retrieved in Apr. 5, 2017, from: http://www.economist.com/node/1476653

Etzioni, A. (1973). *Organizações Modernas. (*M. L. M. Leite, trad.). São Paulo: Pioneira.

Etzkowitz, H. (2013). Silicon Valley at risk? Sustainability of a global innovation icon: an introduction to the special issue. *Social Science Information 52*(4), 515-538.

Etzkowitz, H. (2008). *The Triple Helix: University-Industry-Government Innovation In Action*. New York: Routledge.

Etzkowitz, H., & Leydesdorff, L. (2000). The dynamics of innovation: from national systems and ‘‘Mode 2’’ to a Triple Helix of university–industry–government relations. *Research Policy 29*(2), 109–123.

Etzkowitz, H., & Klofsten, M. (2005). The innovating region: toward a theory of knowledge-based regional development. *R&D Management 35*(3), 243-255.

Etzkowitz, H., Ranga, M., Benner, M., Guaranys, L., Maculan, A. M., & Kneller, R. (2008). Pathways to the entrepreneurial university: towards a global convergence. *Science and Public Policy 35*(9), 681-695.

Etzkowitz, H., & Zhou, C. (2017). Hélice Tríplice: inovação e empreendedorismo universidade-indústria-governo. *Estudos Avançados*, *31*(90), 23-48. Retrieved from: http://dx.doi.org/10.1590/s0103-40142017.3190003

Ferguson, P. P. (1998). A cultural field in the making: gastronomy in the 19th century France. *American Journal of Sociology, 104 (3), 597-641.*

Foss, L., & Gibson, D. V. (2015a). The entrepreneurial university: case analysis and implications. In L. Foss & D. V. Gibson (Eds.). *The entrepreneurial university: context and institutional change* (Chap. 12, pp. 249-279.). New York: Routledge.

Foss, L., & Gibson, D. V. (2015b). The entrepreneurial university: context and institutional change. In L. Foss & D. V. Gibson (Eds.). *The entrepreneurial university: context and institutional change* (Chap. 1, pp. 1-17). New York: Routledge.

Fryges, H., & Wright, M. (2014). The origin of spin-offs - A typology of corporate and academic spin-offs. *ERC - Enterprise Research Center - Research Paper n.26,* 1-35.

Garcia, R., Araújo, V., Mascarini, S., Santos, E. G. D., & Costa, A. R. (2014). Interações universidade-empresa e a influência das características dos grupos de pesquisa acadêmicos. *revista de Economia Contemporânea 18*(1), 99-120.

Gibbons, J. F. (2000). The role of Stanford University: a Dean's reflections. In C-M. Lee, W. F. Miller, M. G. Hancock, & H.S. Rowen (Eds.). The Silicon Valley Edge: a habitat for innovation and entrepreneurship. (Chap. 10, pp. 200-217). Stanford: Stanford University Press.

Gibson, D. V., & Foss, L. (2017). Developing the Entrepreneurial University: Architecture and Institutional Theory. *World Technopolis Review 6*(1), p. 1-15. Retrieved from: https://doi.org/10.7165/wtr17a0809.16

Giddens, A. (1984). *The Constitution of Society.* Berkeley: University of California Press.

Giddens, A. (2013). *New rules of sociological method: A positive critique of interpretative sociologies.* New York: Wiley.

Gillmor, C. S. (2004). *Fred Terman at Stanford: building a discipline, a university, and Silicon Valley.* Stanford: Stanford University Press.

Goldstein, H. A. (2010). The 'entrepreneurial turn' and regional economic development mission of universities. *The Annals of Regional Science, 44(1), 83-109.*

Gourley, B. M. & Brennan, J. (2006). Strategic alliances between universities and their communities. In L. E. Weber & J. J. Duderstadt (Eds.). *Universities and Business: partnering for the knowledge society* (Chap. 4, pp. 39-61.). France: Economica.

Gray, B., Purdy, J. M., Ansari, S. (2015). From interactions to institutions: microprocesses of framing and mechanisms for the structuring of institutional fields. *Academy of Management Review 40*(1), 115-143.

Green Jr., S. E., & Li, Y. (2011). Rhetorical institutionalism: language, agency, and structure in institutional theory since Alvesson 1993. *Journal of Management Studies 48* (7), 1662-1697.

Greenwood, R., Hinings, C. R., & Whetten, D. (2014). Rethinking Institutions and Organizations. *Journal of Management Studies 51*(7), 1206-1220.

Harmon, D. j., Green Jr., S. E., & Goodnight, G. T. (2015). A model of rhetorical legitimation: the structure of communication and cognition underlying institutional maintenance and change. *Academy of Management Review 40*(1), 76–95.

Hartley, J. (2004). Case study research. In: C. Cassell & G. Symon. (Eds.). *Essential guide to qualitative methods in organizational research.* London: Sage, pp. 323-333.

Hartley, M. & Soo, D. (2009). Building democracy's university: university-community partnerships and the emergent civic engagement movement. In M. Tight, K. H. Mok, J. Huisman & C. C. Morphew (Eds.). *The Routledge International Handbook of Higher Education* (Chap. 29, pp. 397-407.). New York: Routledge.

Havas, A. (2015). Types of knowledge and diversity of business-academia collaborations: implications for measurement and policy. *Triple Helix*, *2*(1), 1-26. Retrieved from: https://doi.org/10.1186/s40604-015-0023-4

Hoffman, A. J. (1997). *From heresy to dogma: an institutional history of corporate environmentalism.* San Francisco: New Lexington Press.

Hofstede, G. (1991). *Culture and Organizations:* software of the mind. New York: McGraw-Hill.

ICO - Industry Contracts Office. (2017). *ICO supports Stanford research by negotiating agreements that balance university and industry interests.* Retrieved in: Oct, 10, 2017, from: https://sites.stanford.edu/ico/ .

Jacob, M. (2009). Out with Humboldt and in with the knowledge society: on the consequences of the redefinition of the role of higher education and research. In M. Tight, K. H. Mok, J. Huisman & C. C. Morphew (Eds.). *The Routledge International Handbook of Higher Education* (Chap. 36, pp. 501-521.). New York: Routledge.

Jepperson, R. L. (1991). Institutions, institutional effects, and institutionalism. In W. W. Powell & P. J. DiMaggio (Eds.), *The New Institutionalism in Organizational Analysis* (pp. 143-163). Chicago: University of Chicago Press.

Kodeih, F. & Greenwood, R. (2014). Responding to institutional complexity: the role of identity. *Organization Studies 35* (1), 7-39.

Krause, K. L. (2009). Interpreting changing academic roles and identities in higher education. In M. Tight, K. H. Mok, J. Huisman & C. C. Morphew (Eds.). *The Routledge International Handbook of Higher Education* (Chap. 30, pp. 413-425.). New York: Routledge.

Kvamme, E. F. (2000). Life in Silicon Valley: A first-hand view of the region's growth. In C-M. Lee, W. F. Miller, M. G. Hancock, & H.S. Rowen (Eds.). The Silicon Valley Edge: a habitat for innovation and entrepreneurship. (Chap. 4, pp. 59-80). Stanford: Stanford University Press.

Laredo, P. (2007). Revisiting the third mission of universities: toward a renewed categorization of university activities? *Higher Education Policy 20* (4), 441-456.

Lawrence, T. B, Leca, B., & Zilber, T. B. (2013). Institutional work: current research, new directions and overlooked issues. *Organization Studies 34*(8), 1023-1033.

Lawrence, T. B. & Suddaby, R. (2006). Institutions and institutional work. In Stewart R. Clegg, Cynthia Hardy, Thomas B. Lawrence & Walter R. Nord (Eds.), *Sage Handbook of Organization Studies*, 2nd Edition (pp. 215-254). London: Sage.

Leca, B., Battilana, J., & Boxenbaum, E. (2006). Taking Stock on Institutional Entrepreneurship: what do we know? Where do we go? *Academy of Management Meetings*, 1-43.

Lécuyer, C. (2005). What do universities really owe industry? the case of solid state electronics at Stanford. *Minerva 43*(1), 51-71.

Lendel, I., Allen, P., & Feldman, M. (2009). University-based economic growth. In M. Tight, K. H. Mok, J. Huisman & C. C. Morphew (Eds.). *The Routledge International Handbook of Higher Education* (Chap. 28, pp. 381-396.). New York: Routledge.

Lenoir, T. (2014). Inventing the entrepreneurial university: Stanford and the co-evolution of Silicon Valley. In T. J. Allen, & R. P. O'Shea (Eds.). *Building Technology Transfer within Research Universities: an entrepreneurial approach* (Chap. 5, pp. 88- 128.). Cambridge: Cambridge University Press.

Leydesdorff, L., & Etzkowitz, H. (1998). The triple helix as a model for innovation studies. *Science and Public Policy 25*(3), 195-203.

Leydesdorff, L., & Park, H. W. (2014). Can synergy in Triple Helix relations be quantified? A review of the development of the Triple Helix indicator. *Triple Helix*, *1*(4), 1-18. Retrieved from: https://doi.org/10.1186/s40604-014-0004-z

Loise, V. & Stevens, A. J. (2010). The Bayh-Dole Act Turns 30. *Science Translational Medicine 2*(52), 1-5.

Lowen, R. (1992). Exploiting a Wonderful Opportunity: The Patronage of Scientific Research at Stanford University, 1937-1965. *Minerva 30*(3), 391-421.

Luengo, M. J., & Obeso, M. (2013). El efecto de la Triple Hélice en los resultados de innovación. *RAE-Revista de Administração de Empresas*, *53*(4), 388-399. Retrieved from: http://www.redalyc.org/html/1551/155127925006/

Machado, H. P. V., Sartori, R., & Curbellate, J. M. Institucionalização de núcleos de inovação tecnológica em instituições de ciência e tecnologia da região Sul do Brasil. *Revista Eletrônica de Administração*, *23*(3), 5-31. Retrieved from: https://dx.doi.org/10.1590/1413 - 2311. 177.67190

Machado-da-Silva, C. L., Fonseca, V. S., & Crubellate, J.M. (2005). Unlocking the institutionalization process: insights for an institutionalizing approach. *BAR - Brazilian Administration Review, 2*(1), 01-20.

Mello, L. E. A. , & Sepúlveda, E. S. (2017). Interação academia-indústria. Relato da experiência da Vale. *Estudos Avançados*, *31*(90), 89-101. Retrieved from: http://dx.doi.org/10.1590/s0103-40142017.3190006

Mintzberg, H. (1995). *Criando Organizações Eficazes: estruturas em cinco configurações.* (C. Bernardes, trad.). São Paulo: Atlas.

Mollas-Gallart, J., Salter, A., Patel, P., Scott, A. and Duran, X. (2002). *Measuring Third Stream Activities, Report to the Russell Group Universities*, Brighton: SPRU.

Mowery, D. C. (2005). The Bayh-Dole Act and high-technology entrepreneurship in U. S. Universities: chicken, egg, or something else? In Gary D. Libecap (Ed.). *University Entrepreneurship and Technology Transfer:* process, design and intellectual property. Advances in the Study of Entrepreneurship, Innovation & Economic Growth, Volume 16. (Chap. 2, pp. 39-68). Oxford: Elsevier.

Mowery, D. C., & Ziedonis, A. A. (2000). Numbers, quality, and entry: How has the Bayh-Dole Act affected US university patenting and licensing?In A.B. Jaffe, J. Lerner, & S. Stern. (Eds.). *Innovation Policy and the Economy*, volume 1. (Chap. 6, pp. 187-220.). Cambridge: The MIT Press.

Mutch, A. 2007. Reflexivity and the institutional entrepreneur: A historical exploration. *Organization Studies, 28* (7), 1123–1140.

Nelles, J., & Vorley, T. (2010). Constructing an entrepreneurial architecture: an emergent framework for studying the contemporary university beyond the entrepreneurial turn. *Innovative Higher Education 35*(3), 161-176.

NFS - National Science Foundation. (2017). *Fact sheet.* Retrieved in May 30, 2017, from: https://www.nsf.gov/news/news_summ.jsp?cntn_id=100595

O'Mara, M. P. (2012). Beyond town and gown: university economic engagement and the legacy of the urban crisis. *Journal of Technology Transfer 37*(2), 234-250.

O'Mara, M. P. (2005). *Cities of Knowledge: cold war science and the search for the next Silicon Valley.* Princeton: Princeton University Press.

O'Shea, R. P., Allen, T. J., Morse, K. P., O'Gorman, C., & Roche, F. (2007). Delineating the anatomy of an entrepreneurial university: the Massachussets Institute of Technology experience. *R&D Management 37*(1), 1-16.

OSTP - The White House Office of Science and Technology Policy. (2017). Retrieved in Dec. 29, 2017, from https://www.whitehouse.gov/ostp/

OTL. Office of Technology Licensing. (2017c). *Inventor's Guide.*Retrieved in: Oct, 12, 2017, from: https://otl.stanford.edu/documents/OTLinventorsguide.pdf .

OTL - Office of Technology Licensing. (2017a). *Life of a Stanford Invention.* Retrieved in: Oct, 10, 2017, from: http://otl.stanford.edu/documents/OTL_overview.pdf.

OTL - Office of Technology Licensing. (2014). *Risky Business - Office of Technology Licensing annual report 2013/2014.* Retrieved in: May, 1, 2016, from: https://otl.stanford.edu/documents/otlar14.pdf .

OTL - Office of Technology Licensing. (2017b). *The technology transfer process at a glance* Retrieved in: Oct, 10, 2017, from: http://otl.stanford.edu/documents/process.pdf

Owen-Smith, J., & Powell, W. (2001). Careers and contradictions: Faculty responses to the transformation of knowledge and its uses in the life sciences. *Research in the sociology of work 10,* 109-140.

Owen-smith, J.; Powell, W.W.(2008). Networks and institutions. In: Greenwood, R.; Oliver, C.; Sahlin, K.; Suddaby, R (Eds.). *The Sage handbook of organizational institutionalism***.** London: Sage, pp. 596-623.

Owen-Smith, J., & Powell, W. W. (2001). To Patent or Not: Faculty Decisions and Institutional Success at Technology Transfer. *Journal of Technology Transfer 26*(1), 99-114.

Pache, A. C.; Santos, F (2010). When Worlds Collide: the internal dynamics of organizational responses to conflicting institutional demands. *Academy of Management Review***,** 35(3), 455-476.

Padgett, J. F.; Powell, W. W. (2012). The problem of emergence. In: J. F. Padgett; W. W. Powell (Eds.). *The emergence of Organizations and Markets.* Princeton: Princeton University Press, pp. 1-29.

Petersen, A. M., Rotolo, D., & Leydesdorff, L. (2016). A triple helix model of medical innovation: Supply, demand, and technological capabilities in terms of Medical Subject Headings. *Research Policy*, *45*(3), 666-681.

Pfeffer, J., & Salancik, G. R. (2003). *The external control of organizations: A resource dependence perspective*. Stanford University Press.

Phillips, N., & Tracey, P. (2007). Opportunity recognition, entrepreneurial capabilities and bricolage: connecting institutional theory and entrepreneurship in strategic organization. *Strategic Organization 5*(3), 313-320.

Pinto, H. (2017). Connecting the Triple Helix space: actor-network creation and institutionalisation of knowledge transfer offices. *Triple Helix*, *4*(2), 1-23. Retrieved from: https://doi.org/10.1186/s40604-017-0045-1

Plonski, G. A. (2017). Inovação em transformação. *Estudos Avançados*, *31*(90), 7-21. Retrieved from: http://dx.doi.org/10.1590/s0103-40142017.3190002

Popadiuk, S., Rivera, E. R., & Bataglia, W. (2014). Heterogeneity of isomorphic pressures: Intertwining the Resource-Based view and the neoinstitutional approach. *BAR-Brazilian Administration Review*, *11*(4), 455-475. Retrieved from: http://dx.doi.org/10.1590/1807-7692bar2014130003

Powell, W. W., & Owen-Smith, J. (2002). The New World of Knowledge Production in the Life Sciences. In S. Brint (Ed.), *The Future of the City of Intellect: the changing american university.* (Chap. 4, pp. 107-130). Stanford: Stanford University Press.

Powell, W. W., & Snellman, K. (2004). The knowledge economy. *Annual Review of Sociology 30*, 199-220.

Ranga, M., & Etzkowitz, H. (2013). Triple Helix systems: an analytical framework for innovation policy and practice in the knowledge society. *Industry & Higher Education 27*(3), 237-262.

Reay, T., Chreim, S., Golden‐Biddle, K., Goodrick, E., Williams, B. E., Casebeer, A. & Hinings, C. R. (2013). Transforming new ideas into practice: An activity based perspective on the institutionalization of practices. *Journal of Management Studies*, *50*(6), 963-990.

Reimers, Niels J. (2015). Oral History. Stanford Historical Society Oral History Program Interviews (SC0932). Department of Special Collections & University Archives, Stanford University Libraries, Stanford, Calif. Retrieved in Jan. 10, 2018, from: https://purl.stanford.edu/sk314qb9448

Rodrigues, F. C. R., & Gava, R. (2016). Capacidade de apoio à inovação dos Institutos Federais e das Universidades Federais no estado de Minas Gerais: um estudo comparativo. *REAd-Revista Eletrônica de Administração*, *83*(1), 26-51. Retrieved from: http://dx.doi.org/10.1590/1413-2311.0282015.5445

Rosa, R. A., & Frega, J. R. (2017). Intervenientes do Processo de Transferência Tecnológica em uma Universidade Pública. *RAC - Revista de Administração Contemporânea, 21*(4), 435-457. Retrieved from: http://dx.doi.org/10.1590/1982-7849rac2017160097

Rossoni, L. (2016). O que é Legitimidade Organizacional? *Organizações & Sociedade*, *23*(76), 110-129. Retrieved from: http://dx.doi.org/10.1590/1984-9230766

Rossoni, L., Guarido Filho, E. R., & Coraiola, D. M. (2013). Recomendações metodológicas para a adoção da perspectiva da estruturação nos estudos organizacionais. *Organizações & Sociedade*, *20*(66), 523-542. Retrieved from: http://dx.doi.org/10.1590/S1984-92302013000300009

Rowen, H. S. (2000). Serendipity or strategy: how technology and markets come to favor silicon valley. In C-M. Lee, W. F. Miller, M. G. Hancock, & H.S. Rowen (Eds.). The Silicon Valley Edge: a habitat for innovation and entrepreneurship. (Chap. 9, pp. 184-199). Stanford: Stanford University Press.

Sauermann, H., & Stephan, P. (2013). Conflicting logics? a multidimensional view of industrial and academic science. *Organization Science 24*(3), 889-909.

Saxenian, A. (1994). *Regional Advantage: culture and competition in Silicon Valley and Route 128.* Cambridge, MA: Harvard University Press.

Schattschneider, E. E. (1975). *The Semisovereign People: a realist's view of democracy in America.* Chicago: Wadsworth Thomson Learning.

Schmidt, S., Balestrin, A., Engelman, R., & Bohnenberger, M. C. (2016). The influence of innovation environments in R&D results. *RAUSP - Revista de Administração (São Paulo)*, *51*(4), 397-408. Retrieved from: http://dx.doi.org/10.1016/j.rausp.2016.07.004

Schoen, A. *et al.* (2006). *Strategic Management of University Research Activities, Methodological Guide, PRIME Project 'Observatory of the European University*. Retrieved April 01, 2016, from http://www.enid-europe.org/PRIME/documents/OEU_guide.pdf

Science. (2016). *Science in the Oval Office: 1933–2016.* Retrieved in Nov. 30, 2016, from: http://www.sciencemag.org/news/2016/10/science-oval-office-1933-2016

Scott, W. R. (2014). *Institutions and Organizations: ideas, interests and identities.4ed.* Thousand Oaks: Sage

Scott, W. R. (2016). Institutional Theory's Past and Future Contributions to Organization Studies [Interview given to Juliana Marangoni Amarante]. *BAR- Brazilian Administration Review, 13* (3), 1-6.

Siegel, D. S., & Wright, M. (2015). Academic entrepreneurship: time for a rethink? *ERC - Enterprise Research Center - Research Paper n.32,* 1-38.

Shah, S. K., & Pahnke, E. C. (2014). Parting the ivory curtain: understanding how universities support a diverse set of startups. *Journal of Technology Transfer 39*(5), 780-792.

SLAC - National Accelerator Laboratory. (2017). *About SLAC.* Retrieved in Dec. 28, 2017, from: https://www6.slac.stanford.edu/about

Smets, M., Morris, T. I. M., & Greenwood, R. (2012). From practice to field: A multilevel model of practice-driven institutional change. *Academy of Management Journal*, *55*(4), 877-904.

SRI International. (2017). *About us.* Retrieved in Oct. 12, 2017, from: https://www.sri.com/about

Stake, R. E. (2005). Qualitative case studies. In N. K. Denzin & Y. S. Lincoln (eds.), *The Sage handbook of qualitative research* (3rd ed., pp. 443-466). Thousand Oaks, CA: Sage Publications.

Stanford University (2017c). *Administrative Guide.* Retrieved in Aug. 15, 2017, from: https://adminguide.stanford.edu/chapter-9/subchapter-2/policy-9-2-1

Stanford University. (2017b). *A History of Stanford.* Retrieved in Jun. 22, 2016, from: https://www.stanford.edu/about/history/

Stanford University. (2017a). *Stanford Facts 2017 - A look at Stanford University Today.* Retrieved in Dec. 28, 2017, from: http://facts.stanford.edu/pdf/StanfordFacts_2017.pdf

Stanford University. (2016). *Stanford Stories From The Archives.* Retrieved in Dec. 28, 2017, from: https://exhibits.stanford.edu/stanford-stories/feature/1910s

Stevens, A. J. (2004). The Enactment of Bayh-Dole. *Journal of Technology Transfer, 29*(1), 93-99. Retrieved in Jan. 18, 2017, from: https://link.springer.com/content/pdf/10.1023%2FB%3AJOTT.0000011183.40867.52.pdf

Suchman, M. C. (1995). Managing Legitimacy: Strategic and Institutional approaches. *Academy of Management Review 20 (3), 571-610.*

Suddaby, R. (2010). Challenges for institutional theory. *Journal of Management Inquiry*, *19*(1), 14-20.

Suddaby, R. (2011). How communication institutionalizes: a response to Lammers. *Management Communication Quarterly 25*(1), 183-190.

The Administration. (2018). *Executive Offices*. Retrieved in Jan. 15th, 2018, from: https://www.whitehouse.gov/the-trump-administration/

Thornton, P. H., & Ocasio, W. (2008). Institutional logics. In R. Greenwood, C. Oli- ver, R. Suddaby, & K. Sahlin-Anderson (Eds.), *The handbook of organizational institutionalism* (pp. 99-129). Thousand Oaks, CA: Sage.

Thornton, P., & Ocasio, W. (1999). Institutional logics and the historical contingency of power in organizations: executive succession in the higher education publishing industry, 1958-1990. *The American Journal of Sociology,* 105(3), 801-843.

Tolbert, P. S., David, R. J., & Sine, W. D. (2011). Studying choice and change: The intersection of institutional theory and entrepreneurship research. *Organization Science*, *22*(5), 1332-1344.

Tolbert, P. S.; Zucker, L. G. (2010). A Institucionalização da Teoria Institucional. In: S. Clegg; C. Hardy; W. Nord. (Orgs.). *Handbook de estudos organizacionais*. v.1. (pp. 194-217). São Paulo: Atlas.

U.S. Const. amend. I.

United Nations Educational, Scientific and Cultural Organization (UNESCO). (1998). *Declaração Mundial sobre Educação Superior no Século XXI*: Visão e Ação. Retrieved January 08, 2015 from http://www.direitoshumanos.usp.br/dh/index.php/Direito-a-Educa%C3%A7%C3%A3o/declaracao-mundial-sobre-educacao-superior-no-seculo-xxi-visao-e-acao.html.

United Nations Educational, Scientific and Cultural Organization (UNESCO). (2009). 2009 World Conference on Higher Education: the new dynamics of higher education and research for societal change and development, UNESCO, Paris, 5-8 July 2009, Communiqué, 8 July.

Vieira, M. M. F. (2006). Por uma boa pesquisa (qualitativa) em administração. In: M. M. F., Vieira & D. M. Zouain (Orgs.). *Pesquisa qualitativa em Administração***.** (pp. 13-28). Rio de Janeiro: FGV.

Vorley, T. (2015). Foreword. In: L. Foss; D. V. Gibson (Eds.). *The entrepreneurial University: context and Institutional change* (Chap. Foreword, pp. xxiv-xxv). New York: Routledge.

Vorley, T., & Nelles, J. (2008). (Re)conceptualising the academy: Institutional development of and beyond the third mission. *Higher Education Management and Policy 20*(3), 23-35.

Voronov, M., & Yorks, L. (2014). “Did you notice that?” Theorizing differences in the capacity to apprehend institutional contradictions. *Academy of Management Review 40*(4), 563–586.

Weick, K. E. (1976). Educational Organizations as loosely coupled systems. *Administrative Science Quarterly 21*(1), 1-19.

Wood, M. S. (2011). A process model of academic entrepreneurship. *Business Horizons 54* (2), 153-161.

Yin, R. K. (2005). *Estudo de Caso: planejamento e métodos.* 3ed. Porto Alegre: Bookman, 2005.

Zahra, S. A.; Wright, M. (2015). Understanding the social role of entrepreneurship. *ERC - Enterprise Research Center - Research Paper n. 33,* 1-40.

APPENDIX A
Semistructured interview script for OTL members.

1) Please describe what are your responsibilities here at OTL.
    a. For "S" – Could you explain how does I farm work?

2) When did your connection with Stanford started, considering the time you were a student?

3) Besides your position at Stanford OTL now, are you connected, even voluntarily, to the government or some private businesses? And what about others coworkers from OTL?

4) By your experience, why the interaction between Stanford and the industry is so important for our researches, professors and students?

5) when it comes to university-industry relations, sometimes the industry make the first move and tries to set some partnerships with Stanford research groups in order to develop something for example, right? In these cases, how does OTL participate?

6) Is it difficult to match Stanford and industry interests? Why?

7) would you say that being Stanford an entrepreneurial university, researchers tend to focus on the development of researches that have a potential to be licensed?

8) If a local and a non local company are competing to be licensees of an invention, and both of them offer similar proposals, which one would be preferred and why?

9) If a researcher here at Stanford creates something and believes that it is possible to create his or her startup to develop this into a product and then commercialize it, where can he or she find help to make this come true here at Stanford? Does OTL help in these cases?

10) And one last question: Considering the spread of all this entrepreneurial logic within universities, do you believe that there's no room for scientists who produce blue sky science nowadays?