ORCHESTRATING UNIVERSITY INNOVATION ECOSYSTEM: THE CASE OF A BRAZILIAN UNIVERSITY

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Abstract
The universities have become more entrepreneurial and constitute innovation ecosystems, responsible for promoting innovation and generating development for people, busines and regions. Although the theme of innovation ecosystems has been expanding in the literature, there is a gap about the management/orchestration of those environments. Therefore, this paper aims at understanding which are the roles and activities of the orchestrator of the university innovation ecosystem. For that, we conducted an action research in the innovation ecosystem of UFRGS, orchestrated by its Science and Technological Park, Zenit. We identified key success factors for that process and we understood that the orchestrator of the university has as roles and activities: architect (map and compose the network, link complementary actors, construct a collective identity), knowledge broker (managing knowledge mobility, knowledge activation, facilitate transactions) and market translator (articulate demands, recognize and commercialize innovation, manage innovation appropriability). From that, we proposed some insigths to facilitate actions for the orchestration of the innovation ecosystem in the university.

Keywords: innovation ecosystem, universities, network orchestrator, orchestration

1. INTRODUCTION

Innovation ecosystems have been recognized as an important tool for the local and regional socioeconomic development, given their potential to generate jobs, income and social well-being through innovation. Despite its focus on a city level (Schaeffer, Fischer and Queiroz, 2018), lower levels of innovation ecosystems, as the case of universities, are also transforming their environments. Universities serves as catalysts for the entrepreneurial mindset and comprise a bundle of actors and resources that can be connected for the purpose of transforming knowledge into innovation (Spigel, 2017).

The role and demand of universities is changing in recent years, just generating knowledge did not ensure that knowledge would spill over for commercialization driving innovative activity and economic growth. The emergence of the concept of entrepreneurial university gave universities a dual mandate—to produce new knowledge but also to alter its activities and values in such a way as to facilitate the transfer of technology and knowledge spillovers (Audretsch, 2014).

Such differences have implications for how universities are able to reach-out to the local and regional community in order to participate in the building of the entrepreneurship and innovation ecosystem (Wright, Siegel and Mustar, 2017). There has been a strong growth of the movement of universities and the recognition of its role as inducer of technological development and of innovations. Universities are considered important infrastructures that sustain innovation ecosystems and, at the same time, institutional mechanisms that stimulate local and regional development.

An ecosystem is a result of various mechanisms and actors, in different contexts and evolves over time. Innovation ecosystem are co-created rather than one group or sector being at the centre of the process and managing it. Many stakeholders are engaged as co-creators: students, professors, university managers, research groups, laboratories, science parks, incubators, investors, angel networks, local authorities, start-ups and corporations. Each of these stakeholders has different objectives, norms, standards, and values. Thus, many dimensions of the ecosystem go beyond actions by universities management. The complexity and variety of ecosystems suggest the need to develop mechanisms for bringing together the range of different stakeholders (Wright, Siegel and Mustar, 2017).

Ecosystem include broad sets of actors and the relationships and interactions are not always governed with contracts (Valkokari et al, 2017). This lack of formal structure increases the role of relational governance mechanisms (Poppo and Zenger, 2002). A key challenge concerns the question of who designs the ecosystem (Wright, Siegel and Mustar, 2017). We understand that there is a gap

in the literature on how orchestration of innovation ecosystems occurs, specially in the context of universities.

The concept of orchestration emerged in the literature as a set of activities aimed at the development, management and coordination of actors that are intended to create and extract value from the network or ecosystem (Dhanaraj and Parkhe, 2006). Orchestration is thus a fundamentally dynamic and uncertain activity, where participantion is voluntary and coordination resembles enabling leadership rather than scrict management (Ritala et al, 2009). Such capacity respects the specific identities of each actor and tries to ensure that they continue to collaborate fruitfully (Parmentier and Mangematin, 2014).

Thus, we propose the follow research question: *what are the roles of an orchestrator in a university innovation ecosystem?* Orchestrating innovation ecosystems or networks by firms in a business context is already common in the literature (Dhanaraj and Parkhe, 2006). The aim of this paper is to understand what activities are required for the functioning of an innovation ecosystem in a university, orchestrated by its Science Park. Thus, a participatory action research was carried out in UFRGS – Federal University of Rio Grande do Sul, in the south of Brazil from April 2015 until March 2019.

UFRGS is among the top five Brazilian universities, being a reference in teaching, research and extension. In recent years, the university has begun to focus on construction an innovation ecosystem from its Science Park, called Zenit. The Zenit Science Park can be considered the orchestrator of this movement, being in charge of the articulation and management of the university's internal and external actors. Thus, it is understood that this is an important and relevant case to answer the research question.

The paper is divided into four more sections besides this introductory one. In the theoretical background, the fundamentals of the research will be presented: university as an innovation ecosystem and orchestration of innovation ecosystems. In the method, the explanation of the participant research and the research steps are presented. Then the results of the paper are analised and discussed. Finally, the conclusions of the research and suggestions for continuity are exposed.

2. Theoretical Background

The management literature presents a wide range of concepts related to interorganizational arragements, such as clusters, innovation networks and ecosystem. Innovation ecosystems include different of stakeholders, and are perhaps the broadest of the different strategic network-based constructs (Autio and Thomas, 2014), and consider the ability of a territory to create a system of

actors and infrastructures, and the mere construction of a network structure between companies (Nicotra et al., 2017).

In the same line of Autio and Thomas (2014), we consider innovation ecosystems as a unique and specific type of networks encompassing a diverse community of actors with multilateral and multisectoral ties, spanning the boundaries of a single industry and emphasizing increased interdependence as well as symbiotic potential among the actors (Adner, 2017). However, we decided to explore to innovation ecosystem in the context of university and the relation among the different actors in university community to foster innovation. Based on this delimitation, this section the key conceptual elements of this research: (i) university innovation ecosystem and (ii) orchestrating innovation ecosystems.

2.1. University as an innovation ecosystem

The innovation ecosystem approach emphasizes precepts of natural systems that resemble what happens in business environments, such as the connections and dynamics of evolution, competition, predation and mutualism among their actors (Shaw and Allen, 2016). The term "ecosystem", originating from biology, was first associated with business by Moore (1993), but only started to be used more frequently from the 2010 decade, being mainly linked to entrepreneurship (Isenberg, 2010; Stam, 2015) and to innovation (Autio and Thomas, 2014). Since then, the term has gained ground in academic discussions.

The innovation ecosystem is understood as a dynamic system whose objective is economic and technological development (Wang, 2010). Recent studies of such innovation pratices underline a variety of diferentes forms, such as interorganizational aliances and collaborations with and within communities, crowds, or networks of individuals – including user, citizens, scientists and others (Valkokari et al, 2017).

In this context, universities are moving from a traditional role of promoting research, teaching and dissemination of knowledge to a more advanced one, of technology transfer and promotion of academic entrepreneurship, resulting in the creation of academic spinoffs and, consequently, in the provision of new technologies and solutions to the market (Pattnaik and Pandey, 2014). They can be viewed as innovation ecosystems, as they bring together a number of internal and external actors with the purpose of fostering innovation. The science parks emerge as a strategy and a core structure to make these activities viable, by concentrating a series of specialized services and establishing the connection between the knowledge generated in the academic environment and the demands of the community in general (Guadix et al., 2016).

Drawing on recent research on contextual factors influencing innovation ecosystems we conjecture that the ecosystem is influenced by the university's

external environment, including the nature of the local, state, regional and national government policy stances towards university entrepreneurship, government objectives concerning the role of universities in society, and the ownership of IP between universities and faculty/students (Wright, Siegel and Mustar, 2017). Country, regional and industrial contexts provide variety in their access to customers, suppliers, finance, human capital and other resources (Wright et al., 2006, 2008).

Likewise, an important dimension of the ecosystem is the historical trajectory and culture of a university. Some universities have a teaching focus, while others are focused on research. Public universities, especially land-grant universities, also have a strong economic development mission, which complements any efforts to enhance innovation and entrepreneurship (Wright, Siegel and Mustar, 2017). One element of the framework concerns the variety of university contexts, in terms of scale, scope, research quality, history and culture, location and local networks, resources and capabilities. Heterogeneity among universities has important implications for the extent and nature of spin-offs by academics (Clarysse et al., 2005).

The main mechanisms created by universities to facilitate the spillover of knowledge by innovation undertaken at the universities are the science parks, incubators, and proof of concept centers, Technology Transfer Office (TTO) (Audretsch, 2014). The Science Parks facilitate the acceleration of business through the agglomeration of knowledge, resource sharing and collaboration among firms and institutions, thereby helping to transform a business idea into an economic organization (Phan, Siegel and Wright, 2005; Guadix et al., 2016). Thus, firms located in parks tend to be more effective in terms of generation of new products, services and patents (Siegel et al., 2003). Academic spinoffs, specifically, may play an even more relevant role in generating financial returns for the inventor and university, as well as employment and economic development for the region (Pattnaik and Pandey, 2014).

The International Association of Science Parks (IASP), defines science park as “an organisation managed by specialised professionals, whose main aim is to increase the wealth of its community by promoting the culture of innovation and the competitiveness of its associated businesses and knowledge-based institutions” (IASP, 2019). Thus, science parks play an important role in regional development. In addition to the generation of jobs provided by the creation of new technology-based businesses, they promote the articulation between developed research and its transformation into innovations through technology transfer, resulting in benefits not only economic but also cultural and social (Guadix et al., 2016).

Given the science park's responsibility and complexity in articulating and managing the university innovation ecosystem, we sought to understand more about orchestrating innovation ecosystem, the theme of the next subsection.

2.2. Orchestrating innovation ecossystem

There is an ongoing debate in the literature about the best collaboration models and their management in network and ecosystem contexts (Hurmelinna-laukkanem & Natti, 2018). Managing – or orchestrating (Dhanaraj & Parkhe, 2006) – innovation ecossystem is not a new issue, but discussion on the phenomenon has been on the rise in recent years (McDermott, Mudambi, & Parente, 2013; Hurmelinna-laukkanem & Natti, 2018).

Innovation ecosystem orchestration can be characterized as a purposeful action or practice by an orchestrator (an actor such as a hub firm) to initiate and manage knowledge in the innovation process in networks and ecosystems (Nambisan & Sawhney, 2011). Orchestration comprises a set of activities, and when an orchestrator conducts (some of) these activities in a specific manner (e.g., by exerting more or less power on other network or ecosystem members), it can be considered that the orchestrator takes a specific role (Pikkarainen et al, 2017).

The expected behaviour, or role, of the orchestrator is connected to various crucial network activities and processes. These activities and processes are used in the following to build a framework of the roles needed to perform them (Nielsen and Gausdal, 2017). The orchestrator generally influences the network design and how the process are established (Laukkanen and Natti, 2012). The orchestrator also monitors and controls the knowledge flow and has a huge number of connections tha are willing and able to provide it with important opportunities and resources (Cinelli, Ferraro and Iovanella; 2019)

The orchestration model was originally defined by Dhanaraj and Parkhe as the set of deliberate, purposeful actions undertaken by a central actor to create and extract value from a network or ecosystem (Dhanaraj and Parkhe, 2006). Dhanaraj and Parkhe (2006) begin this discussion by composing such capacity from three dimensions: knowledge mobility, appropriability of innovation and network stability. Knowledge mobility refers to the sharing, acquisition and deployment of knowledge within the ecosystem. The appropriability of innovation involves ensuring that innovators are able to capture the results generated by innovations; and the stability of the ecosystem refers to the intentionality of maintaining collaboration among ecosystem members.

Batternik et al. (2010) have shown that orchestration is composed of three functions: the beginning of innovation, the composition of the network and the process of innovation. The fundamental aspect of the beginning of innovation is articulation and the direction of the project. The ecosystem composition would be the mapping and selection of complementary actors, as well as the definition of procedures and tasks for the partnership. The innovation process includes conflict management, project management and interaction stimulation.

In a complementary way, Nambisan and Sawhney (2011) list six processes for orchestration, including managing innovation leverage, managing innovation coherence, managing knowledge flows, managing network adherence, managing stability management of the appropriability of innovation. However, the authors focus on managing innovation leverage, managing innovation coherence, and managing the appropriability of innovation. Innovation leverage refers to optimizing opportunities and facilitating relationships to take advantage of value creation. The coherence of innovation is related to the coordination of the internal and external activities to the network and aligning it with the output generated. Finally, the appropriability of innovation seeks mechanisms to appropriate the proposed value generations.

Hurmelinna-Laukkanen et al. (2011) add more dimensions to the Dhanaraj and Parkhe (2006) proposition and also place six dimensions as the basis for the orchestration of innovation networks: setting agenda, mobilizing, stabilizing the network, creating and transferring knowledge, coordination. By combining the dimensions proposed by Dhanaraj and Parkhe (2006) with the proposals by Hurmelinna-Laukkanen et al. (2011), six grouped dimensions are generated (agenda definition, mobilization, knowledge mobility management, knowledge appropriability management, network stability management and coordination).

We understand that these dimensions and activities are valid for business-orchestrated innovation ecosystems in the business context. Assuming that the role and function of the orchestrator changes according to the ecosystem, our purpose in this paper is to understand what the orchestrator's roles and activities in a university innovation ecosystem are. In the next section, we present the methodological procedures adopted in the research.

3. Method

In this research, we conducted participatory action research, because it foresees the accomplishment of an action of transforming character (Kemmis and Mctaggart, 2007). In this method there is no separation between subject and object, since the respondents are also part of object of this research and they participate in its construction in a collaborative way. Moreover, it unites theory and practice, since it takes the theory to the field and there it performs an action together with the researched ones (Brandão, 1984; Kemmis; Mctaggart, 2007; Thiollent, 2003). There is also an educational and social transformation character, since all those involved in the research learn together, in addition to being emancipatory, since, in becoming aware of their situation, the respondents can proceed to act more critically in relation to the environment in that are inserted (Kemmis and Mctaggart, 2007).

In addition, the participatory action research has a strong social commitment on the part of the researcher, who feels connected to the researched subject and acts

according to values shared by the respondents (Brandão, 1984). This makes the researcher concerned on making his research accessible to the public researched and put his scientific curiosity in the service of a social benefit to the community (Brandão, 1982). All the steps proposed by Kemmis and McTaggart (2007) were followed:

1) **Plan** - collect all necessary data and jointly plan the action to be performed;

2) **Acting and Observing** - is the moment of action itself, which must be carefully observed in order to generate a wealth of data that will feed the reflection;

3) **Reflect** - together with the respondents, reflect on the action taken, to understand what emerged from the action and, if necessary, provide inputs for a new planning of a new action.

The researchers are also members of the Zenit Science Park, since they acted in the planning, implementation and monitoring of the process of construction of the innovation ecosystem. Thus, the data collection took place through participant observation, individual interviews with actors of the sectors correlated of University (Department of Technological Development, Entrepreneurship Center, Business Incubators, Academic Units, Junior Companies, Incubated Startups) and data access (management reports, strategic planning, University plan, site). The survey took place from April 2015 to March 2019. Our research recognizes the importance of time in this process of develop resources and capabilities to enable innovation ecosystem to exist (Siegel et al, 2017).

3.1. **UFRGS and Zenit Science Park**

The Federal University of Rio Grande do Sul (UFRGS) is one of the most important universities in Brazil. UFRGS ranked second in the ranking of the Ministry of Education of Brazil of the best universities in the country (BRASIL, 2018). The university has 93 graduation courses, 80 masters and 90 doctorates. In addition to teaching, the university also encourages research and development, extension projects, international mobility of students and interaction with society. UFRGS strategy increasingly emphasizes its purpose in promoting sustainable socio-economic development through innovation and entrepreneurship in articulation with society, thus translating the knowledge produced in academia into new technologies and market solutions, and becoming an international reference (UFRGS, 2019). In 2019, UFRGS received the award for the fourth most enterprising university in Brazil and the most enterprising university in the south of the country.

In that context, the Science Park of the Federal University of Rio Grande do Sul (Zenit) was created with the purpose of "promoting research, development and technological innovation activities of organizations that present a cooperation plan with Units and Interdisciplinary Centers of UFRGS" (Zenit, 2012, p.1). In the UFRGS innovation ecosystem, Zenit Science Park links incubators, startups, junior companies, technological laboratories and researchers of the University, also connecting them with external actors such as companies, research and development centers, public and private spaces of entrepreneurship, governments and society. Its actions include education and entrepreneurship training, business incubation support (primarily the technology-based ones), and services to promote open innovation and the consequent connection of university startups with established partner companies (Zenit, 2018).

The Science Park, therefore, stands as a multisectoral activities. The official regiment of the park does not specify or exclude any area of knowledge, but defines that the park prioritizes, according to its Article 12, initiatives that comply with the following principles:

I - the enterprises will be anchored in the knowledge generated in the UFRGS, transferred to the enterprises according to the norms regarding the preservation of the intellectual property of the university;

II - the projects should be guided by sustainable development, understood by all its social, economic, scientific, technological and environmental dimensions;

III - the enterprises should prioritize the social, human and economic development of the State of Rio Grande do Sul and of the Country (ZENIT – Strategic Plan, 2012, page 4).

In 2015, the board of the Science Park of UFRGS presented in a public event open to the community the new name and the new visual identity of the park. From this moment, the park was renamed Zenit. According to the director of the Park, the definition of the name had two main motivators: the need to create a specific brand for the park and to adapt it to the new portfolio of services and projects of the park, presented at the same event.

The structuring of the Park and its portfolio of services has as main objective the capture of associated companies and the engagement of the different stakeholders inside and outside the UFRGS. This process of orchestrating the university's innovation ecosystem will be presented in the next section.

4. Analysis and the Discussion of Results

4.1. Planning

In this stage, we initially sought to understand the university in which the Park is installed and to identify the actors that comprehends its innovation ecosystem. As a result, the essential points for the Zenit service portfolio and the areas for its orchestration were defined.

UFRGS has its decentralized infrastructure composed of three campus in the city of Porto Alegre, south of Brazil. The academic units are distributed in these three spaces. In this way, the spaces of teaching, research and extension of the University were built in time in a grouped manner by areas, making it difficult to exchange and coexist different segments in a common space.

The UFRGS incubators followed this pattern, as previously specified. Its activities take place in the physical spaces of the academic units with which the theme is closely related. The positive point for incubators, in this regard, is the possibility of communication and direct relationship with the research and teaching source of the area to which it is connected. The critical point to be considered is that incubated companies lose in interdisciplinary relationships with other areas, which could result in promising partnerships.

The innovation ecosystem of UFRGS itself is decentralized and, in addition to Zenit, the following actors are found in different units. The main actors involved in entrepreneurship and innovation at the University are:

- **Sedetec:** The Department of Technological Development of UFRGS is the NIT (Nucleus of Technological Innovation) responsible for patents and intellectual property developed at the University.
- **Junior Companies:** UFRGS has, in 2017, seventeen initiatives of junior companies formalized. Companies are formally linked to undergraduate courses such as design, administration, engineering (s), chemistry among other University courses.
- **Incubators:** UFRGS has 4 active technology incubators: CEI (Information Technology), Héstia (Engineering, Chemistry and Physics areas), IE-CBiot (Biotechnology) and Germina (Multi-sector).
- **Center of Entrepreneurship:** The Center of Innovative Entrepreneurship aims to disseminate the culture of entrepreneurship in UFRGS among students, technicians and teachers in a transversal way. They are responsible for innovation and entrepreneurship courses and disciplines.
- **Technology Labs:** UFRGS has around 200 multidisciplinary laboratories thatoffer services for academic research and market demands.

- **Academic Units:** there are 27 academic units with 98 undergraduate programs and 90 postgraduate programs. In them, more than 900 research groups are linked.
- **Incubated or Associated Businesses:** There are about 35 incubated or associated businesses in the university in the areas of technology, health, biotechnology, energy, food, education, creative economy and others.

From this mapping, we conducted individual conversations with representatives of each actor in the ecosystem to understand what and how Zenit could act. It was identified, from the interviews, that although the UFRGS is one of the most traditional and well-respected brazilian universities of the present time, it has a still incipient performance regarding technology transfer and generation of innovation. In this way, it becomes necessary to articulate in order to maximize all the research potential that the University possesses, and also to build an image focused on the area of innovation.

Another point raised was the absence of headquarters building for shelter of associated companies and research centers. This question is one of the main generators of Zenit's uncertainty regarding the academic community. With this, it was up to the Park to seek services and a position that would overcome this lack.

In addition to these considerations, it was possible to identify from the visits and conversations with university actors the need to connect the different initiatives of entrepreneurship and innovation once they end up acting in isolation and often overlapping. We realized that there was no innovation ecosystem identity at the university. Allied to this, it was realized that the action of the Park should be interdisciplinary since the University has research actions and extension of excellence in different areas of knowledge.

From the points raised, we sought to define the scope of action of Zenit. It was understood that the Park should act not only as a connector between the internal actors to the UFRGS but also external, involving the city as a whole in order to build an image linked to innovation. Along these lines, it became necessary for Zenit to offer innovation-related services to this public. In addition, by the incubators already incorporated to the Park and, also, by the desire to attend more companies, the incubation service would be essential. Finally, due to the University's teaching tradition and the identification of the need to prepare the entrepreneurs and the students, it was understood that the training would be another performance of Zenit. Thus, the Park's service portfolio was organized from four pillars: Incubation, Connection, Training and Innovation. Their development and implementation are presented in the next section.

4.2. Action and Observation

In this section the development of Zenit services will be presented from the orchestration of the ecosystem actors. Initially, the services related to activities of **Incubation** were focused on the support to Incubators and Incubated Companies and Companies Associated with Zenit. The scope of these services is to offer of support in the management of the business, the stimulation of exchanges and interactions and the training and development of the entrepreneurs.

Therefore, Zenit incorporated the Network of Technological Incubators of UFRGS (Reintec) in order to offer support to the incubators regarding the follow-up of essential processes such as selection of incubated, processing and analysis of contracts and support in the certifications. In addition, Reintec seeks to integrate into the incubators, through meetings or being present at the internal meetings of the incubators.

We observed that the great challenge of that articulation was the incubators to acknowledge the Park as an orchestrator since they emerged previously and had total autonomy. According to an interviewee, "the incubators [...] are very old, preceding the idea of a park that emerged from the initiative of informatics, engineering and biotechnology teachers [...] each one created their own incubator".

Another service is the association of non-resident companies. Due to the lack of physical space to house companies and a physical area for the implementation of new buildings with their own resources, this modality was developed. It started from the premise that an organic environment of exchange and interaction does not depend exclusively on a physical space. Therefore, the purpose of this service is to promote interaction from the services offered by the Park and partners, generating and applying new knowledge and developing the skills of companies in the area of innovation.

In relation to the ventures planned in Statute, the Park can host research and development laboratories, incubated companies, companies, sector and business, technological or scientific representation entities or even other organizations that serve the principles and goals of Zenit. We observed that the program is oriented especially to the organizations that have as a goal the increment of activities of R&D&I. The first companies to participate of the program sought innovation and access to the infrastructure, network and reputation of the university.

The services related to the **Connection** area seek to make interactions between Zenit and agents internal or external to UFRGS, both to promote technological skills of the university and to offer services and opportunities. These processes are established through third parties, with advantages for the academic community and, also, for companies associated with Zenit.

With this, the network of internal and external partners was created as a service that seeks to establish connections with internal actors (junior companies, research groups) and external (entrepreneurs, startups, associations) to offer services related to the support of entrepreneurship and innovation, such as funding, investment, networking and consulting. Thus, Zenit partners would offer exclusive advantages to incubated companies and associated companies. The main objective of this service is to connect the actors of the entrepreneurship and innovation ecosystem of UFRGS and Porto Alegre with the companies associated and incubated in Zenit.

We also noticed three main benefits with that service (1) bring the internal actors of the university closer to clients, (2) bring companies closer to the university environment and (3) offer cheaper consultancy and qualification services to incubated companies or companies associated with the park. According to a partner entrepreneur, "it is an opportunity to link our brand with the university".

Furthermore, the Network of Laboratories was developed, a virtual environment, available on the Zenit website, to facilitate access to information from UFRGS technological laboratories that have a partnership with the Park. The objective of this service is to provide a platform for dissemination of the technological competencies of UFRGS laboratories. The information on services, equipment and certifications are provided by the laboratories that meet the accreditation criteria and later standardized and published by Zenit. Following this process, the park provides an accredited laboratory seal.

We noticed that it is also about an activity to bring the actors of the University closer to the market. This way, Zenit mapped, trained and announced the services of the laboratories. Thus, "when the companies get in touch, we already have the laboratories that are ready to serve companies".

The services related to the **Training** aim to enable the internal and external communities of UFRGS to access events that involve the themes of innovation and entrepreneurship, promoting a space of interaction among the most diverse actors of the community. In addition, training is also offered focused on topics relevant to new enterprises already established and seeking to innovate.

An example of this would be the *Quartas de Inovação*, meetings in the form of panels on emerging themes and cases of success related to entrepreneurship and innovation. Each meeting addresses a different theme, just as there are different speakers and / or moderators, invited by the team executing the project. The meetings are of monthly periodicity with the objective of training entrepreneurs, stimulating networking and exchanging experiences.

In addition, the Project Workshop would be a Project Development Workshop for Resource Prospecting aimed at training entrepreneurs who have an innovative project with market potential, but do not have enough capital to make it viable. Thinking about the different possibilities of fundraising, this program

was conceived in four modules, which contemplate the main possibilities of raising funds for entrepreneurs and entrepreneurs with different levels of knowledge, both for public and private resources being designed in partnership with incubators.

We observed that the training activities, besides transferring knowledge to the entrepreneurs, promote disclosure of different services of the University both to external and internal actors. "We had a very diverse public: entrepreneurs, company employees, students, teachers… many people that did not even know UFRGS came".

Finally, in the services of the area of **Innovation** we have those who seek to foster both the development of an innovative culture in organizations and support the development of innovative projects. The aim is to guide companies towards the implementation of an innovation management system and also to support the development of innovative products through prototyping practices.

The AcelerEA is a business accelerator project, designed by Zenit and the School of Management. It aims to stimulate the interaction between students, teachers and pre-incubated startups. The accelerator will offer face-to-face and online weekly activities in the theoretical/ practical model, which will help the startup on better defining and validating its hypotheses and business model as well as its operations. By the end of the program, startups can pitch their business to potential investors.

> It was a demand that came up from the managers of university's incubators [...] the coordination of REINTEC said that they had difficulties in having a common training program for the incubated companies. And in the end, each incubator made their training program differently […] we thought: why not offer an Extension Program linked to the Administration School? Who coordinates is Zenit, but it is operated by the Administration School. The students and former students of the Administration School offer mentorship and support for the development of an acceleration plan for the incubated companies.

We observed that the activity of AceleraEA, besides training the businesses in innovation, also influenced the construction of a collective agenda among the incubators that unify their selection processes from the program. "We could show the reason to make a unified calendar […] it is not a calendar to please to Park […] that is because it will enable joint actions like that".

On the other hand, the NAGI is a project that aims at supporting startups, small and medium enterprises into the development and implementation of an Innovation Management Plan. The methodology used is the *Innovation Route*, which was created by a team of researchers and students from UFRGS and it is

divided into four main stages: (1) Initial diagnosis; (2) Training; (3) In-company consulting, with elaboration of an Innovation Management Plan (IMP); and (4) New diagnosis.

We identifie that the initiative had already been initiated in 2013 with the Informatics Institute and the Administration School from a public promotion public notice. From that, Zenit Science Park started to integrate the activity and connect more actors in its execution.

The Rapid Prototyping Multiuser Center (CMPR) is a laboratory linked to the Zenit Park, in partnership with the Hestia Incubator, which aims at providing rapid 3D prototyping infrastructure to its users for the development and development of their own and / or collaborative projects. The CMPR is multiuser, that is, it serves both the internal community of UFRGS (teachers, students, research groups and incubated companies) and the external public to the University (associated companies, entrepreneurs and research institutes). The Center has the following equipment: 3D printer and milling machine, which allow the rapid development of concrete prototypes coming from 3D virtual projects. We noticed that this activity is a way the University can share technology with its ecosystem.

In the next section we have the reflections about the process of implementation of these services.

4.3. Reflection

In this section we reflected on the process of implementation of the activities developed by Zenit Science Park and the critical factors for the orchestration of the innovation ecosystem. Regarding the Incubation services, we noticed that because of the technological incubators of UFRGS have arisen prior to the existence of Zenit (except Germina, which came later) one of the major difficulties is the mutual integration of these with the Park.

As for Reintec services, it is understood that incubators are increasingly involved with Zenit, with more and more open communication flows. The biggest challenge, therefore, was to generate incubators' sense of belonging to the university's innovation ecosystem. According to one interviewee, “the incubators have their own life, they follow their guidelines, and the Park makes a great effort to see if they can work in a more articulate manner”. However,

> “the mapping of the processes of work of the incubators of network and the offer of exclusive services to them, enabled the improvement of that relation [...] The incubators are already feeling part of the Park as well as liked to it [...] it is not only a feeling, we are working for the documents to be unified, standardized.”

The network of the associated companies depends as much of the operationalization of the conceived services as of the bureaucratic procedures of viabilization the establishment of the contract. In this way, after the other services of the Park are fully executable, it will be possible to offer such an association. We understand that there was a prior need to structure and operationalize the other services in order to be able to offer the proposed benefits to the business association.

Regarding connection services, it was identified that there is interest and willingness to be part of a network of both partners and laboratories. Despite this, there is a lack of knowledge and preparation to offer services to the external community of the University.

For example, the network of laboratories counts on 12 accredited laboratories, being these mainly composed of laboratories of the School of Engineering and the ones that already have a trajectory of interaction with companies/transfer of technology being easier to deal with. It has been difficult to find laboratories able to participate in the Network according to the accreditation criteria since technology transfer and the interaction of companies with the university is still incipient. In spite of the estimate of the existence of 200 technological laboratories in the University, we noticed that the laboratories, for the most part, do not fulfill the requirements agreed as necessary to be part of the Network. Finally, we identified the need to make the online platform more intuitive to the user in the search of information about the laboratories.

Besides the lack of knowledge and train of actors in relation to the innovation generation, we also noticed the superposition of activities and resistance to change as critical factors of the ecosystem orchestration of the university. According to one of the interviewees "the Park faced some competence conflicts with other instances in the university when it started to position as a pro active actor in the promotion of innovation". We identified that some actors were afraid to lose their space.

"We worked with the concept that the Park has the role to connect actors. Then, that was our keyword, let's say, that it is a matter of connection [...] we don't want to replace any existent actor in the ecosystem [...] we don't want to be in conflict with activities that are already established, but we do want to give more synergy to that system of entrepreneurship and innovation, science and technology, in the sense of connecting companies with laboratories, with public agencies". Another interviewee adds "the Park has the fundamental role to connect actors allowing the scientific knowledge to come to the society". In his opinion, that was always a "neck of the university".

From that, Zenit Science Park, in partnership with SEDETEC, created the campaign #UFRGSInnovation aiming at acknowledging, valuing and disclosing the actors and services of the university ecosystem. According to the campaign website, the development of #UFRGSInnovation starts with the understanding that UFRGS is nationally and internationally recognized for its excellence in

teaching, research and extension, however, there is still space to expand and consolidate its actions and image of innovative and entrepreneurial University. We noticed that as far as the roles of each actor were cleared, the resistance and the superposition of actions reduced.

In the network of internal and external partners, we verified it becomes necessary to continually evaluate the partner's reputation with feedback from associated and incubated companies to not undermine the reputation of the Park. In addition, the Park must continuously seek new partnerships to meet the most diverse demands of associated and incubated companies - not to overburden companies and the public with the presence of the same speakers and consultants.

We noticed that in the last years, that connection with external actors increased. Zenit established partnership in 2018 with City Hall of Porto Alegre and with the Ministry of Science, Technology, Innovation and Communication (MCTIC) for the creation of a Center of Computer Reconditioning (CCR). The program promotes the professional training for young people and transforms technological garbage in products. “That initiative interests the municipal public government and the university with all that generates electronic garbage” said one interviewee. Another example of interaction and expansion that Park Zenit is working is the Office of Innovation in partnership with the City Hall of Farroupilha, in Serra Gaúcha. Representing UFRGS, Zenit “will promote the training in entrepreneurial education and innovation management of that region”. In the same year, Park Zenit, with UFRGS, founded a partnership with the municipal government, local entrepreneurs and two more universities of the city (PUCRS and UNISINOS) with their Science Parks: The Alliance for Innovation. The initiative aims at connecting and exchanging expertise in order to promote greater innovation for the city.

When it comes to training services, it was found that the *Quartas de Inovação* events worked well for Zenit's relationships and image building both internally and externally to the University - bringing different partners to attend these meetings as speakers, it was possible to give visibility to the Park and to the partnerships. In addition, it is a means to stimulate entrepreneurship and innovation, presenting and applying techniques related to the topics addressed and stimulating networking and the exchange of experience. In addition, it became possible to reach out to the public: students and future entrepreneurs - who may in the future contact Zenit via incubation or via a business association.

The Project Workshop has not yet been validated since the service was in the phase of market analysis and validation with the public. However, according to an incubated entrepreneur, only by being on the ecosystem of the University it is possible to have access to many sources of funding, being them public or private. The access to knowledge of teachers and researches was also pointed out as a benefit by the startups. Moreover, an entrepreneur created a consulting council for the company with actors of the ecosystem. “One is from the stock market, another of interaction university-company, another from the corporative part

and another from the academic part. To conclude, “everything we decide – contract, price, client, strategy – everything the council directs us”.

In the innovation services, NAGI UFRGS brings a lot of potential to Zenit since the businesses served have great chances of becoming companies associated with the Park. We noticed that the NAGI activity is an alternative to make to services of the internal actors tangible for the market and a faster way for the organizations to know and be linked to the ecosystem of the university. The “UFRGS seal is very important because it is a reference institution in research and knowledge” states one of the participants.

The CMPR involved the involvement of university actors, the design of the business model, and it is currently in the validation phase of the value proposition and the market. With the center it will be possible to attend different actors (researchers, companies) because it is multiuser. It is possible that Zenit is also a provider of technological services to its own stakeholders, thus strengthening the idea of the park being a connector of its peers.

However, we noticed that a blocking for the operation of the center is the bureaucracy and lack of agility and autonomy of the university. The processes are restricted and limited to the demands of a Public University. With that, they end up being slower and, many times, inefficient. Besides that, we observed complaints of entrepreneurs and internal actors in relation to the limitations of infrastructure of the university such as the internet service, reception service and physical space. With that, inadequate infrastructure may be considered a limiting factor for the innovation process.

After that thought, we can imply some critical factors for the orchestration process of the innovation ecosystem of the university. Bittencourt et al (2018) had already listed the engagement of actors; the alignment among the actors and the joint definition and communication of common agenda as key points for the orchestration of an emergent innovation cluster. With the case of the innovation ecosystem of UFRGS we validated those three factors and added two more for the university context: the internal flows and infrastructure of the university and the heterogeneity of knowledge of the actors in relation to the innovation.

The engagement of the actors on the innovation ecosystem of the university may be realized with the resistance of some actors in the activities proposed by Zenit and with the lack of initial sense of belonging showed by the incubators. The alignment among the actors, we could observe the moment when there was superposition of similar activities in the ecosystem such as lectures and courses of entrepreneurship. The joint definition and communication of common agenda was identified since the processes were individualized and the actions isolated, for instance, the incubation public notices.

The internal flows and infrastructure were realized with difficulty to buy supplies for CMPR and with the complaints and structural limitations of the university. Lastly, we identified the heterogeneity of knowledge from a lack of

knowledge and unpreparedness of the laboratories and other actors in achieving to generate innovation for the market. On Table 1 we compiled the key success factors and their evidences for the orchestration of the innovation ecosystem in the university.

Table 1: Key Success Factors for the Orchestration of University Innovation Ecosystem

Key Success Factors	Evidence
Engagement of actors	Resistance and lack of belonging sense
Alignment among the actors	Superposition of similar activities
The joint definition and communication of common agenda	Individualized processes and isolated actions
Internal Flow and Infrastructure of the University	Not adequate infrastructure for innovation
Heterogeneity of knowledge	Unpreparedness and knowledge to innovate

According to observed activities of Zenit Sciente Park as orchestrator of the innovation ecosystem of UFRGS, in the next section, we present a model for the role of the orchestration in that context.

5. The role of the orchestrator of a university innovation ecosystem

There is a vast and rapidly growing literature on the use of innovation ecosystem as policy instruments to enhance innovation and to explain how regional cooperation and innovative networks work (Sydow et al., 2016). Broad discussions on how to orchestrate appropriate forms of cooperation are, however, relatively recent (Nielsen & Gausdal, 2017). Hurmelinna-Laukkanen *&* Natti (2017) likewise argue that there is a lack of research on the orchestrator's roles and activities in innovation ecosystem (see also Heidenreich, Landsperger & Spieth, 2014; Paquin & Howard-Grenville, 2013).

In that scenario, the present paper contributes to the discussion with the proposition of the roles and the activities of the orchestrator of an ecosystem of innovation in the university. The emerging in the definition of innovation ecosystem orchestration addresses what orchestrators do (Hurmelinna-Laukkanen *&* Natti, 2017). Nyström et al. (2014, 484) define roles as "behaviors

expected of parties in particular positions." Role is here defined as a set of actions and responsibilities (Mintzberg, 1973).

Orchestration comprises different activities for formulating the network and directing and managing the practices and processes so as to enable value creation and capture (Batterink et al., 2010). It is about "a set of evolving actions, not a static structural position" (Paquin & Howard-Grenville, 2013, 1624). From the Case of UFRGS, we could identify three main roles performed by Zenit that helps us understand the acting of the orchestrators in that context: architect, knowledge broker and market translator.

The first role is the architect (Hinterhuber, 2002. Hurmelinna-Laukkanen *&* Natti, 2017). This role involves mapping and composing the network (identify and recruit the actors), linking complementary actors (promote connection among them) and constructing a collective identity (develop common agenda and processes) (Nambisan & Sawhney, 201; Laukkanen & Natti, 2012). In this role, a lot of responsibility and initiative comes from the orchestrator (Hurmelinna-Laukkanen *&* Natti (2017). We noticed such activities developed by Zenit with the initial mapping of actors, draw of the ecosystem, connection among the projects, construction of the unified processes with the incubators, definition of joint events calendar and the development of the campaign #UFRGSInnovation.

Another role identified was Knowledge Broker (Dhanaraj & Parkhe, 2006; Nilsen & Gausdal, 2017), that is, the orchestration as sensor, disseminator and manager of knowledge. For that, the activities involved on that role are: knowledge activation (hold and search for knowledge), facilitate transactions (articulate and stimulate the exchange of knowledge) and managing knowledge mobility (guarantee the dissemination of knowledge). Managing knowledge mobility is at the core of an innovative network, since knowledge is the key resource, while knowledge sharing and knowledge creation are the key processes (Dhanaraj and Parkhe, 2006; Gausdal and Nilsen, 2011). Knowledge Broker involves sharing, acquiring and deploying knowledge, and includes facilitating common meeting places for learning (Nilsen &Gausdal, 2017). We observe that external partnerships, the training programs and the unified processes are examples of actions of that role performed by Zenit.

The last role identified was Market Translator, that seeks to approximate, translate and trade the knowledge generated by the university for the market (Dhanaraj and Parkhe, 2006; Gausdal and Nilsen, 2011). That role encompasses the activities of articulate demand (identify the needs of the market), recognize and commercialize innovation (identify the value of the innovations of the university) and manage innovation appropriability (transform the knowledge in innovation). Translation is likely to be a challenge in an innovation network; additionally, the lack of a common knowledge and terminology constitute barriers for the network's survival — as well as for its innovativeness and success (Clegg et al., 2004).

Even when knowledge mobility is managed, networks frequently face the challenge of capturing the profits generated by innovation (Dhanaraj and Parkhe, 2006), where the ability to recognize innovative ideas and commercialize these are prerequisites. This is taking knowledge brokering one step further, to innovation brokering. Managing innovation appropriability — which consists of recognizing and developing innovative ideas, securing patents and copyrights, and governing the ability to capture the profits generated by innovation — it is a crucial process within innovation brokering (Dhanaraj and Parkhe, 2006; Gausdal and Nilsen, 2011). We noticed that the network of laboratories and the connection among the services of the junior companies and other actors of the ecosystem are examples of that acting.

We believe that the roles of the orchestrator of the innovation ecosystem of the university are different from the ones performed in an ecosystem/network of business. The acting of the universities as innovation ecosystems is still recent, therefore, the function to draw the ecosystem and translate and transform their knowledge in innovation is fundamental for their success. We understand that the roles identified do not respect, necessarily, a linear sequence, being possible to exist alteration of agreement with the stage of development of the ecosystem. Besides that, it is also understood that the roles are not restrict to the activities listed here. However, in order to synthesize the roles and the activities of the orchestrator of the innovation ecosystem in the university, we created Table 2.

Table 2: Orchestrator's Roles and Activities

Orchestrator Roles	Activities	References
Architect	Map and compose the network	Hinterhuber (2002); Nambisan and Sawhney (2011); Laukkanen and Natti (2012) Hurmelinna-Laukkanen and Natti (2018)
	Link complementary actors	
	Construct a colletive identity	
Knowledge Broker	Knowledge activation	Dhanaraj and Parkhe (2006); Nambisan and Sawhney (2011); Nilsen and Gausdal (2017);
	Facilitate transactions	
	Managing knowledge mobility	
Market Translater	Articulate demands	Clegg et al. (2004). Dhanaraj and Parkhe (2006);
	Reconise and comercialize innovation	

	Manage innovation appropriability	Gausdal and Nilsen (2011); Batternik et al (2010)

From the analysis of the UFRGS Zenit case and the proposition of roles and activities of the orchestrator for that context, we suggested a toolbox with facilitating actions to orchestrate an innovation ecosystem in the university. As first point, we believe that the creation of a collective campaign, such as #UFRGSInnovation is important to touch the actors of the ecosystem and develop a joint purpose.

In the sequence, we understand that the definition of roles and the creation of a common agenda collaborate for the engagement and alignment of the actors and avoid the superposition of similar activities and the isolated processes. About the training programs, we noticed that they can be important allies to level the innovation knowledge of the internal actors and attract new external actors for the ecosystem, enjoying this way, the reputation of the universities in teaching and research. Lastly, we bet on the creation of platforms to spread the services and the projects developed as mechanism to bring the university closer to the market and generate more innovations. The Activities for facilitating actions for university ecosystem orchestration can be viewed in Table 3 below.

Table 3: Activities for Orchestration of University Innovation Ecosystem

Actions
Collective Campaign
Definition of the roles of the actors
Common Agenda
Training Programs
Platform for communication of projects

CONCLUSIONS

Innovation ecosystems have been calling attention of the researchers and private and public managers because of their potential of innovation generation and development. Thus, the universities are seeking to build innovation ecosystems in their contexts in order to meet the demands of market claimed. However,

there is a gap in the literature about the orchestration of those ecosystems in the university. Therefore, this paper sought to answer the following questions: *what are the roles of an orchestrator in a university innovation ecosystem?* For that, we performed a survey action in the innovation ecosystem of UFRGS orchestrated by its Science Park, Zenit.

We note that the innovation ecosystem is an important mechanism for universities to connect their internal actors, bring them closer to the market and promote greater innovation and development for society. In the literature, innovation ecosystems and their management are being increasingly discussed, however, always focusing on the business environment. Thus, we realized that became essential to understand the particularities of innovation ecosystem orchestration in the university environment.

The first difference we have identified is that the main objective of the university's innovation ecosystem is not economic gains, but to building and exchanging knowledge in order to generate innovation. Thus, managing knowledge mobility is an important activity of the orchestrator. The second difference refers to the articulation of actors of the same institution. We have identified challenges of this context as belonging and overlapping activities. Also, we realize the need for the orchestrator to construct a colletive identity. Finally, the third difference identified is the challenge of bringing the knowledge and innovations generated by the university closer to the market. Generating and comercializing innovation is not the university's main activity, so being a translator for the market is one of the orchestrator's roles of university innovation ecosystem.

With theoretical contributions, we opened the black box of the roles of the orchestrator proposing a model for innovation ecosystems in universities, context not explored yet by the literature. Besides that, we brought empirical evidences about the relation of the university with the construction of an innovation ecosystem from a method that connects researcher and objective and, thus, we could bring perceptions that are not identified in simple case studies. Orchestration comprises different activities for formulating the network and directing and managing the practices and processes so as to enable value creation and capture (Batterink et al., 2010). It is about “a set of evolving actions, not a static structural position” (Paquin & Howard-Grenville, 2013, 1624).

From the Case of UFRGS, we could identify three main roles performed by Zenit that helps us understand the acting of the orchestrators in that context: architect (map and compose the network, link complementary actors, construct a collective identity), knowledge broker (managing knowledge mobility, knowledge activation, facilitate transactions) and market translator (articulate demands, recognize and commercialize innovation, manage innovation appropriability).

Management contributions, we identified the critical factors of the orchestration of the ecosystem and innovation in universities and we suggested a toolbox with

facilitating actions of the process. As critical factors, we identified the engagement of actors, alignment among the actors, the joint definition and communication of the common agenda, internal flow and infrastructure of the university, heterogeneity of knowledge. As facilitating actions, we suggest: collective campaign, definition of the roles of the actors, common agenda, training programs, platform for communication of projects. We believe we can help managers of universities and science parks to identify their roles and activities for the construction of an innovation network.

We had as limitation of the study the unique case, which hinders the generalization of the findings proposed. We understand that a historical analysis, expanding the time of the research could have brought even more insights. We know, however, that the research action at the same time that brings important contributions as result of the involvement of the researcher with the object may have left some short-sighted analysis.

We suggest as future studies to expand the research to other universities as well as compare roles and the activities of the orchestrator with other ecosystems of innovation. We also believe that longitudinal studies can bring new elements, such as a possible alteration of roles or of orchestrators throughout the process.

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