RELISE

MAPPING AN INNOVATION SYSTEM: THE CASE OF THE SOUTHERN REGION OF RIO GRANDE DO SUL[1]

MAPEAMENTO DE UM ECOSSISTEMA REGIONAL DE INOVAÇÃO: O CASO DA REGIÃO SUL DO RIO GRANDE DO SUL

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ABSTRACT

This article aims to develop strategies to address the challenges and leverage the opportunities presented by the characteristics of the southern region, generating an information base that enables more precise identification of the opportunities and strengths of this ecosystem. This work was developed and implemented by the INOVA RS Program, which aims to position Rio Grande do Sul on the global innovation map. The region consists of 22 municipalities, including the city of Camaquã, in the southern region of the INOVA RS Program, according to the territorial coverage of the Regional Innovation Ecosystems (ERIs) of Rio Grande do Sul (Portaria SICT nº 01/2020). To achieve this, descriptive research of qualitative and quantitative nature was conducted, with questionnaires distributed using the "Google Forms" tool to collect responses and tabulate the results. Based on the responses, it was possible to analyze five key dimensions, namely: talent and knowledge, financial capital, infrastructure for innovation, institutions and legislation, and interaction and quality of life. In the

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areas that represent the future of the region, the identified sectors include agribusiness, health, maritime economy, renewable energies, and tourism. This study, therefore, contributes to understanding the innovation ecosystem of the southern region, and its drivers can be applied to other innovation ecosystems.

Keywords: INOVA RS Program, areas holding the future, regional innovation ecosystems.

RESUMO

Este artigo busca construir estratégias que possam enfrentar os problemas e aproveitar as oportunidades que as características da região Sul oferecem, gerando uma base de informações que permita identificar com mais precisão as oportunidades e forças desse ecossistema. Este trabalho foi desenvolvido e aplicado pelo Programa INOVA RS, que tem como objetivo incluir o Rio Grande do Sul no mapa global de inovação. A região é composta por 22 municípios e a cidade de Camaquã, na região sul do Programa INOVA RS, conforme a cobertura territorial dos Ecossistemas Regionais de Inovação (ERIs) do Rio Grande do Sul (Portaria SICT nº 01/2020). Para isso, foi realizada uma pesquisa descritiva de natureza qualitativa e quantitativa, com a aplicação de questionários utilizando a ferramenta "Google Forms" para envio da pesquisa e tabulação dos resultados. A partir das respostas, foi possível analisar cinco dimensões importantes, a saber: talentos e conhecimento, capital financeiro, infraestrutura para inovação, instituições e legislação, e interação e qualidade de vida. Nas áreas que detêm o futuro para a região, foram listados os setores de agronegócio, saúde, economia marítima, energias renováveis e turismo. Este trabalho, portanto, contribui para a compreensão do ecossistema de inovação da região Sul e seus drivers podem ser utilizados para outros ecossistemas de inovação.

Palavras-chave: Programa INOVA RS, áreas detentoras do futuro, ecossistemas regionais de inovação.

INTRODUCTION

The financial markets' convergence among countries is one of the main features of the contemporary world, making innovation an indispensable source of competitiveness. Countries, states, and regions are challenged to develop their market competencies, where knowledge plays a leading role. To understand the

innovation context of a given location, one must first comprehend its innovation ecosystem; to operate and perform effective work within these environments, it is necessary to have an overview of the context presented (SEBRAE, 2015).

First, let us consider the concept of an ecosystem. In biology, an ecosystem is the term given to a group of communities inhabiting a specific location and interacting with each other and with their environment, forming a stable, balanced, and self-sufficient system (ODUM, 2007).

Given the presented concept, to think about development, competitiveness, and sustainability is to think about entrepreneurship and innovation - the driving forces that integrate high-impact economic and social ecosystems worldwide (TEIXERA et al., 2016). A region will only be innovative when it can train and attract talent, spread knowledge, secure financial capital to fund innovation activities, offer support entities, infrastructure, laws, and regulations that facilitate citizens' lives, and provide a quality of life, ranging from opportunities for social interaction to safety, employment, and health conditions. It is understood that an environment with these features constitutes an innovation ecosystem.

These ecosystems comprise not only companies but also universities, researchers, entrepreneurs, investors, venture capitalists, governmental and non-governmental institutions such as banks, venture capital (VC) funds, business angels, among others (JACKSON, 2011).

An innovation ecosystem refers to a complex system of relationships formed among entities whose functional objective is the development of technology and innovation. In this context, innovation ecosystems and their constituents must be studied to find solutions, technological development, and local and regional growth. In addition to enabling new products or solutions, innovation ecosystems bring together structural, organizational, and cultural conditions that permeate inter-organizational relationships (FENNER, 2023).

It is important that the actors understand the dynamics of the innovation ecosystem they are part of, identifying their role within it (TEIXEIRA et al., 2017). The various regions that make up a country have their own historical, cultural, political, and economic characteristics, distinguishing themselves from one another and constituting their own innovation systems. Although regions are part of the same country and, therefore, share a common history, each region presents characteristics that set it apart from the others (CASALI; SILVA; CARVALHO, 2010).

Identifying these most relevant differences, as well as the other elements that compose the innovative universe in a given region, is necessary to drive socioeconomic development. According to Stefenon and Gimenez (2023), one of the main challenges for future research on entrepreneurial ecosystems involves building methodologies for diagnosing local ecosystems that serve as references for public policy makers in entrepreneurship.

Several surveys have mapped the innovation ecosystem of Rio Grande do Sul, namely: (i) Pires (2024) evaluated the innovation ecosystem in Frederico Westphalen, highlighting the importance of communication between academia, companies, and startups; (ii) Valle (2023) analyzed the ecosystem at UERGS, emphasizing the Technological Park of Cachoeirinha; (iii) Fenner (2023) identified seven groups of actors in the Northwest and Missions Region of RS, highlighting the stage of local evolution; (iv) Dolci (2022) studied INOVA RS, which promoted smart specialization and fostered innovation; (v) Tubin (2023) analyzed the orchestration of INOVA RS, identifying 29 key activities; and (vi) Felizola and Aragão (2021) presented the innovation ecosystem of RS, highlighting challenges in articulating among actors.

However, efforts to map the Southern Region of Rio Grande do Sul have not yet been consolidated. In this context, the objective is to analyze the innovation ecosystem in 22 municipalities and the city of Camaquã in the

southern region of the INOVA RS Program, according to the territorial scope of the Regional Innovation Ecosystems (ERIs) of Rio Grande do Sul (Portaria SICT N° 01/2020), focusing on their potential and allowing for a better understanding of the region's opportunities and strengths.

This study aims to build strategies capable of addressing the challenges and capitalizing on the opportunities presented by the characteristics of the southern region, generating an informational basis that enables more precise identification of opportunities and strengths in this ecosystem.

INNOVATION SYSTEM

Throughout history, the State has played a central role in developing national skills, as it can intervene in almost all areas of economic life. This includes implementing a wide range of strategic measures to foster new productive skills among companies and directly financing innovative activities. To achieve “catch up,” nations have historically relied on state support policies to deliberately promote scientific and technological advancement. In this sense, governments adopt more aggressive stances when pursuing radical technical change (entering new techno-economic paradigms); even after achieving the desired position with a stronger productive sector, the State continues to act, albeit indirectly (SANTOS, 2014).

The State’s role changes according to different historical, economic, political, and social moments of each nation. For recently industrialized countries, the State’s participation was more incisive in changing the productive matrix, with both targeted and universal measures, having to act on different fronts of lag. For countries that industrialized until the early 20th century, State intervention, although strong, was executed differently since these already had some foundations in place, such as the presence of relatively autonomous business

groups and an established educational base; while the former had to build from virtually nothing (SANTOS, 2014).

Niosi (2002) outlines some of the main factors explaining inefficiencies and proposes methods to measure the efficiency and effectiveness of national innovation systems. The author explains that the institutional configuration related to innovation, and the underlying production system, are the key characteristics of national innovation systems, which are a set of interrelated institutions; their core is made up of institutions that produce, disseminate, and adapt new technical knowledge, whether industrial firms, universities, or government agencies. The innovation system discussion involves understanding the evolutionary trajectory of system concepts, which have developed over decades, up to the current debate on the National Innovation System. Azevedo (2006) notes that in 1968, Sábato and Botana introduced in Latin America the initial ideas of a science and technology strategy for the countries' development process, involving three key actors: government, the productive sector (companies), and the scientific infrastructure (universities), forming the Sábato Triangle. Relationships may occur among agents of each vertex (intra-relations), between parts of vertices (inter-relations), and, finally, among the three actors and the external environment (extra-relations). Innovation arises as a product of this system of relationships, emphasizing the central and essential role of university-company inter-relations.

Lundvall (2007) reflects on this concept and looks forward from a personal perspective, also offering insights into how and why the concept emerged. The document argues that the key to progress is to better understand knowledge and learning as the basis for innovation, and to comprehend how different modes of innovation complement each other and find support within the specific national context. A core of the innovation system is defined, and it is

shown that it is necessary to understand both the micro-behavior at the core and “the broader landscape” in which the core operates.

Pereira and Dathein (2012) review the theoretical discussion on the role of companies in consolidating innovation systems, emphasizing the importance of the learning process as the foundation for accumulating the knowledge needed to promote technological, organizational, and institutional innovations. In this sense, companies contribute to and at the same time benefit from innovation systems, as the learning process is an inherent part of the “co-evolution of physical and social technologies,” leading to progress at the micro and mesoeconomic levels, which promotes economic development.

Lemos (2013) highlights that the main research topics in the field point to the process of knowledge transfer and how this can be influenced by the characteristics of companies, universities, and researchers; the channels through which interaction occurs; the creation of spin-offs; the importance and function of intermediary agents such as technology transfer offices; geographical factors; policy implications; and the measurement of university/company collaboration, among others. Santos (2014) empirically presents State actions to promote the National Innovation System in both developed countries and recently industrialized nations, analyzing some actions in Germany, Japan, the USA, Taiwan, and South Korea in the early stages of their technical change processes as well as in maintaining their achieved positions, providing a summary of the State’s role in technological development.

Bittencourt and Cario (2016) discuss the concept of the National Innovation System, highlighting its relevance for recent analyses. Its roots and evolution are debated, emphasizing fundamentals that support its importance as a central device for contemporary analyses. From an academic perspective, the concept’s underpinning vision was a counterpoint to the liberalism gaining strength at the time of its emergence (the 1980s), and not only for that reason, it

bears similarities to the Latin American structuralist view on the limits of industrial development. Within the evolutionary/neo-Schumpeterian theoretical framework, based firmly on historical premises marked by distinct social, economic, and political realities, it is noted that the greatest challenge for the concept is to address the complexity and uniqueness of innovation processes in different national systems. The importance of geography in innovation studies is linked to the fact that the geographic and spatial concentration of economic agents—and the resulting proximity—generates benefits that stimulate interactive learning and innovation processes. Thus, many studies have sought to demonstrate these benefits linked to geographic concentration and proximity.

INNOVATION ECOSYSTEMS

The concept of ecosystem began to appear in the 1930s, primarily within biology and ecology. Jackson (2011), a National Science Foundation (NSF) researcher, was one of the first to draw analogies, though not completely, between biological and innovation ecosystems (JUCEVICIUS, et. al., 2016). Jackson (2011) provided a comprehensive definition of an innovation ecosystem, focusing on its interrelations and interdependencies, attributing exchange and interaction as more fundamental factors for innovation formation than infrastructure and invested capital. The author emphasized that an innovation ecosystem can be understood as two distinct economies: the knowledge economy, driven by fundamental research, and the commercial economy, driven by the market.

Carayannis and Campbell (2009) take a similar approach, defining innovation ecosystems as places where people, culture, and technology meet and interact to catalyze creativity, spark invention, and accelerate innovation in scientific and technological fields, both in the public and private sectors, policy-driven as well as bottom-up, entrepreneurially.

Later, Hayter (2016) describes the concept of regional innovation ecosystems (RIEs), which are defined mainly as interactions based on location and knowledge absorption. Thus, literature seeks to understand the dynamics within this approach and the corresponding economic success or failure of regions.

This interaction comes from the union of various actors, such as companies, colleges and universities, R&D centers, government, intermediary agencies, industry associations, and economic, political, and social environments (HAYTER, 2016; CAI; HUANG, 2018). In a real ecosystem, actors must operate in complex synergy through the flow of innovation resources, agent interaction, and interdependence within a given geographic space (CAI; HUANG, 2018).

According to Ferreira and Prestes (2023), interactions within ecosystems tend to reduce uncertainty in entrepreneurship by establishing cooperative relationships, as no single actor in the ecosystem can possess all the necessary resources to develop innovations. Additionally, leadership, public and private organizations, educational institutions, contact networks, resources of various kinds (financial, knowledge, workforce, technology), as well as cultural aspects and the very attributes inherent to companies (such as clients, suppliers, market), in combination, cooperate amid competition among enterprises.

Therefore, a collaborative and co-creative approach involving all societal actors is necessary for implementing a regional policy focused on creating new opportunities to increase growth, competition, and quality of life in the region. This approach also includes new opportunities to engage universities as collaborators in reframing problems and seeking solutions (MARKKULA; KUNE, 2015).

INNOVATION ECOSYSTEM IN RIO GRANDE DO SUL

Previous research has mapped aspects and regions of innovation ecosystems in Rio Grande do Sul. Pires (2024) evaluated the development of an

innovation ecosystem in the region of Frederico Westphalen, where the UFSM campus operates, demonstrating that effective management can drive regional growth and reinforce the local ecosystem, as communication among academia, companies, and startups, capacity-building, and support from governments and universities are essential to strengthening innovation ecosystems, with a focus on emerging technologies and innovative projects.

Valle (2023) analyzed the innovation ecosystem at the State University of Rio Grande do Sul (UERGS). According to the author, UERGS, as a young and expanding institution, is actively shaping its innovation ecosystem. Strategic projects, such as the Technological Park of Cachoeirinha, reflect its commitment to connections and infrastructure for innovation, and the university adopts practices aligned with the dynamic capabilities model, strengthening its position in the innovation landscape.

Focusing specifically on the Northwest and Missions Region of Rio Grande do Sul, Fenner (2023) identified seven groups of actors in the ecosystem: (i) Ideation, (ii) Investors, (iii) Research & Development (R&D), (iv) Support Organizations and related entities, (v) Industries, (vi) Startups, and (vii) Society. The author indicates that the region is in a phase of evolution and expansion, with emphasis on interactions among technological incubators, universities, and public authorities. These connections drive local technological development, but the ecosystem still needs significant advancement to create a mature environment capable of fostering innovation and the creation of high-tech companies that generate regional impact.

Dolci (2022) investigated how the state innovation program - INOVA RS - worked to stimulate innovation in its eight regions. The smart specialization process was implemented in six phases, beginning with the analysis of the regional context and the structuring of an inclusive governance. Practical examples and real cases showed effective innovation creation. The study showed

that with public policies, such as calls for proposals and events promoted by the regions and SICT, it was possible to spread knowledge about innovation. Universities played a key role, orchestrating the decentralized innovation process. Finally, the creation of the Gaúcha Innovation Law in 2021 was highlighted as a milestone, boosting support for innovative projects and preparing the state for the new economy.

Tubin (2023) explored the activities of regional innovation ecosystem orchestrators, focusing on the "Inova RS" program of Rio Grande do Sul. The research identified 29 key activities associated with orchestration, analyzing four regional innovation ecosystems, two more and two less developed. The seven orchestration dimensions were found in the program, highlighting the importance of universities, events, communication, and knowledge management. The study also revealed the significant role of Innovation and Technology Managers (GITs), who receive government scholarships. The analysis also emphasized coopetition as an essential factor.

Covering the entire state, Felizola and Aragão (2021) present the innovation ecosystem of Rio Grande do Sul through the integration among universities, government, companies, and society, following the Triple Helix and Quadruple Helix models. The authors point out that universities like UFRGS, PUCRS, and Unisinos lead initiatives in technology parks and incubators, promoting innovation and entrepreneurship. TECNOPUC and Zenit Park demonstrate these institutions' impact on regional development. Civil society, with community universities and entities such as the S System, complements the ecosystem with local development initiatives. Among the challenges cited by the authors are the lack of coordination among actors and the limited government connection, reducing the state's competitiveness.

PROPOSED METHOD

The motivation for this work stemmed from the understanding that, to act within the innovation ecosystem, one must first have an initial understanding of how it operates and is organized. To this end, a descriptive qualitative and quantitative research was conducted, applying questionnaires using the “Google Forms” tool to distribute the survey and tabulate the results.

The mapping questions were organized in an effort conducted in August 2020. The following dimensions were used: Talent and Knowledge, Financial Capital, Innovation Infrastructure, Institutions and Legislation, Interaction and Quality of Life. Secondary data related to these dimensions were collected through searches of official agencies, city halls, national reports, the strategic development plan of the Southern Region, and institutions such as SEBRAE, INEP, INPI, and FEE (Foundation for Economics and Statistics). To broaden the understanding of these dimensions, internal reports and indicators were requested from the technological parks of Pelotas and Rio Grande. For this, questionnaires were prepared with the technical and strategic committees of Inova RS and key businesspeople from the region. First, a questionnaire with eighteen open questions was prepared with the committees, answered by 23 committee members. From the analysis of these responses, various factors were identified, enabling the construction of a new instrument, this time directed at key businesspeople in the region, featuring seven open and closed questions, answered by 29 businesspeople. The research was delimited to 22 municipalities and the city of Camaquã in the southern region of the INOVA RS Program, according to the territorial coverage of the Regional Innovation Ecosystems (ERIs) of Rio Grande do Sul (Portaria SICT N° 01/2020). These are: Amaral Ferrador, Arroio do Padre, Arroio Grande, Canguçu, Capão do Leão, Camaquã, Cerrito, Chuí, Herval, Jaguarão, Morro Redondo, Pedras Altas, Pedro Osório, Pelotas, Pinheiro Machado, Piratini, Rio Grande, Santa Vitória do Palmar,

Santana da Boa Vista, São José do Norte, São Lourenço do Sul, Tavares, and Turuçu.

INOVA RS AND THE SOUTHERN REGION OF RIO GRANDE DO SUL

With the goal of placing Rio Grande do Sul on the global innovation map, the Inova RS program was launched, instituted by Decree No. 54767 of 08/22/2019, linked to the Secretariat of Innovation, Science, and Technology. It has been consolidated into eight regional innovation ecosystems in the State - Metropolitan and North Coast; South; Western Border and Campanha; Central; Valleys; Northwest and Missions; Production and North; and Serra and Hortênsias - through the interconnected action of organized civil society and the business, academic, and governmental sectors. Actions in the macroregions aim to coordinate and build projects for the state's economic and social development, based on defining local priorities and opportunities and valuing regional assets and potential.

The program stimulates investment in technological innovation to boost the State's growth and make it a place capable of generating, retaining, and attracting entrepreneurs, businesses, and knowledge-intensive investments. For this, a local governance was formed by two Inova RS committees. The strategic committee consists of engaged leaders capable of coordinating the regional ecosystem. The technical committee comprises people recognized for their technical capabilities in various areas such as management, innovation, planning, and ecosystem analysis.

Rio Grande do Sul leads the global competitiveness ranking in technological sectors, according to the FIEC Innovation Index of the States, as the most innovative Brazilian state, with Paraná and Santa Catarina in third and fourth positions, respectively, behind only São Paulo. Another significant indicator for the region is the FIEC Innovation Index of the States, in which the southern

states ranked among the top five in the 2022 analysis, with special mention to the research results component, where the south of the country repeated the excellent results achieved in 2021, again, only behind São Paulo.

The Southern Region is part of the Southern Half of RS, considered the fourth most populous region in the state and the second largest in territorial extension. It is characterized by significant natural wealth, with large freshwater reserves and an extensive maritime coast, being the only region in the state bordered by three lagoons. It is dominated by the Pampa biome, and its soils allow for a diversification of agricultural and forestry products (Socioeconomic Atlas, 2020).

The Southern Region is strategically located in relation to Mercosur countries, having a natural connection with Uruguay through the Lagoa Mirim waterway, with the Port of Rio Grande serving as the point of connection (Socioeconomic Atlas, 2020). Its border location with Uruguay and the sharing of the Uruguay/Brazil waterway underscores the importance of this link for progress in binational relations.

With a strong presence in agribusiness, fishing, commerce, and services as drivers of its economic development, the industrial sector includes companies in food, health, fertilizers, among others. Of note is the prominent role of the Port of Rio Grande, the only seaport in RS and the last port in southern Brazil. The growth of wind energy production is also seen as an opportunity, with the Campos Neutrais Wind Complex standing out.

In the services sector, the region is also recognized as a center of excellence in education and health. Academically, it is known for excellent research centers, with federal universities and institutes as well as private educational institutions.

The Pelotas/Rio Grande axis concentrates 63.26% of the region’s population and a high percentage of its regional wealth. Other municipalities have

around 20,000 inhabitants, considered small, except for Canguçu, Santa Vitória do Palmar, and São Lourenço do Sul, with populations between 30,000 and 55,000. All have potential in various areas to develop and reduce inter- and intra-regional disparities.

The region is characterized by a period of economic stagnation in recent decades, as shown in Table 1, which details some aspects of the 23 cities that are important for characterizing the Southern Region in terms of per capita GDP, Human Development Index (HDI), and population and territorial information.

Table 1: Constituent Cities of the Southern Region within the Regional Innovation Ecosystems – Socioeconomic Data.

CITY	Per capita GDP	HDI	Population	Area (km²)
Amaral Ferrador	15,008.24	0.624	7,085	505.983
Arroio do Padre	20,140.95	0.669	2,951	124.693
Arroio Grande	32,643.03	0.657	18,238	2,508.545
Camaquã	30,617.83	0.697	66,478	1,680.168
Canguçu	20,327.86	0.650	56,211	3,526.253
Capão do Leão	21,267.98	0.637	25,409	783.624
Cerrito	15,361.39	0.649	6,047	451.699
Chuí	37,264.87	0.706	6,770	202.387
Herval	20,122.72	0.687	6,814	1,759.717
Jaguarão	25,658.02	0.707	26,500	2,051.845
Morro Redondo	13,590.80	0.702	6,589	244.645
Pedras Altas	49,669.96	0.640	1,954	1,373.985
Pedro Osório	18,955.62	0.678	7,706	603.757
Pelotas	24,894.68	0.739	343,132	1,609.708
Pinheiro Machado	22,623.23	0.661	12,195	2,248.221
Piratini	19,056.39	0.658	20,704	3,537.799
Rio Grande	44,014.66	0.744	211,965	2,709.391
Santa Vitória do Palmar	30,713.95	0.712	29,483	5,195.667
Santana da Boa Vista	20,850.51	0.633	8,067	1,420.616
São José do Norte	12,416.92	0.623	27,721	1,071.824
São Lourenço do Sul	24,869.92	0.687	43,540	2,036.125
Tavares	15,184.91	0.656	5,483	610.106
Turuçu	27,803.08	0.629	3,423	253.635
AVERAGE	24,480.76	0.671	———	———
TOTAL	———	———	944,465	36,510.393

Source: research data.

Among the data presented, what stands out most is the wide variability of per capita GDP in the region. Cities like São José do Norte and Morro Redondo have a per capita GDP in the range of 12 to 13 thousand reals, while Pedras Altas and Rio Grande are above 40 thousand reals.

The data shown can be compared to those provided by IPEA in conjunction with the United Nations Development Programme (UNDP) and the João Pinheiro Foundation in the book “Human Development in Brazilian Macroregions,” published in 2016. This publication makes it clear that all Brazilian macroregions fall within the range of medium or high human development. UNDP Brazil, IPEA, and the Pinheiro Foundation also created the Municipal HDI (IDHM), which estimates the development level of cities as very low (0 to 0.499), low (0.500 to 0.599), medium (0.600 to 0.699), high (0.700 to 0.799), and very high (0.800 to 1). Considering that Brazil’s current average HDI is 0.759 (considered high), the country ranks 79th in the global HDI ranking (a list of more than 180 countries), according to UNDP data published in 2018.

Fica evidente que na Região Sul, apenas Pelotas e Rio Grande encontram-se no patamar de desenvolvimento alto, enquanto as outras 21 cidades ainda estão na faixa de desenvolvimento médio.

Esta realidade precisa ser alterada, e um dos caminhos é através de investimentos nos Ecossistemas Regionais de Inovação. Pelotas e Rio Grande têm grande responsabilidade nesse processo por contarem com Universidades renomadas nacionalmente e internacionalmente e, ainda, por estarem em processo de consolidação de seus respectivos Parques Científicos e Tecnológicos que podem impulsionar o empreendedorismo e a inovação no ambiente acadêmico.

A partir da análise foi possível identificar cinco dimensões importantes para o mapeamento do ecossistema regional de inovação (ERI), a saber: (i)

talentos e conhecimentos; (ii) capital financeiro; (iii) infraestrutura para inovação; (iv) instituições e legislações; e (v) interação e qualidade de vida. Esses estão mais bem explicados a seguir (quadro 2).

It is evident that in the Southern Region, only Pelotas and Rio Grande are at a high development level, while the other 21 cities still fall within the medium development range.

This reality needs to change, and one path is through investments in Regional Innovation Ecosystems. Pelotas and Rio Grande have significant responsibility in this process due to their nationally and internationally recognized universities and the ongoing consolidation of their respective Science and Technology Parks, which can drive entrepreneurship and innovation within the academic environment.

From the analysis, it was possible to identify five important dimensions for mapping the regional innovation ecosystem (ERI), namely: (i) talents and knowledge; (ii) financial capital; (iii) innovation infrastructure; (iv) institutions and legislation; and (v) interaction and quality of life. These are further explained below (see Chart 1).

Chart 1: Dimensions and delimitations

ID	DIMENSIONS	DELIMITATION
01	Talents and knowledge	Training of individuals with higher education, existence of universities, graduate programs (stricto sensu), and number of registered patents.
02	Financial capital	Availability of financial resources for Innovation (government transfers, angel investors), startups with investment programs.
03	Infrastructure for Innovation	Existence of innovation infrastructure such as: Technology Parks, Innovation Hubs, NITs (Centers for Technological Innovation), and APLs (Local Productive Arrangements).
04	Institutions and legislation	Incentives, norms and laws favorable to innovation, and the existence of organizations that support innovators.
05	Interaction and quality of life	Human Development Index; Number of physicians per capita; Hosting of international events; Availability of free-access Wi-Fi.

Source: research data.

In the area of talent and knowledge, the Southern region stands out by hosting 10 universities, such as: Católica de Pelotas (UCPel), Federal do Rio Grande (FURG), Federal de Pelotas (UFPel), Federal do Pampa (UNIPAMPA), the Federal Institute Sul-rio-grandense (IFSul), and the Federal Institute of Rio Grande do Sul (IFRS), each with a group of campuses and distance learning centers in several municipalities. In the same vein, there is a noteworthy number of Stricto Sensu graduate programs, amounting to 66 programs in various fields of knowledge. These structures make higher education more accessible, offering the population the chance to better prepare for the job market, as well as serving as a gateway for entrepreneurship, idea development, and experience sharing.

However, the low rate of talent attraction and retention poses a threat to the region. Talent retention involves a set of actions aimed at quality of work life, people management processes aligned with organizational strategies and integrated with each other, based on the principle of managing people as valuable assets, with the people manager supporting other managers. Leadership and organizational culture focused on people are also retention factors (OLIVEIRA et al, 2013). Talent attraction is also linked to municipal assets such as leisure, safety, among others.

Respondents also highlighted the threat of policy discontinuity in several areas, including the promotion of education, teacher training, and classroom content unrelated to market needs.

As society and technology progress rapidly, companies must also solve both new and old problems. Thus, in terms of financial capital, regarding investments by municipalities in the region in Science and Technology, the municipalities of Pelotas and Rio Grande reported an investment of R$ 1,110,000. As for startups accelerated or in the acceleration process, 46 were

mentioned in the municipalities of Pelotas, Jaguarão, São Lourenço do Sul, and Rio Grande.

The growing number of startups is noticeable, with some already established outside the state. However, investors, banks, venture capital funds (VC), angel investors, and others are still scarce. Banks that work specifically with innovation investment credit are almost nonexistent in the Southern Region. There is also little or no relationship between traditional companies and startups, thus making the creation of opportunities more difficult. According to Schueffel and Vadana (2015), financial institutions and businesses face internal challenges in assessing and implementing products/services offered by emerging companies.

In the innovation infrastructure dimension, according to the SICT Observatory (2019), the region has two technology parks (Oceantec - Science and Technology Park and Pelotas Technology Park), three incubators (Conectar - UFPel Technology-Based Incubator, CIEMSUL UCPel Business Incubation Center for the Southern Region, and INNOVATIO - FURG Technology-Based Business Incubator), two Technological Innovation Poles, one Industrial Innovation Pole, three Scientific, Technological, and Innovation Institutions (EMBRAPA - Temperate Climate, Federal University of Pelotas – UFPel, Federal Institute of Education, Science, and Technology – IFSUL), three Technological Innovation Centers (NITs) (Technology Innovation Directorate – FURG, Technology Innovation Coordination (COINT) – IFSUL, Technology Innovation Coordination – UFPEL, EMBRAPA - Temperate Climate, Technology Innovation Directorate – FURG), and three APLs (Local Productive Arrangements) (Maritime, health, and food). These consolidate a set of effective mechanisms for the transfer of technology/knowledge from the scientific-technological infrastructure (universities, research institutes, etc.) to the productive structure (companies/industry).

Regarding the institutions and legislation dimension, incentives for scientific and technological research are necessary for a country to foster appropriate conditions for economic development (Pnud, 2003). In Brazil, the Technological Innovation Law No. 13,243 of January 11, 2016, or the legal framework for innovation, known as the Science, Technology and Innovation (CT&I) Code, sets forth measures to encourage innovation and scientific and technological research in the productive environment, aiming at technological capacity building, achieving technological autonomy, and developing the country's and region's productive system (BRASIL, 2016).

The law was an important milestone in the evolution of innovation promotion instruments and in fostering technological partnerships among various actors in Brazil (KOSLOSKY et al., 2014).

In the state of Rio Grande do Sul, the Innovation Law (13,196/2009) established in July 2009 (RIO GRANDE DO SUL, 2009), encourages the development of a regional innovation ecosystem (ERI). Thus, the Institutional-Legal dimension mainly consists of the laws, regulations, and institutional practices that foster innovation in the ecosystem.

Rio Grande is the only municipality in the Southern region of the state with specific legislation for the area of innovation; Municipal Law No. 8,830, known as the Innovation Law, addresses measures to encourage innovation and scientific and technological research in the business, academic, and social environments, aiming at generating employment and income, and is seen as a decisive step for the city to establish itself as an attractive environment for technology and new economy companies.

Regarding the average Service Tax (ISS) rate, it ranges from 1% to 5%. The average time to open new businesses is around 2 to 15 days. Time is an important factor when launching a new venture that requires the opening of a legal entity. In this sense, actions to reduce bureaucracy are being discussed in

some municipalities; one example is the Cidade Empreendedora Program, an initiative by Sebrae RS focused on improving the business environment (SEBRAE, 2021).

The interaction and quality of life dimension is linked to the population's well-being, access to health, safety, culture, and job opportunities. These aspects directly influence people's quality of life, making the region attractive (or not) for living and/or investment.

In this regard, the average HDI of the Southern region is 0.53, which according to the UNDP is considered low (0.500 to 0.599); the higher the indicator, the better the region's performance.

In terms of health, only the municipalities of Pelotas and Rio Grande have high-complexity health services.

Few municipalities offer free access to Wi-Fi; as with the data collection, 11 points were registered. Deep inequalities are reproduced in the online environment, with a lower proportion of internet use in rural areas, among individuals with lower income and education, as well as among the elderly. Furthermore, there are persistent disparities in the quality of household internet connections and in the types of devices used to access the network—in most municipalities, the only connected device is the cell phone (CGI.br, 2020).

Beyond its relationship with economic development, innovation is also regarded as important for improving quality of life, since opening new markets can help create job opportunities (SALERNO; GOMES, 2018), or, with digital transformation, enable citizens who have been excluded until now to access services.

In this sense, innovation is seen as the fundamental element for the region's transformation and revitalization. It is understood that only the transition from a competitive to a cooperative scenario, the replacement of polarization with

collaboration, and the sum of efforts among the quadruple helix can place the Southern region at a distinguished level.

Considering the region's potential (important educational hub, privileged geographic position with the state's largest seaport and waterways connecting to Uruguay and Porto Alegre, natural beauty with high tourism potential, and vast arable land), the future-leading areas are agribusiness, health, the blue economy, renewable energy, and tourism.

FINAL CONSIDERATIONS

The results of this research allow acknowledgement of a close connection between learning and innovation. Development depends on the technical and organizational changes caused by continuous innovation processes. Innovations introduce technical and organizational knowledge into the market. This knowledge can be understood as a result of learning and ultimately contributes to removing barriers of lack of learning opportunities and economic opportunities. This knowledge also contributes to increasing substantive freedoms such as the ability to work, communicate, learn, and participate democratically in political processes. They are important means in the development process.

The definitive recognition of the efficiency of national innovation systems and the adoption of benchmarking can also help go beyond mere description toward a more policy- and management-oriented evolutionary approach to national innovation systems. Based on both inefficiency and ineffectiveness, it is likely to identify the weight of past decisions, path-dependent results of organizational and technological trajectories. Recognition of national or regional differences (both in institutions and at the system levels) should not prevent systematic benchmarking. According to Azevedo (2006), the concept of the helix highlights the role and importance of the entrepreneurial university in national

development. The SNI approach, in turn, emphasizes the role of existing interactions between universities and companies in the innovation process. In addition to these strategic actors, the national innovation system is also composed of laws, coordination mechanisms and institutions, governments, market selection mechanisms, and financial systems that support innovative investment, among others.

In developing countries, it is easier to map and analyze public infrastructure and what occurs in the public sphere than to study what happens at the system's core. Even so, it is believed that keeping the company in focus is crucial to understanding what works and what does not in the national innovation system. Growth is a necessary but not sufficient condition for development unless the latter has already been largely consolidated, that is, unless the combination of different forms of innovation (technological, organizational, and institutional) has promoted favorable conditions for long-term economic development. In summary, from the “institutionalist-evolutionary” perspective, development is synonymous with sustained and lasting growth, resulting from a concatenation of innovations. NIS has become understood as a fundamental support for promoting economic development, as it comprises a set of actors and institutions whose interactive trajectory has been fundamental for the performance of industrialized economies from a historical perspective (PEREIRA; DATHEIN, 2012).

The transfer of knowledge between university and company can occur through personal contractual interactions between university and company researchers, or through formal structures such as specific university departments, technology transfer offices, and other types of knowledge transfer organizations. In the former case, relationships are strongly supported by the professional and social network and are based on trust. Scientists are individually hired as consultants on company projects, whose scope and content are defined, organized, and monitored by the companies themselves. Furthermore, the

project results are fully appropriated by the companies. In the second case, the company partners with the university for project execution and the researchers involved work as university employees (LEMOS, 2013).

All elements that contribute to forming a national environment that fosters or inhibits innovative activity are considered, including not just universities, the financial system, and the State, but also business culture, social capital, labor market conditions, macroeconomic regulation, and more. A nation's national innovation system, in this sense, is understood as a broad and systemic set of factors and encompasses relationships among organizations, institutions, and socioeconomic structures. Such factors determine the rate and direction of innovation and the development of competencies that arise from science- and experience-based learning processes. Thus, from this perspective, similar measures may not have the same effect or promote convergence in the performance of nations (SANTOS, 2014).

As limitations of this research, it should be noted that only one type of data collection was used, whereas additional data could have been gathered in greater depth through interviews and focus groups.

Thus, for future research, it is suggested to conduct further studies on the characteristics or types of innovation ecosystems in the region under study, with qualitative research to broaden the sample and sector to be investigated, thus making it possible to describe what type of innovation ecosystem predominates in the Southern Region of the State of Rio Grande do Sul.

REFERENCES

AZEVEDO, P. **A interação UFSC e PETROBRAS para o desenvolvimento inovativo sob a óptica institucionalista-evolucionária**. 2016. 374 f. Tese (Doutorado em Administração). Programa de Pós-Graduação em Administração, Universidade Federal de Santa Catarina, Florianópolis, 2016.

BITTENCOURT, P. F.; CARIO, S. A. F. O conceito de sistema nacional de inovação: das raízes históricas à análise global contemporânea. In: XXI Encontro Nacional De Economia Política, 2016, São Bernardo do Campo. **Anais** [...] Florianópolis, 2016, p. 1-24.

CAI, B. Q.; HUANG, X. H. Evaluating the Coordinated Development of Regional Innovation Ecosystem in China. **EKOLOJI**, v. 27, n. 106, p. 1123–1132, 2018.

CARAYANNIS, E. G.; CAMPBELL, D. F.J. “Mode 3” and “Quadruple Helix”: toward a 21st century fractal innovation ecosystem. **International Journal of Technology Management**, v. 46, n. 3/4, p. 201, 2009.

Comitê Gestor da Internet no Brasil [CGI.br]. (2020). **Pesquisa sobre o uso das tecnologias de informação e comunicação nos domicílios brasileiros**: TIC Domicílios 2019. https://www.cetic.br/pt/pesquisa/domicilios/publicacoes/

DOLCI, P. C. Especialização inteligente no Brasil: análise e reflexões da aplicação no INOVA RS. In: XLVI Encontro da ANPAD - EnANPAD 2022, 2022, On-line. **Anais** [...]. 2022, p. 1-20.

FELIZOLA, M.; ARAGÃO, I. M. de. A regionalização do ecossistema de inovação do Rio Grande do Sul. **Revista Pensamento Contemporâneo em Administração**, Macaé, v. 15, n. 3, p. 145-165, nov. 2021.

FENNER, R. S. **Ecossistemas de inovação: uma análise da Região Noroeste e Missões do estado do Rio Grande do Sul**. 2023. 159 f. Dissertação (Mestrado em Administração). Programa de Pós-Graduação em Administração, Universidade Federal do Pampa, Santana do Livramento, 2023.

FERREIRA, F. L. A.; PRESTES, J. A. Ecossistemas empreendedores: uma discussão sobre os aspectos gerais que os norteiam. **Revista Livre de Sustentabilidade e Empreendedorismo**, v. 8, p. 11-22, 2023.

GARCIA, R. Geografia da inovação. In: RAPINI, M.; RUFFONI, J.; SILVA, L. A.; ALBUQUERQUE, E. D. M. (org.). **Economia da ciência, tecnologia e inovação – Fundamentos teóricos e a economia global**, 2. ed. Belo Horizonte: Cedeplar/UFMG, 2021.

HAYTER, C. S. A trajectory of early-stage spinoff success: the role of knowledge intermediaries within an entrepreneurial university ecosystem**. Small Business Economics**, [s. l.], v. 47, n. 3, p. 633–656, 2016.

JACKSON, D. J. What is an Innovation Ecosystem?. **National Science Foundation, Arlington**, VA, 2011.

JUCEVICIUS, G.; JUCEVICIENE, R.; GAIDELYS, V.; KALMAN, A. The emerging innovation ecosystems and “Valley of death”: Towards the combination of entrepreneurial and institutional approaches. **Engineering Economics**, v.27, n,4, p. 430-438, 2016.

LEMOS, C. Inovação da era do conhecimento. In: Lastres, H. M. M.; Albagi, S. Orgs) **Informação e globalização na era do conhecimento**. Rio de Janeiro, 999. Reproduzido em Revista Parcerias Estratégicas. Brasília, Centro de Estudos Estratégicos, n.8, p. 157-79, maio de 2000.

LEMOS, D. D. C. **A interação universidade-empresa para o desenvolvimento inovativo sob a perspectiva institucionalista-evolucionária**: uma análise a partir do sistema de ensino superior em Santa Catarina. 2013. 416 f. Tese (Doutorado em Administração). Universidade Federal de Santa Catarina, Florianópolis, 2013.

LOPES, J. N. M.; FARINHA, L. Measuring the Performance of Innovation and Entrepreneurship Networks. **Journal of the Knowledge Economy**, v. 9, n. 2, p. 402–423, 2018.

LUNDVALL, B. A. National innovation systems-analytical concept and development tool. **Industry and innovation**, v. 14, n. 1, p. 95-119, 2007.

MARKKULA, M.; KUNE, H. Making Smart Regions Smarter: Smart Specialization and the Role of Universities in Regional Innovation Ecosystems. **Technology Innovation Management Review**, [s. l.], p. 7–15, 2015.

NIOSI, J. National systems of innovations are “x-efficient” (and x-effective): Why some are slow learners. **Research policy**, v. 31, n. 2, p. 291-302, 2002.

ODUM, E. P. **Fundamentos de ecologia** 5. ed. São Paulo: Pioneira Thomson, 2007.

OLIVEIRA, M. R. et al. O ENGAJAMENTO DOS TRAINEES NAS EMPRESAS. In: V Congreso Internacional de Investigación y Práctica Profesional en Psicología XX Jornadas de Investigación Noveno Encuentro de Investigadores en Psicología del MERCOSUR. **Anais**… Facultad de Psicología-Universidad de Buenos Aires, 2013.

PEREIRA, A. J.; DATHEIN, R. Processo de aprendizado, acumulação de conhecimento e sistemas de inovação: a "co-evolução das tecnologias físicas e sociais" como fonte de desenvolvimento econômico. **Revista Brasileira de Inovação**, v. 11, n. 1, p. 137-166, 2012.

PIRES, J. R. **Mapeamento do ecossistema de inovação regional**: contribuição da UFSM na identificação de atores, recursos e interações. Trabalho de Conclusão de Curso (Especialização em Gestão de Tecnologia da Informação) – Universidade Federal de Santa Maria, Frederico Westphalen, 78 f., 2024.

SALERNO, M. S.; GOMES, L. A. V. **Gestão da Inovação mais Radical**, Elsevier Editora Ltda, 2018.

SANTOS, E. C. D. C. Papel do Estado para o desenvolvimento do SNI: lições das economias avançadas e de industrialização recente. **Economia e Sociedade**, v. 23, p. 433-464, 2014.

SCHUEFFEL, P.; VADANA, I. Open Innovation in the financial services sector - A global literature review. **Journal of Innovation Management**, v. 3, n. 1, p. 25-48, 2015.

SEBRAE. **Mapeamento dos Ecossistemas de Startups do Paraná**. Curitiba, 2015. Disponível em: <http://www.sebraepr.com.br>. Acesso em: 12 mar. 2025.

STEFENON, R.; GIMENEZ, F. A. P. Ecossistemas empreendedores: questões críticas para o campo das políticas públicas. **Revista Livre de Sustentabilidade e Empreendedorismo**, v. 8, p. 23-55, 2023.

TEIXEIRA, C. S.; TRZECIAK, D. S.; VARVAKIS, G. **Ecossistema de inovação**: Alinhamento conceitual [recurso eletrônico]. Florianópolis: Perse, 2017. p. 24.

TUBIN, L. C. **Papéis e atividades dos orquestradores de ecossistemas regionais de inovação**: um estudo de caso com o Programa Inova RS. Dissertação (Mestrado em Administração) – Universidade do Vale do Rio dos Sinos, Porto Alegre. 147 f., 2023.

VALLE, V. Z. **Análise do ecossistema de inovação da Universidade Estadual do Rio Grande do Sul**. Monografia (Graduação em Administração Pública) – Universidade Estadual do Rio Grande do Sul, Porto Alegre. 38 f., 2023.