Open innovation as innovation management strategy - an investigation into São Paulo public universities.

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Abstract. Study goals: Understand how the innovation policies of public universities in São Paulo are covering or restricting open innovation. Relevance / originality: Open innovation is developing among practitioners and academics, however, there are specific policy implications that must be analyzed. Methodology / approach: Qualitative research software (NVIVO) and other software (Miro and Excel) were used to elaborate the results that allowed coding the innovation policies of the investigated public universities, correlating the previous scientific literature and, thus, answering the guiding questions. Main results: Open innovation is an innovation management strategy. Among the higher education institutions that had the highest record of open innovation practices was FATEC with 37%, followed by Unifesp with 33% and USP with 30%. Theoretical / methodological contributions: A hierarchical map of the characteristics of open innovation in the innovation policies of these universities is presented as a research artifact. As well as the descriptive analyzes correlated to open innovation in relation to the study's guiding questions. Social / management contributions: (i) the lack of objective indicators for monitoring the success of open innovation; (ii) no specific limitation was identified regarding open innovation practices in policies; (iii) open innovation practices are implicit in the content of innovation policies.

Keywords. open innovation, innovation policies, public universities, strategy, innovation management.

1. Introduction

Innovation is the primary strategy used to address global challenges such as climate change, energy efficiency, and pandemics like COVID-19 (IDB, 2021). Open innovation is evolving among professionals and academics, but there is still much to analyze from the perspective of its implications for the formulation of specific public policies. In practice, policy measures can either support or hinder the adoption of open innovation practices. Therefore, the role of public policy makers is crucial for the effectiveness of open innovation (De Jong et al., 2010; Freitas & Dacorso, 2014; Santos et al., 2022).

To overcome the current inertia and dysfunction in Brazil, it is necessary to change the paradigms of public management by applying agile methodologies to keep up with the speed of changes and their impact on society, thus generating more effective decision-making tools (Santos et al., 2022). Open innovation in the public sector can enhance service improvement and add value to results and social benefits (Lee et al., 2012; Cavalcante et al., 2017). These notions of open innovation were initially identified in the private sector, but it was observed that aspects of the innovation process could be operationalized in both private and public organizations. Among these aspects are interactions between different actors related to open innovation, such as co-creation and experimentation (Fuglsang & Pedersen, 2011; Sabel & Zeitlin, 2012; Cavalcante et al., 2017).

Public management has been questioned for its traditional Weberian approach. Although efficient for predictability, hierarchy, transparency, and control, it does not meet the current context of rapid change and interdependence of the needs and missions of public organizations. Social sciences view innovation as a fundamental element in public organizations (Pollitt, 2011; Osborne & Brown, 2013; Cavalcante et al., 2017).

To better understand public innovation policies in the context of open innovation, this empirical qualitative research, using content analysis and textual exploration, seeks to answer the following questions: (i) do public university innovation policies encompass the context of open innovation?; (ii) how do public university innovation policies contribute to open innovation?; (iii) what are the limitations or constraints of public university innovation policies regarding open innovation practices?; (iv) is open innovation a strategy for innovation management?; and (v) how to identify the success of open innovation in universities?

Thus, the aim of this research is to understand the scope of innovation policies related to open innovation in public universities in the capital of São Paulo. To achieve this, the first section of this technical report covers this introduction; the second section explores the investigated context, focusing on open innovation in universities and the public sector; the third section provides a more detailed explanation of the problem situation diagnosis; the fourth section presents the proposed intervention; the fifth section discusses the obtained results, and finally, the technological-social contribution.

2. Theoretical Framework

2.1. Open Innovation in the University Context

There has been a shift in research focus on innovation with the advent of Open Innovation (OI), which, in free translation, means "intentional knowledge flows to accelerate internal innovation and expand markets for external use of innovation" (Chesbrough et al., 2006, p. 2). Thus, OI allows organizations to integrate and commercialize resources and capabilities complementary to their own structure, thereby adding value and maximizing the benefits of innovative activity (Laursen, 2004; Chesbrough & Crowther, 2006; Huggins et al., 2020; Bogers et al., 2021; Musiello-Neto et al., 2022).

The term open innovation has been used to characterize a system in which innovation is not only carried out internally within a company but cooperatively with external actors (Fredberg et al., 2008; Bogers et al., 2021).

In this study, we consider the definition of open innovation according to Wehn & Montalvo (2018), meaning that OI is an innovation strategy under scenario analysis that seeks to identify knowledge transfer with governance levers to better formulate strategies and policies that support growth and sustainability in organizations.

Studies by Jugend et al. (2018) emphasize that for efforts in radical innovation, which have a greater propensity for profitability, organizations use more external knowledge compared to incremental innovation. Additionally, they reveal that public support plays a significant role in driving innovation, whether radical or incremental.

In this context, Hewitt Dundas and Roper (2018) observed that lack of awareness of the benefits of cooperation, limited information about potential partners and their functional capabilities can exacerbate market failures. Therefore, they emphasize the importance of having support and expanding the network of external partners. Grotenbreg and van Buuren (2018) proposed managerial recommendations to encourage local governments to establish partnerships in innovation projects as a collaborative effort between the public and private sectors.

Universities collaborate with industry for various reasons, with the central one being the development of innovation (Alexander et al., 2011; Bessant et al., 2012; Ankrah and Omar, 2015; Cunningham and Link, 2015; Lundberg and Öberg, 2021). Although

there are other sources of technology transfer, the university facilitates the process of generating new ideas in terms of innovation for the industry and businesses (Aaboen et al., 2016; Aaboen et al., 2017; Laage Hellman et al., 2019; Lundberg and Öberg, 2021).

From the perspective of public universities, Pedersen (2020) confirms in his study that in public institutions, OI is used for innovation in society. It aims to create value in terms of citizens' quality of life and neighborhood quality, with the goal of improving citizens' behavior, capabilities, and experiences.

Additionally, in Striukova and Rayna's study (2015), interviews were conducted with university administrators to comprehend the context of open innovation within universities. The authors structured their study by associating it with five characteristics of Open Innovation, as presented in Table 1. Consequently, the criteria for categorizing excerpts from the analyzed public policies were guided by these characteristics, as elucidated below:

Tab. 1 - Characteristics of Open Innovation in Universities

OI Characteristics	Assumptions
Discourse	The objective is to assess communication and identify differences in perceptions of open innovation in universities.
Change	The aim is to investigate changes in the types of open innovation commitments in which the university participates. From an internal perspective, we seek to identify whether the number of patents has increased or decreased during the open innovation trend. Externally, we aim to determine if there have been more opportunities for external partnerships in innovation development.
Strategy	To identify whether the objective of open innovation participation is to fill knowledge or financial gaps (Chesbrough, 2003) or stimulate growth (Chesbrough & Crowther, 2006).
Management	To investigate how open innovation is managed in universities to clarify the approaches used for open innovation within these institutions.
Open Innovation success	To understand how to determine whether the effort invested has been successful and when open innovation practices are most effective.

2.2. Open Innovation in the Public Sector

Zuñiga et al. (2021), through the Inter-American Development Bank (IDB), define open innovation in the public sector as governmental support for the contribution of actors from the public and private ecosystems, fostering the exchange of resources and knowledge to solve public problems and, consequently, enhancing innovation and the quality of services, positively impacting society (Mergel and Desouza, 2013; Bekkers and Tummers, 2018). The adoption of digitization practices or e-government and data transparency are emerging trends in public administration that promote higher quality in public services (Bakici et al., 2013; Ubaldi, 2013; OECD, 2016A; OECD, 2016B; Zuñiga et al., 2021).

Governments have been promoting innovation through various public policies due to its importance for societal growth and economic development. These policies include the advancement of disruptive technologies, support for favorable institutional environments, and innovation financing programs (Autant-Bernard et al., 2013; Colombo et al., 2016; Dumont, 2017; Fabrizio et al., 2017; Kivimaa and Kern, 2016; Sun and Cao, 2018; Silva et al., 2020).

According to Santos et al. (2022), to overcome the current inertia and dysfunction in Brazil, it is necessary to change the paradigms of public management by applying agile methodologies to keep up with the speed of changes and their impacts on society, consequently generating the implementation of more effective decision-making instruments. Open innovation in the public sector can enhance service improvement and add value to results and social benefits (Lee et al., 2012; Cavalcante et al., 2017).

3. Methodology

3.1. Problem Characterization

This study was conceived based on responses from semi-structured interviews replicated from Striukova and Rayna (2015), with the aim of understanding the context of open innovation in universities. The target audience for this study was managers of public universities in São Paulo who are directly involved with innovation centers and open innovation.

Upon analyzing the responses of three managers, a common issue was identified - the limitations of the legislation governing public universities, which, according to them, restrict further advances in open innovation. These statements, while maintaining anonymity, can be evidenced in the following quotes:

"It has to follow a very time-consuming standardization." - Unifesp

"Limitations have always been from a regulatory point of view." - USP

"Transforming these formalities to be more agile." - FATEC

Therefore, this study aims to analyze the innovation policies within these three higher education institutions to understand how the innovation policies of these public universities are either encompassing or restricting open innovation.

3.2. Procedures Adopted in the Diagnosis

Empirical qualitative research allows for in-depth investigations and descriptions of contemporary phenomena within their real-life contexts, promoting an understanding of interaction and collaboration dynamics (Pettigrew, 1973; Yin, 1994; Eisenhardt, 1989). Qualitative research is a flexible method, considered a strength in capturing the multifaceted and evolving nature of interactions (Dubois and Araujo, 2004). Moreover, what is essential, based on the positioning of this study, is that content analysis allows for the discovery of circumstances that are not initially under investigation (Welch et al., 2011) and exploration of the consequences of the phenomena under study.

According to Bardin (2016), content analysis techniques for communications result in diligent work involving categorization, calculations, conflicts, comparisons, and refinements by the investigator. Content analysis is a framework for analyzing communications, considered an empirical method with the aim of overcoming uncertainty and enriching readings with depth of meaning, thereby enhancing content productivity.

Although Sampaio et al. (2021) raise questions about the relevance of using Bardin's reference due to it being a very old manual and, therefore, stagnant, and lacking reliability testing, as per the authors, requiring additional references and

replicability, it was referenced here to better present the characteristics of this research. Among these, the analysis of frequency, which is combined with statistical contribution, is mentioned. It no longer serves merely a descriptive purpose but aims at inference from coded communication frequency or frequency-based data. Thus, with the results, it is possible to identify the causes and respective effects of communication characteristics in a more systematic manner, with an expectation of contributing to replicability. Therefore, NVIVO software was used for coding and exploring the results of textual analyses.

Additionally, to mitigate these propositions, the 5th edition of "The SAGE Handbook of Qualitative Research" was used as a reference to structure this study with document analysis of the innovation policies of public universities. Qualitative research should be referred to as investigation due to its historical context and the conflict between noise and distrust generated by presented results; however, interpretive practice is an artistic and political manifestation since interpreted truth is not singular (Denzin & Lincoln, 2018).

It is expected that the researcher selects the software and its functionalities that best fit the data analysis methodology of their research (Bringer et al., 2006). Due to its scientific nature, NVIVO was chosen as the data analysis software due to its structured data organization, which must be pragmatic and rigorous for scientific analysis to ensure replicability (Marks, 2015).
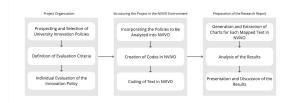

Fig. 1 - Example of the flow used for data analysis in the research.

Criteria for the definition were based on the characteristics of open innovation from the study by Striukova and Rayna (2015), as previously presented in Table 1, associated with each item of the respective innovation policies. This mapping was done through reading and coding associated with open innovation characteristics, considering the open innovation practices documented in the innovation policies of the respective institutions. The following section presents the key findings with their respective results.

4. Analysis and Discussion of Results

4.1. Presentation of Diagnostic Results

The innovation policies of the analyzed higher education institutions had distinct characteristics. There was a lower record of success in innovation in

all analyses, including the absence of specific indicators to measure innovation. The NVIVO software helped highlight the differences between the innovation policies from a quantitative perspective of the mapped codes, as exemplified in Figure 2, which was plotted using Microsoft Excel, Office 365. Regarding the contribution to improving innovation policies, the main results are as follows, following the open innovation characteristics from the study by Striukova and Rayna (2015) - speech, change, strategy, management, and success in open innovation.
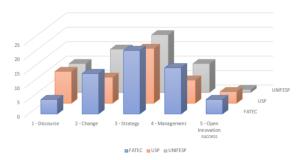

Fig. 2 - Example of a comparative result between the innovation policies of public universities.

Figure 2 shows that there was a low incidence of indicators for the success of open innovation. On the other hand, the open innovation strategy is prominent in the analysis of the policies.

To provide a clearer understanding of the coding done in the public policies, Table 2 exemplifies the characteristics of open innovation presented in Table 1 and their respective criteria, as follows:

Tab. 2 - Coding Criteria.

Codes	Coding Criteria
Discourse	Statements about what it is about.
Change	Relationship with external partners, allocation of people, use of patents.
Strategy	Knowledge transfer, financial resource acquisition, or growth stimulation actions.
Management	Control instruments such as contracts or responsibility definitions.
Open Innovation success	Expectations of results, control indicators, lessons learned.

Among the higher education institutions, there was a higher incidence of open innovation practices, as correlated with the open innovation characteristics

presented in Tables 2 and 3. FATEC had the highest percentage at 37%, followed by Unifesp at 33%, and USP at 30%, considering the total number of codes related to the innovation policy that was mapped.

It's worth presenting some relevant information about the institutions studied: (i) FATEC was founded in 1969 and is administered by the Centro Estadual de Educação Tecnológica Paula Souza, considered the largest educational center for technical studies and vocational education in technology in Latin America. It has 76 units in the state of São Paulo, present in 65 cities in São Paulo. (ii) The Universidade Federal de São Paulo (Unifesp) was created by Law 8.957, dated December 15, 1994, and resulted from the transformation of the Escola Paulista de Medicina (EPM), founded in 1933. Considered one of the best universities in Brazil, it offers more than 50 undergraduate programs and 106 postgraduate programs across 7 campuses in the state of São Paulo. (iii) USP is considered the most relevant university in the Brazilian and Latin American context. Therefore, a more detailed analysis of USP was conducted in this report, included in section 4.1.1 for better structuring the study and contributing to the improvement of university innovation policies.

5. Final Remarks

5.1. Overview of the Study

With the assistance of NVIVO software, it was possible not only to code the characteristics but also to quantitatively observe the codes through the hierarchical map. The hierarchical value map is a graphical representation that provides a structured and visual understanding of the key relationships among the observed attributes. Figure 3 allowed us to organize the codes and their respective volumes for a better understanding of the overall panorama of the innovation policies of the universities under study. The figure was adapted into the digital board of Miro software from the presentation extracted from NVIVO.

Fig. 3 - Hierarchical Map of Open Innovation Characteristics in University Innovation Policies

Based on the visualization of the results presented in Figure 2, as well as the content analyses of the three analyzed public policies, it was possible to infer answers to some guiding questions of the study, as follows:

(i) Do the innovation policies of public universities encompass the context of open innovation? It was analyzed that the innovation policies of

universities encompass the context of open innovation, considering the related characteristics and theoretical knowledge discussed in this report.

(ii) How do the innovation policies of public universities contribute to open innovation? Due to the scope of open innovation in the innovation policies of public universities, it is inferred that the policies analyzed contribute to open innovation, albeit implicitly. With the exception of UNIFESP's innovation policy, which directly mentions open innovation in Chapter 1, Article 7, item VI:

> *VI - the use of open innovation in collaborative platforms and the use of alternative licenses when in the interest of the University.*

(iii) What are the limitations or restrictions of the innovation policies of public universities concerning open innovation practices? In the content analysis conducted, no specific limitations or restrictions regarding open innovation practices in universities were identified. However, it is considered important to review innovation policies with the intention of including open innovation success indicators to monitor its development and evolution.

(iv) Is open innovation a management strategy for innovation? Considering the coded mapping correlated with the characteristics of open innovation, it can be affirmed that open innovation is a management strategy for innovation.

(v) How to identify the success of open innovation in universities? Due to the limited volume in the analysis of innovation policies, it was not possible to ascertain how open innovation success is identified in universities, beyond what is declared. Therefore, it is suggested to improve the way open innovation success indicators are incorporated into innovation policies.

6. Technological-Social Contribution

This technical report, limited to the city of São Paulo, aimed to investigate the application of open innovation through interviews conducted with managers of higher education institutions. It was observed in the managers' statements that there are limitations in the regulations regarding open innovation practices in public universities.

The importance of the qualitative method for an in-depth investigation is highlighted, as it allows us to listen to phenomena that remain within the routines of managers, enabling a better understanding and the proposition of improvements through scientific methods for the problems presented.

One of the main findings of this study, as proposed by previous literature and confirmed by the content analyses conducted, is that open innovation is a management strategy for fostering knowledge transfer and development within organizations, promoting growth and sustainability.

However, in the academic and scientific context, there is still much to explore about open innovation, which effectively began its studies in 2006, as proposed by Chesbrough et al. (2006). In the context of public policies, there is an urgent need for greater contributions from science regarding open innovation for public policy makers, given the global context of emerging changes, both in terms of the speed of technological innovations and efficient returns to society.

The main objective of this applied article was to understand the context of open innovation in universities in the city of São Paulo. The main result was the identification of best practices in open innovation in innovation policies of universities correlated with the characteristics presented in Table 2, through content analysis, as long as they understand open innovation practices. Additionally, it correlated the characteristics of open innovation among the items mentioned in public policies by coding the text and extracting the results for presentation.

As a result, it was possible to answer the guiding questions of the study, presented in Table 6. Initially, it emphasized (i) the lack of objective indicators for monitoring the success of open innovation. After all, how can one identify if practices are succeeding? How to identify the learning obtained in actions and turn it into future improvements? (ii) No limitations regarding open innovation practices in policies were identified since they are well-described and encompass the open innovation context. However, it is important to note that content analysis alone is not a decisive factor. Therefore, it is essential to understand the routines of managers and actors in the open innovation ecosystem to understand how public policies effectively affect or limit open innovation in universities. (iii) Another important discovery was that open innovation practices are implicit in the content of innovation policies.

Thus, it is necessary to propose a better understanding and dissemination of open innovation, as well as to explicitly clarify open innovation in university innovation policies. Additionally, another improvement proposal is for innovation policies to be presented in plain language format. Plain language is a communication methodology initiated in 1940 in the United Kingdom and institutionalized in the United States by a law passed in 2010 (Public Law 111-274, 2010). It aims to ensure that government communication by public policy makers is formatted, read, and interpreted in a simple, objective, and easy-to-understand manner. There is even Law 17.316 (2020) from the City of São Paulo directed at direct and indirect government agencies, establishing plain language and providing it in the form of a booklet for better adaptation, distributed by ENAP (2020).

As a proposal for future studies, it is suggested to open the discussion on the formulation of innovation policies to broaden the perspective of

open innovation in universities across all Brazilian states.

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