Triple helix in the management of innovation in public policies: a study of two countries

Triple helix na gestão da inovação nas políticas públicas: um estudo de em dois países

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Abstract

This study deals with the Triple Helix development model’s efficient application in managing innovation in public policies in a Brazil-Portugal comparison. The Triple Helix model has its origin in England, to resume the economy in decline and unite the initiatives, until then unilateral, of universities-industries-government. Internationally recognized as a model of innovation and development, Triple Helix uses mechanisms that aim to mitigate the failures existing in universities, industries, and governments, transforming knowledge into practices aimed at the economy and improving the three elements’ interactions. In this sense, the work’s objective is to present how the process of operationalization of public policies aimed at innovation is developed, aligning government, Industry, and universities in a Brazil-Portugal comparison. For its development, bibliographic research and a comparative exploratory study about innovation management in Brazilian and Portuguese public policies were used. As a result, it is confirmed that, with the Triple Helix model in innovation management, public policies focused on science and technology is more effective. Even more, the greater the involvement between the three actors of the development model.

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Introduction

This study deals with the efficient application of the Triple Helix development model, in which government, university, and companies are interconnected, in the management of innovation in public policies. The Triple Helix model has its origin in England, with the purpose of resuming the economy in decline at the time, uniting the initiatives, until then unilateral, of universities-industries-government. It is important that the three components of Triple Helix adapt to contingencies and act in a participatory, entrepreneurial, and consensual way. Internationally recognized as a model of innovation and development, Triple Helix uses mechanisms that aim to mitigate the failures existing in universities, industries, and governments, transforming knowledge into practices aimed at the economy and improving the interactions between the three elements. In this sense, the work’s objective is to present how the process of operationalization of public policies aimed at innovation is developed, aligning
Government, Industry, and Universities in a Brazil-Portugal comparison. To meet this proposal, the interactions between these three elements were analyzed from government programs to support innovation in Brazil and Portugal, listing the main benefits arising from the implementation of public policies aimed at innovation, science, and technology. For its development, bibliographic research and a comparative exploratory study about innovation management in Brazilian and Portuguese public policies were used. Innovation is a key requirement for the current dynamic scenario, and the model considers the impetus of the country with socio-economic growth based on knowledge.

Methods

This research was developed from a bibliographic survey on the theme and a comparative exploratory study between Brazil and Portugal. According to Gil (2002, p. 44):

Bibliographic research is developed based on material already prepared, consisting mainly of books and scientific articles. Although in almost all studies some type of work of this nature is required, there is research developed exclusively from bibliographic sources. Much of the exploratory studies can be defined as bibliographic research.

Still, the exploratory study depends, in addition to an initial bibliographic foundation, on the researcher’s perception to aclimatize and elaborate hypotheses about the subject, hitherto unknown and little investigated (SANTOS, 2019).

The application of a comparative study between the management of innovation in Brazilian and Portuguese public policies can be considered by Prodanov and Freitas (2013, p. 37) as

Focused on studying similarities and differences, this method makes comparisons to verify similarities and explain divergences. When dealing with explanations of phenomena, the comparative method allows analyzing the factual data, deducing constant, abstract or general elements.

The research, therefore, followed two phases:

- Phase 1 - Bibliographic survey: in this first stage, information was sought in books, magazines, articles, ebooks, and other sources that are valid and relevant to the project.
- Phase 2 - Comparative exploratory study: among the chosen countries, Brazil and Portugal, aspects of government programs focused on innovation and the interactions existing in each between government, Industry, and university and the benefits arising
from this practice through the government official websites were investigated, such as Brazil (https://www.gov.br/pt-br) and Portugal (https://www.portugal.gov.pt/pt/gc21).

**Theoretical Reference**

### 3.1 The Concept and Evolution of the Triple Helix Model

The Triple Helix model has its origin in England, with the purpose of resuming the economy in decline at the time, uniting the initiatives, until then unilateral, of universities-industries-government. It is important that the three components of Triple Helix adapt to contingencies and act in a participatory, entrepreneurial, and consensual way (ETZKOWITZ, 2000).

Internationally recognized as a model of innovation and development, Triple Helix uses mechanisms that aim to mitigate the failures existing in universities, industries, and governments, transforming knowledge into practices aimed at the economy and improving the interactions between the three elements. Innovation is a key requirement for the current dynamic scenario, and the referred model considers the impetus of the country with socio-economic growth based on knowledge (ETZKOWITZ; LEYDES DORF, 2000).

The Triple Helix approach is that, in a knowledge-based society, the boundaries between the public or private sectors, science and technology, university, and Industry are increasingly diminishing, giving rise to a system of overlapping interactions: Industry operates as the production center; the government acts as a source of contractual relationships that guarantee stable interaction, and; universities are the source of new knowledge and technologies. Besides, each sphere, maintaining its primary role, assumes the role of another. For example, universities assume the role of Industry in supporting the creation of startups in incubator projects (PIQUE et al., 2018).

Although universities have previously been seen as a support structure for innovation, providing trained professionals to the market, scientific research, and theoretical and practical knowledge for the business world, one of the main differences concerning previous approaches is that the model Triple Helix elevated the university to equivalent status. Thus, unlike the initial configurations, before the proposal of Triple Helix’s model, in which universities had a secondary status or were subordinated to Industry or government, in the Triple Helix model, the university emerges as an influential and equivalent actor (PIQUE et al., 2018).
According to Martin et al. (2018), in many cases, the Triple Helix model is interpreted to represent a static scheme, with each actor (Industry, government, and university) in their respective place. However, the movements between the three spheres - or propellers - indicate a dynamic process that leads to different configurations. Each propeller has an important function and a different field of action and, even so, the evolution depends on the synergy between them, in which each one is interdependent on the others, forming an interactive circulatory system about the exchange of goods, services, or functions, as shown in figure 1.

![Figure 1. The elements that make up the Triple Helix.](image)

Source: Adapted from Etzkowitz e Leydesdorff (1995)

As seen in figure 1 above, all are directly related, and this interconnection results in an innovative environment, with a flow of knowledge in all directions. Therefore, Triple Helix demonstrates a reciprocal relationship between industries, government, and university, for the common benefit, without a hierarchical relationship between them, but rather mutuality (ETZKOWITZ; ZHOU, 2017).

### 3.2 Public Policies to Support Innovation in Portugal and Brazil

As Natário and Almeida (2011) addressed, the innovation process has gone through several evolution stages until the present moment. Initially, approximately in the 1960s, there was a linear, hierarchical, and continuous view, which characterized it as restricted for not encompassing the existing feedback between the stages. Given the criticisms of this model, an interactive and multidirectional innovation model was proposed in the 1990s. Thus, the innovation systems became popular, analyzing the dynamics between the innovation actors and how the information flow between them happens. The model mentioned is the Triple
Helix, which approaches innovation as a driver of the country’s economic development. Companies, the state, and higher education institutions assume fundamental functions for this process.

According to Danda et al. (2016), the unfolding of innovation in a given region comes from public and private institutions’ connection to motivate the opening of new ventures. Therefore, the model of the triple Helix was proposed by Leydesdorff and Etzkowitz in the 1990s, addressing the practices between universities, companies, and government (ETZKOWITZ; LEYDESDORFF, 1995). State participation in the innovation process is fundamental for leveraging research and competitiveness due to the possibility of defining regulatory standards and the agents responsible for conducting the university-industry relationship. Even if each one has different trades, they must act collaboratively and synergistically to achieve beneficial results for all.

According to the Brazilian Federal Constitution (1988, art. 218), “the State will promote and encourage scientific development, research, scientific and technological training, and innovation.” Given this legal determination, the promotion and incentive to science and innovation are commonly carried out through public policies. At the federal level, science, technology, and innovation (CT&I) policies are coordinated by the Ministry of Science, Technology, Innovations, and Communications (MCTIC), a public body created in 2016, which aims to promote, in addition to knowledge and quality of life for Brazil, the articulation between States and Municipalities to establish guidelines for national development policies (MCTIC, 2019).

According to Marques (2014), technological change and companies’ effectiveness in a country does not depend only on how much the Research and Development process is used and how resources are managed at the national level. Therefore, the innovation process happens from the dynamics between university, Industry, and government, since the established interaction tends to increase communication and information flow.

As Etzkowitz (2008) reinforces, universities play an important role in society and the innovation process. After the second academic revolution, the contribution to the socio-economic development of the region to which it belongs is included in universities’ objective. A higher education institution has mechanisms that add value to society in the process of trilateral cooperation. Some examples are joint research projects for companies, consultancies, business incubators, and junior companies.

The choice for Portugal is justified due to its recent classification in the European ranking of innovation as leader of a group of moderately innovative countries. This title
achieved is since the country stood out among the others in the various dimensions of innovation analyzed, such as scientific publications, organizational innovations, the qualification of students, and the growing entrepreneurship (EIS, 2019).

**Results and Discussion**

Bearing in mind that the objective of this study is to present, based on bibliographic research and an exploratory study, how the process of operationalization of public policies aimed at innovation is developed, aligning government, Industry, and universities (Triple Helix), it is presented follow the search results.

At the Brazilian level, science, technology, and innovation (CT&I) policies are coordinated by the Ministry of Science, Technology, Innovations, and Communications (MCTIC), a public body created in 2016, which aims to promote, in addition to knowledge and quality of life for Brazil, the articulation between States and Municipalities to establish guidelines for national development policies (MCTIC, 2019). In recent years, Brazil has implemented several policies related to science, technology, and innovation. One of the main aspects of innovation policy in Brazil is the integration between universities, companies, and the government to generate science and technology, and, consequently, innovation. It is possible to mention, among them, the creation of the sectorial funds of Science and Technology (1999), Law of innovation (2004), and Law of Good (2005). The government’s role in managing innovation is to invest in infrastructure for science, technology, and innovation, generating labor and building research laboratories; still, it can support indirectly, through tax incentives, or directly, providing direct subsidies to companies, credits with lower interest rates and partnerships with public research institutions (MENEZES FILHO, 2014). Despite this, Brazil occupied the 66th global position in 2019 in the Global Innovation Index (2019), a drop from the year 2018, in which it occupied the 64th position.

In contrast, Portugal maintained its ranking in 32nd place in the Global Innovation Index in the last two years, 2018 and 2019. In the scope of Science, Technology, and Innovation, the country has several telecommunications, technology, and services innovations. Research and Development (R&D) has constantly increased the number of correlated companies since the 90s (GII, 2019). However, in the European Innovation Scoreboard (EIS, 2019), Portugal positions itself as a group leader. According to EIS (2019), the high performance presented by Portugal consists of the emergence of companies, entrepreneurial education, and the creation of programs such as INTERFACE, in which the
beneficiaries can be Technological Interface Centers (CIT), which aim to perform tasks focused on organizational, technological assistance, higher education institutions, as well as companies, encouraging collaboration between these elements.

4.1 Government Policies Aimed at Triple Helix in Brazil

This section aims to describe the main government policies implemented in Brazil in recent years. It started with the launch of the Industrial Technological and Foreign Trade Policy (PITCE) in 2004, which led to innovation at the center of competitiveness.

Before this, in the 1990s, the Sectorial Fund for Science and Technology was created, which continues to be important for financing these activities. Concerning indirect support policies, the main one is the so-called Lei do Bem (Law No. 11,196, 2005). Law 11,196/05 grants tax incentives to companies that carry out technological innovation research and development (R&D) since this is directly related to its growth. Therefore, the government uses this policy through the Ministry of Science, Technology, and Innovations (MCTI) to instigate the private sector. Still, it makes the approximation between university companies to optimize the results in R&D. However, to obtain tax incentives, the company must opt for the Real Profit regime, or with Tax Profit, have fiscal regularity (issue of CND or CPD-EN) and invest in Research and Development.

About policies that directly support innovation, the main bodies that carry them out are the Financier of Studies and Projects (FINEP) and the National Bank for Social Development (BNDES). Within FINEP, the National Scientific and Technological Development Fund (FNDCT) makes part of the resources available for its programs, subject to the scientific committee’s approval. In contrast, the other part comes from the Sectorial Funds for Science and Technology (1999) and has financing sources for companies. The BNDES, on the other hand, was created in 1952 and is currently the main long-term financing mechanism. Also, its objective is to support the formation and development of innovation ecosystems. Both BNDES and FINEP created the Inova Empresa program in 2013, focused on strategic sectors; integration between companies and research institutions, credit, grant, non-refundable, and equity participation.
4.2 Other Actions that Contribute to the Development of Triple Helix in Brazil

In 2008, the National Confederation of Industry (CNI) initiative emerged to constitute the Business Mobilization for Innovation (MEI), intending to unite the three Triple Helix elements that result in innovation. Therefore, the Support Center for Innovation Management (NAGI) was created, as a stimulus for innovation in the country, uniting the government and other institutions to optimize public policies and, at the same time, provide training for industries in their respective activities, acting basically as a consultancy. An example of this action was carried out in 2012, focusing on companies in the oil industry, guided by the University of São Paulo. One of the main difficulties encountered was in attracting companies to be included in the program. Once part of the program, the company goes through diagnosis, leveling, training, action plan, and advice.

NAGI components are academics (undergraduates, masters, doctoral students, and professors), who receive funds from the government to operationalize their companies’ actions. Therefore, to be effective, this correlation between the actors must be synergistic and uninterrupted. In the event of adversity arising from either party, such as lack of funds or lack of commitment from organizations, innovation will not occur as planned. Etzkowitz, Melo, and Almeida (2005) affirm that Brazil started to apply the Triple Helix model from the moment that universities assumed an entrepreneurial role. However, it is still necessary that the government assume a role of orientation and support of activities, not only of a financier.

Concerning legislation, Brazilian Law No. 10,973, of December 2, 2004, known as the Innovation Law, aims to “encourage innovation and scientific and technological research in the production environment, with a view to technological training, reach of technological autonomy and the development of the country’s national and regional productive system” (BRASIL, 2004, np). This legislation’s operationalization occurs through Scientific, Technological, and Innovation Institutions (ICTs), a non-profit public body whose mission is to research and develop innovations in products, services, or processes. For the research and technologies developed to generate innovation effectively, an important propeller’s support is essential: government, through legislation and public policies. Given the above, Figure 2 shows, in a timeline, Brazilian regulations aimed at innovation and scientific research.

It is important to note that Law No. 13,243 of 2016, called the Science, Technology, and Innovation Code (CT&I), brought with it aspects such as exemption from the mandatory bidding process for the purchase of products or services for research and development purposes; reduction of taxes for the import of material related to research; authorizes
universities and research institutes to share their laboratories with business organizations for research purposes; among other aspects.

At the end of 2017, more precisely on November 29, The Chapter Brazil 2018-2020 was created, organized by the State University of Rio de Janeiro (UERJ), being operated through the Observatory of Innovative Business - ONI, belonging to the Faculty of Administration and Finance - FAF. Since then, several interdisciplinary research and publications have been carried out at different academic levels (dissertations, master’s theses, doctorates, and monographs) on Triple Helix, mostly with an emphasis on incubators, innovations in the area of health and civil construction, government funding for incentives to innovation and financial education. Still, to promote research, innovation, economic competitiveness, and growth, actions were implemented to stimulate the interaction between Triple Helix actors (universities, companies, and government), such as conferences, symposia, workshops, round table, and congresses. The dissemination of this project’s existence was through 251 emails announcing the XVI Triple Helix Conference 2018.

4.3 Government Policies that Contribute to the Development of Triple Helix in Portugal

This section aims to mention government policies aimed at the interaction between Triple Helix agents - industries, government, and universities. This vision of cooperation between the previously mentioned elements started with professors studying for a doctorate at universities outside Portugal and brought this perspective. From this, autonomous institutes were created, but congruent to the university for research and development, lasting until the mid-1990s. After that date, some universities started, on their campuses, to develop strategies and departments to manage the interconnection with companies, being notable at the University of Aveiro, University of Minho, University of Coimbra, University of Porto, and in the universities of Lisbon. In 2009, the teaching career statute was instituted through Decree-Law No. 205/2009, aiming at modernization due to the contribution of the university element in the development of the country, establishing rules to increase research and science activities, in addition to institute mandatory international competitions (OTERO, 2010).

On August 21, 2017, Ordinance No. 258/2017 created the Fund for Innovation, Technology, and Circular Economic, approving the Portuguese Industry’s Capacitating Program and regulating it. This program aims to link educational institutions and companies, focusing on knowledge transfer and new technologies, receiving government funding
annually to promote the dynamics of innovation and insertion of small and medium-sized Portuguese companies. (DIÁRIO DA REPÚBLICA, 2017).

Finally, another important government policy to be cited is creating funds for social innovation (FIS) through Decree-Law No. 28/2018. With an autonomous nature, its objective is to facilitate access to bank credits for small and medium-sized companies, social economy institutions that have entrepreneurial initiatives (DIÁRIO DA REPÚBLICA, 2018).

4.4 Other Government Actions Contribute to the Development of Triple Helix in Portugal

Portuguese culture focuses on the idea that networks and relationships are fundamental to economic and social development, concerning the transfer of knowledge and technologies, mobilizing human resources, and obtaining information about the environment. Therefore, the Portuguese government seeks to foster interconnection between agents that contribute to innovation and act in a network to achieve its economic, industrial, and social objectives. (MARQUES et al., 2002).

In 1995, companies operating mainly in the technological field emerged due to the implementation of NEOTEC. Also, institutions were developed for government action in the form of tax benefits, such as the Portuguese Investment and Foreign Trade Agency (AICEP), as cited by CDP (2020).

In 2001, the Innovation Support Program (PROINOV) was created based on strengthening the national innovation system, reformulating public services, human resources qualification, and developing actions aimed at technology (MARQUES et al., 2002).

In 2008, the Fund to Support Innovation Financing (FINOVA) was created to finance innovative actions by small and medium-sized companies. In that year, the Health Cluster Portugal (HCP) was created, resulting from policies to leverage the country’s competitiveness based on innovation and inspired by the Triple Helix development model. HCP is an institution dedicated to research, development, and supply of goods and services oriented to the health area. Its founders involve the governmental sphere, represented by the North Region Coordination and Development Commission (CCDRN), to establish the State’s commitment to the institution; the university sphere, represented by internationally recognized institutes, such as IPATIMUP, IBMC, INEB, INL, IMM and CNC; and, also, the industrial sphere, composed of the Medical Device and Pharmaceutical Group (GDMF) and other pharmaceutical companies such as Bial and Hovione (SANTOS et al, 2010).
Regarding the National Strategic Reference Framework (QREN), a system of qualification incentives for small and medium-sized Portuguese companies was instituted to reinforce their investments in information technology, organizational innovation, eco-innovation, competitiveness, brand creation, and design. This program was developed between the federal government with a partnership between several European funds signed from 2014 to 2020, denoting this agreement as Portugal 2020, following what was exposed by the Organization of Ibero-American States (OEI, 2020).

There are 25 institutions called “Associate Laboratories” that are important agents in constructing scientific knowledge developed in the country, with approximately 2000 doctors and 3000 researchers in its team. These institutions operate harmoniously with public universities. Furthermore, promoting innovation based on scientific and technological aspects constitutes the center for elaborating government programs (PORTAL DA COMISSÃO EUROPEIA, 2019).

**Final Considerations**

The purpose of this study was to demonstrate, based on a bibliographic search and an exploratory study in Brazil and Portugal, how the process of operationalizing public policies aimed at innovation is developed, aligning government, Industry, and universities.

To meet this proposal, aspects of government programs focused on innovation and the interactions between each element that makes up Triple Helix were studied through the official government websites’ information.

Given the results presented, it is clear the importance of the reciprocal and mutual relationship that all elements of Triple Helix - Industry, universities, and government, must maintain. Industry and government instigate innovation and entrepreneurship, stimulating it and offering inputs to expand academic knowledge. The university element is a scientific research source, discovering new technologies, education, and disseminating knowledge, which is later applied in society through public policies. The greater the involvement between the three actors in the Triple Helix development model, the better its socio-economic development. The interactive relationship between the three development propellers - companies, the State, and higher education institutions - transfers efficient knowledge, stimulating innovation, improvement, and opportunities for a territory’s social and economic development.

As presented in the “discussion and results” section of this study and endorsed by
Segatto-Mendes and Sbragia (2001), the propellers’ interaction generates several benefits mentioned below. For universities, it is possible to mention that cooperation with other propellers contributes to obtaining extra financial and material resources, absorbing practical knowledge about existing events in society, fulfilling the institution’s social responsibility, and aggregating new technologies and information in the research and education processes, in addition to the effective dissemination of the image of the educational institution. Concerning companies, the main benefits arising from joint action with the other elements of the Triple Helix consist of the approximation of qualified labor from universities for inclusion in their teams; in reducing costs related to risks involved in actions in the Research & Development area; in the proximity of the scientific knowledge developed in the academic environment, as well as the solutions generated by elaborated researches. Finally, the State is a fundamental propeller for the above benefits to be achieved.

As a suggestion for future research, it is indicated to deepen this study, since there is a new more recent innovation model, which inserts a fourth helix, based on culture, the media, and the values of the society that, in turn, drive innovation and assist in the development of a knowledge-based economy, called Quadruple Helix, which adds the “civil society” sphere to other propellers, government, Industry, and universities, as approached by Cavallini (2016).

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