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Brics & Entrepreneurial Universities: A Brazilian Perspective

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Abstract

Entrepreneurship is a vital component in a country's pursuit of a sustainable, equitable and inclusive economic development and growth strategy. In the past decades, BRICS nations' rapid economic development and growth have relied strongly on entrepreneurial activities as one of their main economic strategies. BRICS countries have fostered and supported entrepreneurial activities, including the role of universities in fostering entrepreneurial activities. This paper assesses the role and experience of Brazilian entrepreneurial universities in fostering and creating a dynamic entrepreneurial ecosystem within the Brazilian economy. Universities play a key role in unleashing new and innovative rounds of entrepreneurial activity and in creating and fostering a vibrant innovation ecosystem. The aim of the research project that gave rise to this paper was to identify, propose and validate a set of indicators for innovation and ST&I that identify the stage of maturity of the entrepreneurial university model in Brazilian universities. Our results shows that the indicators identified in the literature, proposed and validated using a questionnaire applied to the 68 best Brazilian universities can be used to underpin institutional innovation policies. Our results also strongly indicate that Brazilian universities are becoming vital players in fostering Brazil's innovation and technology ecosystem.

Keywords

Brazilian Entrepreneurial Universities, Innovation and R&D Indicators

1. Introduction

Entrepreneurship is a vital component in a country's pursuit of a sustainable,

equitable and inclusive economic development and growth strategy. In the past decades, the BRICS[1] nations' fast economic development and growth have relied strongly on entrepreneurial activities as one of their main economic strategies. BRICS countries have fostered and supported entrepreneurial activities, including the role of universities in fostering entrepreneurial activities. For instance, the Chinese government has actively promoted innovation and entrepreneurship education in several Chinese universities. The Chinese government understands the vital role played by Small and Medium-Sized Enterprises (SMES) in creating jobs and promoting economic development. SMES make up the large majority of businesses in China and they generate most of the job creation. China sees entrepreneurial universities playing a key role in its quest for a sustainable development strategy, as well as offering new job opportunities for its graduated students. China started promoting its entrepreneurial universities more actively in the late 1990s, with a pilot program aimed at entrepreneurship education introduced in the early 2000s. India has also actively promoted entrepreneurial studies at its universities. In the case of India, privately-owned universities are taking the lead in promoting entrepreneurial studies and developing ties to India's private sector. Russia has also been a latecomer in promoting the "Triple-Helix" model of universities-government-private sector partnerships. Since the 1990s, Russia has made efforts toward technological progress, innovation and sustainable development. The Russian government also understood the vital role played by entrepreneurial universities in creating a vibrant innovation ecosystem in Russia, fostering entrepreneurial education in Russian universities. This paper sets out and discusses the recent Brazilian experience in promoting entrepreneurial universities (Alexander & Evgeniy, 2012; Loganathan & Subrahmanya, 2022; Pesotsky, Grigorieva, & Chistova, 2021; Wang & Ma, 2022).

The university, as an institution that produces and disseminates knowledge, has changed over the centuries to accompany the transformations in society. What is known as the first and second academic revolutions had as their prime objective meeting the needs of society. The first took place during the industrial revolution and the second when the concept of entrepreneurship was incorporated as an academic function, during the post-war period, due to countries' pressing need for economic and social development (Etzkowitz & Webster, 1995; Guenther & Wagner, 2008; Rothaermel, Agung, & Jiang, 2007; Adesola & Datta, 2020; Syed, Singh, & Spicer, 2022).

During the first academic revolution, when the universities were faced with the demands of industrialization, new institutional standards were adopted, with the implementing of laboratory practices by means of research activities. The second academic revolution occurred in the second half of the 20th century, with the incorporation of development activities within their institutional mission. In the USA, these activities arose as a result of the economic development brought about by the transferring of knowledge from universities to society (Webster & Etzkowitz, 1998; Khelifi, 2023).

[1]BRICS is an acronym for five leading economies: Brazil, Russia, India, China and South Africa.

Consequently, academic entrepreneurship or the entrepreneurship university model has been considered an outreach mechanism for teaching and research activities, which turns the university, by means of institutional policies, into an agent of regional development, as it internalizes individual abilities, expressed by technology transfer capabilities, and externalizes them through the capitalization of knowledge to benefit society (Aragao, Jesus, & Santos, 2022; Terra, 2020; Guerrero & Lira, 2023).

This university model is aimed at the contemporary job market and seeks to ensure the professional growth of the students and professors and their successful insertion within this constantly changing market environment. It develops an entrepreneurial culture among the students, contributing to their professional training, so that in the future they may be able to innovate, transform and produce wealth, in a constant search for quality knowledge and identification of possibilities to transform knowledge into innovative businesses. For that goal of the holistic training of the individual to be achieved, the teaching staff must also be prepared for changes at the university (undergraduate, outreach and postgraduate), both in the academic context, with the transformation of pedagogical content suitable for the needs of the labor market, and in relation to the new demands being made by society through government policies aimed at innovation and ST&I. The university leadership, professors and researchers should form the basis of this structure, coordinating with the domestic private sector and policy-makers in the various spheres of government at the municipal, state and federal levels (Clark, 1998; Etzkowitz, 2004; Slaughter & Leslie, 1997; Baporikar, 2022).

The entrepreneurial university has become a global phenomenon and its development process is isomorphic in nature, as it has developed from different starting points and forms of expression. In thar sense, the triple helix innovation model considers the entrepreneurial university to be an important social space, joining forces with other organizations seeking to promote the economic and social development of the region in which it operates, due to its role as a generator of knowledge and innovation in the knowledge economy (Etzkowitz, Webster, Gebhardt & Terra, 2000; Guerrero, Kirby, & Urbano, 2006; Jaki & Huszak, 2023).

Opportunities for the commercial use of scientific research are frequently available to scientists, despite the traditional ethos in science of not crossing the boundary between science and business. What is new about the current situation is that many scientists no longer consider such restrictions to be right or wrong. Until now, there has been a big gap between scientific discovery and its application and business enterprises were expected to have their own industrial scientists to carry out and develop their research, which was considered to be an unsuitable activity for academic scientists. However, in more recent times, academic scientists have often been eager and willing to direct or participate in research and development programs aimed at commercial applications (Etzkowitz, 1983; Guenther & Wagner, 2008; Andrews, Macintosh, & Sitko, 2021).

The entrepreneurial university takes university-industry-government interaction as it's methodological guideline, as the aim is to seek economic and social progress, supported by the production of knowledge. In addition to facilitating the mapping of academic organizational structures, this model also demonstrates how the university is taking on a new and important role in the field of innovation (Etzkowitz & Leydesdorff, 1994; Kirby, Guerrero, & Urbano, 2011; Klofsten et al., 2019).

To become an entrepreneurial university, the path to be followed by a university must be directed towards developing five areas: 1) It needs to have a clear vision of the path to be followed and one that is accepted both by the central management and by the academic departments; 2) In its outreach it has to incorporate society's demands, creating tools to promote exchanges with social organizations; 3) It must diversify its sources of income, to preserve its autonomy and sustainability; 4) It must seek to strengthen its academic departments; 5) It must promote an integrated entrepreneurial culture (Klofsten et al., 2019; Wang & Qian, 2023).

The entrepreneurial university model can also be expressed by a set of five interrelated principles that should be used as guidelines for institutional renewal, namely: 1) capitalization: the generation and transmission of knowledge to strengthen the foundations of economic and social development, establishing a prominent role for the university in society; 2) interdependence: the university-industry-government interaction as part of the academic mission; 3) independence: the ability to plan and implement action to fulfill its vocations, without any dependence on another institutional sphere; 4) hybridity: the resolving of tensions between the principles of interdependence and independence, leading to the creation of hybrid organizational structures to meet multiple academic objectives; 5) reflexivity: the constant renewal of the internal academic structure, based on university-industry-government interaction (Etzkowitz, 2004; OECD, 2008, 2022).

The entrepreneurial university: 1) is an emerging phenomenon whereby the knowledge produced in the institution is also made available for use; 2) is a place where research has expanded into a growing number of areas, with students participating in the generation of knowledge as part of their training; 3) requires a considerable degree of independence from the State and the production sector, but also a high degree of interaction with these institutional spheres. Another critical factor is the perception of society, so that, parallel to this new university organizational structure, new innovation networks will arise and complex relationships become established between institutional parties, university, industry, government, streamlining the innovative process. Organization under the triple helix innovation model is based on the principle whereby the university is expected to play a significant role in society, known as the "third mission" (Etzkowitz & Leydesdorff, 1994, 2000; Rothaermel, Agung, & Jiang, 2007; Artyukhov, Bilan, Volk, Lyeonov, & Serafimova, 2023).

The teaching and research activities carried out at universities make them potential suppliers of technical and scientific knowledge and skills. Consequently, they become a source of innovation for companies and for the generation of new business, particularly for SMEs owned by the researchers themselves, whether they are professors and/or students (Etzkowitz & Webster, 1995; Mainardes, Alves, & Raposo, 2011; Lackeus, 2015).

Another example of great importance in the structure of entrepreneurial universities is the spin-off companies, whether they are incubated or not, which play an important role in the global context of technological innovation. These are companies born out of academic ideas (doctoral theses, master's dissertations, course completion work or scientific initiation projects, among others) that generate knowledge through the interaction between universities, industry and government. Incubators, on the other hand, are important agents in the structure of the entrepreneurial university, as they house these nascent enterprises, usually arising out of scientific research, whose very design involves innovation. Another participant should also be mentioned, which is the research group known as a "quasi-firm", which interacts with the other agents promoting innovation and technology transfer to society (as well as helping to train people and in the preparation of public policies, among other things). These groups function as business entities within the entrepreneurial universities (Clark, 1998; Etzkowitz, 2004; Meek & Gianiodis, 2023).

Several authors mention ST&I indicators, noting the different cultures and research locations. Cozzens & Melkers (1997) mention: jobs created; new jobs; average pay of jobs created; jobs retained; average pay of jobs retained; new companies; patents; licensing; funding raised; increased sales; cost savings; costs avoided; development of new products; marketing of new products; number of publications; number of employees; increased capital spending and customer satisfaction measurements (Cozzens & Melkers, 1997; Etzkowitz, & Viale, 2010; OECD, 2012, 2022).

Indicators of the success of a project should evaluate the product, the impacts, ST&I, job creation and efficiency, as well as the impacts, benefits and assimilation of the technology, among other factors. The PINTEC Innovation Study (IBGE, 2017) suggests as ST&I indicators, which do not always apply to entrepreneurial universities but refer to interaction with those institutions: Tax incentives, for Research and Development; Tax incentives, under the Information Technology Law; Economic subsidies; Financing, for Research and Development and technological innovation projects, excluding partnerships with universities or research institutes; Financing, for Research and Development and technological innovation projects, in partnership with universities or research institutes; Financing, the purchasing of machinery and equipment used for innovation; Scholarships offered by foundations supporting research and by the RHAE/CNPq for researchers at companies; venture capital funding; public procurement (IBGE, 2002, 2017; Kingsley & Melkers, 1999; Sebastian, 2000; Waltman et al.,

2012).

It is also important to emphasize the little research conducted on the characteristics and maturity stage of entrepreneurial universities, which is to say, research on entrepreneurial universities is divided into three main aspects: technology transfer, the university and regional economic development, as shown in **Figure 1** below (Alencar, Terra, & Almeida, 2016).

The need to adopt effective and flexible forms of technological management gave rise to the Triple Helix model, launched in the nineties by Henry Etzkowitz and Loet Leydesdorff, professors at the State University of New York (SUNY) and the University of Amsterdam, respectively (Etzkowitz & Leydesdorff, 1994; Zakaria, Kamarudin, Fauzi, & Wider, 2023).

The Triple Helix is a fundamental concept, representing a mechanism for interaction that enables the participants, university, industry and government, to develop synergy amongst themselves and among the other social agents in a development network. This network, located in an innovation ecosystem, fosters progress by means of entrepreneurial attitude, technological modernization and innovation. Taking the different ideas about entrepreneurship, the concept of the entrepreneurial university can be understood as a series of concentric circles, ranging from broad engagement with society towards the more specific focus of enhancing economic development through research, teaching and entrepreneurial activities. The broader concept allows expansion of academic entrepreneurship,

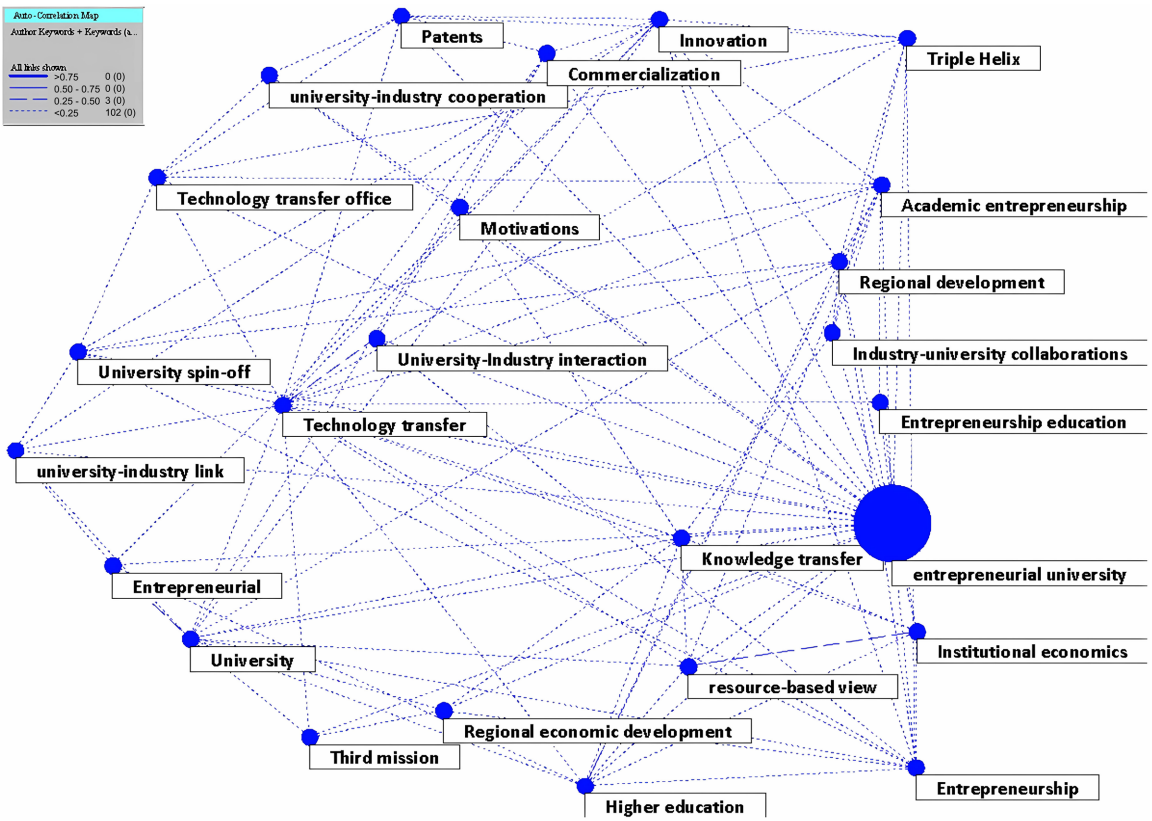

Figure 1. Frequency of keywords. Source: Alencar, Terra, & Almeida (2016).

achieved by research alone, to include universities that place a greater emphasis on teaching, or are at an early stage of research development, or even other sources of new economic activity (Etzkowitz, 2014; Etzkowitz, Webster, Gebhardt, & Terra, 2000; Figueiredo, Soliman, Al-Alawi, & Fatnassi, 2023).

With the change from bipolar interaction between university and industry to multipolar interaction (university-industry-government), government authorities at different levels—international, national, regional, begin to interact significantly in the innovation process generated by management of the knowledge produced in these networks, along with the other social agents. In this new context, the universities often find themselves carrying out activities specific to industry, by setting up spin-off firms, while companies are producing knowledge and carrying out training within academic formats, sometimes with the assistance of universities (Etzkowitz, 2014; Etzkowitz & Zhou, 2023; Liebig & Solterman, 2023).

Institutional and national boundaries are being crossed in the process of creating a new inter-institutional and multinational environment for innovation. With another purpose, but within this same context of the management or transferring of knowledge, incubated companies are also considered to be a product of the interaction between academic, business and government research groups and working within the Triple Helix. The current political programs, proposed by government, also tend to induce collaboration and integration between universities and companies, revealing an emerging network involving the leading participants in the system of innovation, the university (considered an entrepreneurial university), the production sector and the government, thus ratifying the Triple Helix (Etzkowitz, 2013, 2014, 2015, 2016).

On the other hand, the stage of maturity of the entrepreneurial university model is governed by three stages for the transformation of a university into an entrepreneurial university: Stage 1 (if it has innovation infrastructure): the academic institution determines a strategic vision for its path and gains some autonomy in setting its own priorities, typically through negotiations with the resource providers. Stage 2 (if it has infrastructure and an ST&I policy and sells its research results): the academic institution plays an active role in the selling of intellectual property generated by the activities of its faculties, teams and students. Stage 3 (if it has infrastructure and an ST&I policy, sells its research results and operates regionally, especially through licensing): the academic institution plays a proactive role in improving the effectiveness of its regional environment for innovation, often in collaboration with participants from companies and government, such as the examples of the Massachusetts Institute of Technology (MIT) in the United States and the Blekinge Institute of Technology in Sweden (Caputo, Charles, & Fiorentino, 2022).

The objective of the research that gave rise to this paper was to identify, propose and validate a set of ST&I indicators, determined from a literature review, that identify the stage of maturity of the entrepreneurial university model in

Brazilian universities, based on six proposed factors, five of them by Tornatzky & Rideout (2014) and the sixth by Etzkowitz (2004): 1) University culture—objectives and aspirations: related to the elements of university culture are—mission, vision and objectives and strategies linked to innovative activities; 2) Leadership: presenting the leaders, both internal and external to the academic sphere, who affected the growth of technological innovation within each university, highlighting the experience, functions and roles played by these individuals and their teams; 3) Expansion of frontiers—entrepreneurship: describing the activities for promoting entrepreneurship within the academic sphere; 4) Expansion of frontiers—partnerships with industry and the community: presenting policies, practices and support for transforming research into artifacts, with expansion of academic frontiers into the private sector; 5) Expansion of frontiers—technology transfer: presenting the structures that handle technology transfers within the universities, with description of some of their policies and practices; 6) Innovation Environment (stage of implementation of ST&I policy at the university).

The objects studied were the 68 Brazilian universities participating in a cataloging process, carried out using the "Information Form on the Intellectual Property Policy for Scientific and Technological Institutions in Brazil (FORMICT)" issued by the Ministry of Science, Technology & Innovation (MCTIC, 2015), for the year 2014, which were also evaluated by the federal government and were awarded grades 5 and 4 in the General Index of Courses (IGC) of the Ministry of Education, MEC (INEP 2021), plus USP, which did not participate in this assessment, but is considered in national and international rankings, which include innovation in the performance assessment, to be the best university in Brazil (Folha de Sao Paulo, 2012a, 2012b, 2013, 2014, 2015, 2016, 2017, 2018, 2019; MCTIC, 2015; Quacquarelli Symonds, 2023; Shanghai Ranking Consulting, 2022; Times Higher Education, 2023).

The importance of carrying out this work is that the research carried out in Brazil on the subject of the entrepreneurial university tends to be methodologically dominated by case studies, where investigations are performed into the stage of development of the entrepreneurial activities and do not present indicators that can be used in assessing the entrepreneurial stage at which the university finds itself. These studies describe the local institutional context and in some cases there are successes, while others show conflicts and problems often arising from the difficulty of implementing the current legislation, as well as discussions of an ideological nature. It is important to point out that these divergent opinions are observed in both the Brazilian and international context, due to the varied understanding of the university's role in society.

2. Brazil's Innovation and ST&I Characteristics

In Brazil, as of the 1988 Constitution ("Art. 207. Universities enjoy didactic, scientific, administrative and financial and property management autonomy and

shall follow the principle of inseparability between teaching, research and outreach; Section 1: Universities may accept foreign professors, technicians and scientists, as provided for by law; Section 2: The provisions of this article apply to institutions for scientific and technological research"), when academic outreach was determined by law, it was defined not only as activities for the provision of services, but for welfare activities inherent to the social needs of developing countries. These outreach activities include the processes of innovation inherent to an entrepreneurial university (Dalmarco, Hulsink, & Blois, 2018; CONFAP, Egler, & Natola, 2020; Colombo & Cruz, 2023).

Moreover, it must be considered that Brazil is not unaware of these processes of change. The current post-Innovation Law scenario is covered by Innovation Law No. 10,973, enacted on December 2, 2004, which provides incentives for innovation and scientific and technological research in the production sphere and other provisions; regulation of the Innovation Law by Law No. 13,243, of January 11, 2016, called the "legal framework for ST&I", provides incentives for scientific development, research, scientific and technological training and innovation. From this set of laws, several programs and other laws have arisen, such as the Good Law. Law No. 11,196/05, granting tax incentives to companies that invest in research and development for technological innovation, among other provisions, all of which have been changing the Brazilian context regarding innovation. As a result of the federal laws, eighteen of the twenty-six Brazilian states enacted their own state legislation with regard to innovation, namely: Alagoas, Amazonas, Bahia, Ceará, Espírito Santo, Goiás, Mato Grosso, Minas Gerais, Pará, Paraná, Pernambuco, Rio de Janeiro, Rio Grande do Norte, Rio Grande do Sul, Santa Catarina, São Paulo, Sergipe and Tocantins. Of those eighteen states, seven also issued decrees regulating the respective innovation laws, namely: Espírito Santo, Paraná, Pernambuco, Rio de Janeiro, Rio Grande do Sul, Santa Catarina and São Paulo (Brazil, 2005; Gouvea & Kassicieh, 2012; Gouvea, 2010; Will, Kohl, Prim, & Pavim, 2020; MCTIC, 2015; MCTI, 2023; Terra, 2020).

The entrepreneurial university model implemented in Brazil can be considered a synthesis of the characteristics of the American and European models, embracing commercial and social alternatives. Furthermore, from an innovation policy point of view, three national plans were developed that initially took strategic decisions to introduce and reformulate previous policies and initiatives. The Industrial, Technology and Foreign Trade Policy (PITCE) was implemented from 2003 to 2006, the Production Development Policy (PDP) covers the period 2007-2010 and was followed by the Brazil Great Plan from 2008-2011 (Almeida & Rogers, 2015; Etzkowitz, 2015; Filgueiras & Junquillo, 2023).

It is pertinent to note that the national expenditure on ST&I, as depicted by **Figure 2**, during the period from 2000 to 2020. From 2000 to 2015, Brazil saw increasing expenditures on Science, Technology and Innovation. However, Brazil's economic severe economic recession during 2015-2016, had a severe impact

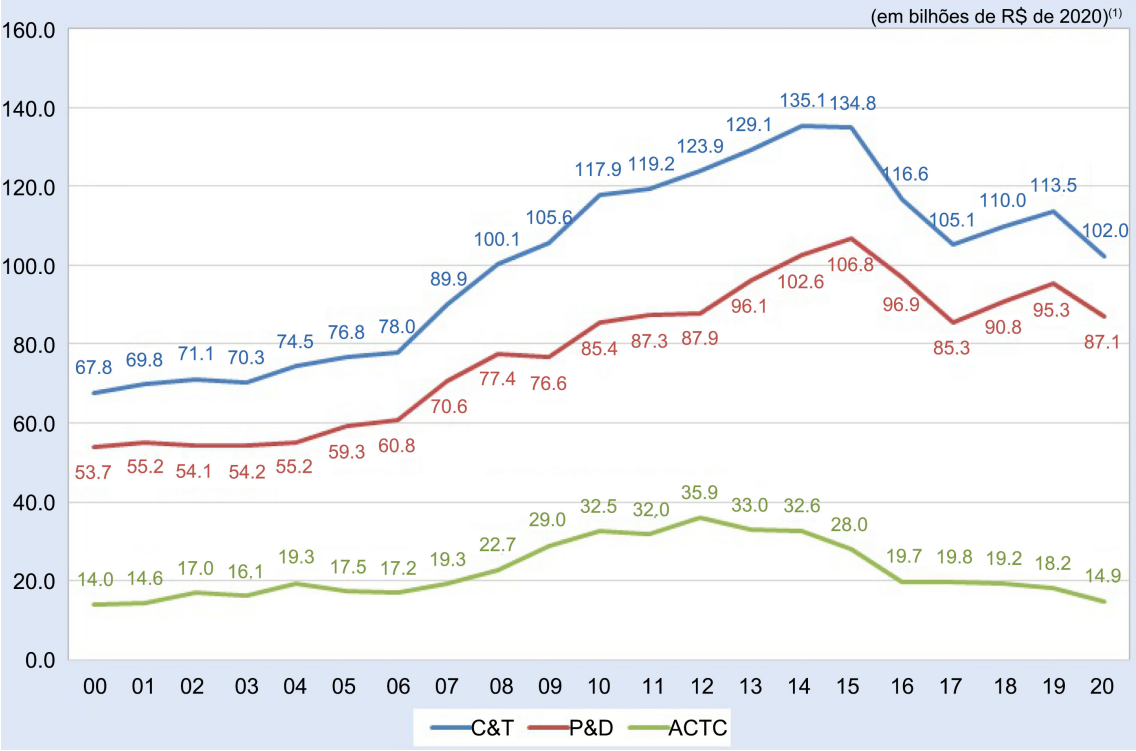

Figure 2. Brazil: National spending on ST&I (2000-2020). Source: Ministry of Science, Technology and Innovation (MCTI, 2023). Note: (1) Amounts corrected according to the implicit GDP deflator. Legend: ●Science & Technology (S&T) = ●Research & Development (R&D) + ●related scientific and technological activities (STA).

on ST&I expenditures as can be seen in **Figure 2**. We see a small increase between 2017-2019, however, the COVID-19 pandemic deeply affected Brazil's economy again, reflecting on expenditures on ST&I. Still, despite of all of Brazil's recent economic setbacks, compared to the year 2000, there has been a growing trend on expenditures on ST&I for the overall period of 2000-2020. With only one exception: the one related to scientific and technological activities (STA).

However, despite the increased Brazilian spending on ST&I, shown in **Figure 2**, the Global Innovation Index (GII), introduced in 2007 for the purpose of studying innovation around the world, provides tools that can help in adapting public policies to promote long-term growth and increase productivity and employment. The IGI enables continual evaluation of innovation, using a key tool (the evaluation structure proposed by the index) and a database of detailed metrics. The index is currently being used to evaluate 128 countries, representing 92.8% of the world's population and 97.9% of the world's GDP. In 2022, the GII, in its 15th edition, is co-published by Cornell University, the *Institut Européen d'Administration des Affaires*, INSEAD and the World Intellectual Property Organization, WIPO, an agency of the United Nations Organization, UNO (INSEAD & World Business, 2007, WIPO, Cornell University, & INSEAD, 2015, 2020).

Table 1 shows Brazil's position in the world innovation ranking, as presented by the GII from 2007 to 2022, in comparison with the other BRICS countries. In 2020, Brazil ranked lower than the other BRICS countries, such as China, Russia,

Table 1. Index and position of the BRICS nations (Brazil, Russia, India, China and South Africa), in 2007, 2015 and 2020.

	Brazil		China		Russia		India		South Africa	
Year	Position	GII	Position	GII	Position	GII	Position	GII	Position	GII
2020	62	31.94	14	53.28	47	35.63	48	35.59	60	32.67
2015	70	34.95	29	47.47	48	39.32	81	31.74	60	37.45
2007	40	2.84	29	3.21	54	2.60	23	3.57	38	2.87

Source: Adapted from INSEAD & World Business (2007) and WIPO, Cornell University, & INSEAD (2015, 2020).

India, and South Africa when came to WIPO's rankings. These countries have invested a higher share of R&D as a percentage of their GDP than Brazil has in the past decade. For instance, in 2020, China invested close to 2.23% of its GDP on R&D. Brazil on the other hand, has historically been allocating close to 0.9% - 1.1% of its GDP to R&D. These low rates of investment on R&D deeply affect Brazil's ability to show a higher degree of performance on the R&D dimension. Moreover, most of the R&D efforts in Brazil are done by state, with the private sector playing a much smaller role (Gouvea & Kassicieh, 2012; Normille, 2020). Moreover, according to the World Competitiveness Report, under the rubric "Incentivize and Expand Patient Investments in Research, Innovation and Invention that can create new "markets of tomorrow" countries like China is better positioned than Brazil (World Economic Forum, 2020).

It is quite clear that Brazil has to enhance its efforts in the field of innovation and ST&I and, as we will show, the Brazilian universities can make a very significant contribution in this regard. Brazil will not be able to establish a strategy of sustainable, stable and inclusive economic growth without a profound change in its innovation and technology policy. Thus, Brazil must revamp and increase its efforts to strengthen its ST&I ecosystem, that includes entrepreneurial universities (World Economic Forum, 2020).

3. Methodology

The methodology of this research project comprised four steps: 1) General Approach, whereby document analysis and theoretical analysis were carried out to identify the ST&I indicators to be proposed, under the topics: a) entrepreneurial university; b) ST&I indicators; c) the Triple Helix; 2) Data Collection, whereby an exploratory, quantitative and qualitative field study was carried out, using a questionnaire with 33 questions for those responsible for the Technology Transfer Offices (TTOs)[2] at the 68 universities that are the object of this study, as already mentioned, for validation of the proposed ST&I indicators; 3) Analysis of the Results; 4) Disclosure of the Results.

4. Results

The sample analyzed for validation of the ST&I indicators comprised the 68

[2]Under the Brazilian legislation governing innovation, the TTOs are referred to as Technological Innovation Centers (NITs).

universities mentioned above, which were rated on the basis of a questionnaire with 33 questions about the 43 indicators identified in the literature review and in each of the 6 proposed factors for analysis in this study, which are shown below in Table 2. It should be pointed out that the questionnaire was fully applied and answered by the management of the TTOs in the survey.

Table 2. Proposed ST&I Indicators.

Factor	PROPOSED INDICATORS
1. UNIVERSITY CULTURE—OBJECTIVES AND ASPIRATIONS (Tornatzky & Rideout, 2014)	1. Dissemination instruments focused on popularizing Science
	2. Defined Intellectual Property Policy
	3. Institutional Instrument for hiring professors with business experience (dual function)
	4. Policies and Procedures for rewarding Entrepreneurial, Technology and Innovation activities by students, researchers and professors
	5. Internal structure in support of Intellectual Property (Technological Innovation Center or equivalent)
	6. Technology incubation programs for startups
	7. Accelerator or Incubator Programs (inside or outside the university, but easily accessible for students and alumni)
	8. Cooperative Incubator Programs
	9. Social Incubator Programs
	10. Technology Park in operation, linked to the university
	11. Number of companies located within the Technology Park
2. LEADERSHIP (Tornatzky & Rideout, 2014)	12. Entrepreneurship courses available for undergraduate students
	13. Entrepreneurship courses available for Master's/Doctoral students
	14. Student entrepreneurship activities (clubs, fairs, happy hour, etc.)
	15. Participation in the development of strategies and policies: business at regional/national level
	16. Participation in the development of strategies and policies: regional clusters
	17. Regional Cluster created by university efforts
3. EXPANSION OF FRONTIERS—ENTREPRENEURSHIP (Tornatzky & Rideout, 2014)	18. Proportion of undergraduate students participating in Outreach Projects
	19. Proportion of Master's/Doctoral students participating in Outreach Projects
	20. Total number of Outreach Projects
	21. Proportion of professors participating in Outreach Projects
	22. Total number of companies founded (SPINOFFS)
	23. Amount of investment received PER YEAR
	24. Number of jobs created PER YEAR
4. EXPANSION OF FRONTIERS—PARTNERSHIP WITH INDUSTRY AND THE COMMUNITY (Tornatzky & Rideout, 2014)	25. Participation of industry/company representatives in university committees
	26. Number of university cooperation agreements with companies
	27. Number of university cooperation agreements with government agencies
	28. Number of university cooperation agreements with third sector organizations
	29. Scholarships for university students and faculty members, paid by companies

Continued

	30. Professors who have dual functions (company/university)—Professors who hold positions at the university and at the company (2nd Innovation Law)
	31. Student interns at Incubator/Accelerator companies
	32. Student interns at Technology Park companies
5. EXPANSION OF FRONTIERS—TECHNOLOGY TRANSFER (Tornatzky & Rideout, 2014)	33. Perceived earnings from technology transfers, PER YEAR
	34. Perceived earnings from technology licensing, PER YEAR
	35. Perceived earnings from other activities (consultancy, laboratory services, etc.) performed on behalf of companies, PER YEAR
	36. Financial resources in support of marketing university research, PER YEAR
	37. Number of Patents Granted in which the university has a full or partial ownership stake
	38. Number of International Patents (granted and applied for) in which the university has a full or partial ownership stake
	39. Number of Patents applied for in which the university has a full or partial ownership stake
	40. Number of invention patent applications (TOTAL)
6. INNOVATION ENVIRONMENT (stage of implementation of ST&I policy at the university) (Etzkowitz, 2004)	41. NASCENT: if it has innovation infrastructure
	42. INTERMEDIATE: if it has infrastructure and an ST&I policy and sells its research results
	43. MATURE: if it has infrastructure and an ST&I policy, sells its research results and operates regionally (especially through licensing)

Source: Drawn up by the authors (2023).

The questionnaire was developed and designed by the authors of this paper. The reliability and validity of the questionnaire was tested and validated. The results are available on request from the corresponding author.

The results obtained in the interviews carried out, through the application of the questionnaire to the 68 universities comprising the sample, are shown below. However, to perform the data analysis it was necessary to standardize the results obtained from the questionnaire. The intention was to standardize the answers so that the analysis would be facilitated and they could really all be compared within the same parameters. This standardization was carried out by means of two different procedures (see below), applied according to the type of response obtained to the question (Simoes, 2019):

1) First procedure: when the answer given by the university was a numerical value and it was noted that the higher the number provided, the more desirable that indicator would be to describe an entrepreneurial university:

1st step: assign to the highest value obtained among the 68 responses a rating of ten and to the lowest value obtained a rating of zero; assign a proportional rating to any other response within that range.

2nd step: compare the results, once the new values have become clearer and more intuitive.

3rd step: draw up charts that represent the numerical results obtained by each university for each of the questions. As an example, take Question No.40: "What

is the number of invention patent applications (total)?" The highest numerical value obtained was that of the UFRJ, at 1400, so the UFRJ was assigned a rating of 10. The lowest numerical value obtained was zero and several universities responded with that number, so they all received a rating of zero. Calculating the other values was performed as shown in the case of the Federal University of Viçosa, which gave the numerical value of 578 in response to this question. The calculation was performed as follows:

$$\frac{578-0}{1400-0}=\frac{x-0}{10-0} \quad x \cong 4.13$$

2) Second procedure: when the answer given by the university was not a numerical value, but one of the following four options: "Yes", "No", "No Data" and "Not Available", ratings ranging from one to five were assigned and the higher the value, the more desirable that indicator would be to describe an entrepreneurial university. The assigned ratings took into consideration the frequency with which that answer was repeated (for each question) by the universities and a rating was previously determined for each of the four different answers. The procedure was carried out as follows:

1st step: establish the so-called "base value" ratings of one, two, three and four, assigned respectively to the response categories: "Not Available", "No Data", "No" and "Yes".

2nd step: add to this "base value" a rating that was calculated for each category, ranging from zero to one, as the result of dividing the number of responses obtained in the category in question by the largest number of responses obtained in any single category. Thus, the ratings took into account not only the desire to obtain positive results, but also the difficulty involved in obtaining such results, expressed through the frequency with which they occurred.

3rd step: draw up charts that show the frequency of the responses and the rating assigned to each category. As an example, take Question No.2: "Does the University have a defined intellectual property policy?" To this question, only one university answered: "Not Available", none of the universities answered: "No Data", 59 answers from the universities were a negative "No" and 8 answers were a positive "Yes". The frequency of the responses is shown in Table 3 below:

The calculation was performed as follows:

- Identify the highest frequency of responses in a single category = 59.
- Standardize the response: "Not Available" $\leftrightarrow 1+\frac{1}{59} \cong 1.02$
- Standardize the response: "No Data" $\leftrightarrow 2+\frac{01}{59}=2$
- Standardize the response: "No" $\leftrightarrow 3+\frac{59}{59}=4$
- Standardize the response: "Yes" $\leftrightarrow 4+\frac{8}{59} \cong 4.14$

Table 4 shows the ratings assigned to each response category.

Table 3. Frequency of the responses to question No.2: "Does the university have a defined intellectual property policy?"

Not Available	No Data	No	Yes
1	0	59	8

Source: Drawn up by the authors (2023).

Table 4. Response ratings.

Not Available	No Data	No	Yes
1.02	2	4	4.14

Source: Drawn up by the authors (2023).

It should also be mentioned that the chi-square test was performed for several of the indicators identified in the literature review and proposed for the evaluation of activities in entrepreneurial universities, with a view to assessing the relationship between those variables. The results sent by the universities were transformed into qualitative variables that indicated whether or not the university had sent information regarding each of the indicators proposed in the questionnaire, for validation in the field study. Thus, the responses sent by each TTO, for each variable, were coded as a binary response (for example: Number of patent applications vs non-number of patent applications, respectively representing the cases where the number of patents was sent and those others where that number was not sent). The significance level was set at 5%. An association was observed between the variables "Policies and procedures for rewarding Entrepreneurial, Technology and Innovation activities by students, researchers and professors" vs. "Number of patents applied for".

It should be noted that Tables 5-10, below, include the results of the analyses of the FACTORS 1, 2, 3, 4, 5 and 6, respectively, presenting the universities that stood out most in the study, from among the 68 universities that answered the questionnaire and comprised the object of this study:

A) FACTOR 1: UNIVERSITY CULTURE, OBJECTIVES AND ASPIRATIONS.

This factor can be evaluated according to the elements of the university culture—mission, vision, objectives and strategic aspirations related to innovative activities (Tornatzky & Rideout, 2014). The results for Factor 1: **UNIVERSITY CULTURE—OBJECTIVES AND ASPIRATIONS** reveal that the 15 universities, in descending order, that stood out the most for the perception of a "strong entrepreneurial culture", based on 11 indicators in the survey (See Table 5), are as follows:

For Factor 1, the 15 universities listed as outstanding showed a high level of arithmetic mean from the ratings of the answers to the interviews. Notably, in relation to the Federal University of Rio Grande do Sul (UFRGS), it is pertinent to mention that the university culture regarding innovation has been fostered by the "UFRGS INNOVATION Portal", which, in addition to disseminating the

Table 5. The top 15 universities in the results for Factor 1.

FACTOR 1—UNIVERSITY CULTURE, OBJECTIVES AND ASPIRATIONS		
TOP 15 UNIVERSITIES	UNIVERSITY	AVERAGE RATING OF THE RESPONSES OBTAINED FROM THE QUESTIONS RELATING TO FACTOR 1
1	UFRGS	4.89
2	UNB	4.75
3	PUCRS	4.71
4	USP	4.71
5	UERGS	4.70
6	UFCE	4.63
7	UFPE	4.59
8	FEEVALE	4.52
9	UERJ	4.51
10	UFSJ	4.51
11	UNIJUI	4.51
12	FURG	4.49
13	UFPA	4.49
14	UFRJ	4.47
15	UEM	4.12

Source: Drawn up by the authors (2023).

university's innovation and entrepreneurship ecosystem in the community, also spreads information about the various activities to stimulate a culture of innovation and entrepreneurship among the university community. The Portal is also the main repository and channel for dissemination of the activities of the "#inovaçãoUFRGS" campaign and the "UFRGS Entrepreneur" project. The former activity is aimed at consolidating the role of the university as an innovative and enterprising institution, broadening and disseminating the effects and potential of the innovation and entrepreneurship activities developed by academic agents. The campaign encourages the involvement of different university departments in carrying out activities related to innovation and entrepreneurship. The latter aims to foster an entrepreneurial culture at the university through the following activities: formally setting up organized junior companies involving undergraduate students from different courses at the university; improving the physical spaces, furniture and equipment of the university's laboratories and incubators; increasing the synergy between research groups and startups incubated in the university's incubator; providing training in management, indicators and continual improvement for startups; supporting the generation of spin-offs from the university.

B) FACTOR 2: LEADERSHIP.

This factor can be evaluated according to the leaders, both internal and external to the academic sphere, who are working for the growth of technological innovation within the universities, highlighting the experience, functions and roles of these individuals and their teams (Tornatzky & Rideout, 2014). The results for Factor 2: LEADERSHIP reveal that the 15 universities, in descending order, that stood out the most for the perception of "strong leadership", based on 6 indicators in the survey (See Table 6), are as follows:

For Factor 2, the 15 universities listed as outstanding showed a high level of arithmetic mean from the ratings of the answers to the interviews. One can mention that at the Universidade Estadual do Norte Fluminense Darcy Ribeiro (UENF) the UENF Innovation Agency (AgeInov) was founded on November 4, 2011 by the Rector at that time (Silvério de Paiva Freitas), with the approval of the University Committee. It has the following responsibilities: acting as proponent and management of the UENF innovation policy, in accordance with State Law No. 5361 of December 29, 2008; participating in the development of university-company relations, including with support foundations; acting in the Patent and Technology Transfer sector, promoting formal registration, monitoring and custody of patent applications and useful models, registration with the responsible

Table 6. The top 15 universities in the results for Factor 2.

FACTOR 2—LEADERSHIP		
TOP 15 UNIVERSITIES	UNIVERSITY	AVERAGE RATING OF THE RESPONSES OBTAINED FROM THE QUESTIONS RELATING TO FACTOR 2
1	UENF	4.73
2	UNESP	4.73
3	UNIFEI	4.73
4	UFPEL	4.73
5	UFPE	4.73
6	UESM	4.73
7	UESM	4.73
8	UFSJ	4.73
9	UFES	4.73
10	UNIPAMPA	4.73
11	FURG	4.73
12	UFRJS	4.73
13	UNISC	4.67
14	USP	4.67
15	UNIVALI	4.67

Source: Drawn up by the authors (2023).

bodies of software, cultivars and brands developed by the UENF; acting to maintain the database of new technologies to be commercialized (technology transfer mechanisms) and proposing cooperation agreements for this purpose; acting in the Project Management sector, analyzing, preparing, promoting the procedure internally at the university, and acting in the administration of signed cooperation agreements; advising the Business Incubator and Technology Park, participating in endeavors that favor the setting up and maintaining of business incubators and the establishing of a future technology park (UENF, 2023).

C) FACTOR 3: EXPANSION OF FRONTIERS & ENTREPRENEURSHIP

This factor can be evaluated according to the activities for promoting entrepreneurship in the academic sphere (Tornatzky & Rideout, 2014). The results for Factor 3: EXPANSION OF FRONTIERS—ENTREPRENEURSHIP reveal that the 15 universities, in descending order, that stood out the most for the perception of "various entrepreneurial activities", based on 7 indicators in the survey (See Table 7), are as follows:

For Factor 3, the 15 universities listed as outstanding showed a high level of arithmetic mean from the ratings of the answers to the interviews. The Pontifical Catholic University of Rio de Janeiro (PUC-Rio) determines that the additional domain in Entrepreneurship at PUC-Rio is a pedagogical initiative of the university, which is complementary to the professional training of students, professors,

Table 7. The top 15 universities in the results for Factor 3.

FACTOR 3—EXPANSION OF FRONTIERS—ENTREPRENEURSHIP		
TOP 15 UNIVERSITIES	UNIVERSITY	AVERAGE RATING OF THE RESPONSES OBTAINED FROM THE QUESTIONS RELATING TO FACTOR 3
1	PUC Rio	3.85
2	UNICAMP	3.82
3	UFG	3.66
4	UFSCAR	3.57
5	UNIOESTE	3.55
6	UFSM	3.54
7	FEEVALE	3.48
8	UFABC	3.45
9	UFES	3.43
10	UFCE	3.38
11	UDESC	3.37
12	UFRGS	3.35
13	UEM	3.31
14	UFBA	3.31
15	UFRRJ	3.31

Source: Drawn up by the authors (2023).

technicians and researchers, involving the performing of studies into new areas of knowledge. Entrepreneurship at the university is inclusive and comprehensive, based on pedagogy that provides elements for an individual, whatever their professional background: to discover new opportunities for business development, select and plan ventures in different sectors and leverage their insertion in the marketplace. The "additional domain in entrepreneurship" was set up in 2005, as a means of complementing studies that offer the community the possibility of obtaining certification by completing certain subjects, adding a certificate in entrepreneurship to the graduation qualification (PUC-RIO, 2023).

D) FACTOR 4: EXPANSION OF FRONTIERS & PARTNERSHIPS WITH INDUSTRY AND THE COMMUNITY

This factor can be evaluated according to the policies, practices and support for transforming research into artifacts, with expansion of the academic frontiers to the private sector (Tornatzky & Rideout, 2014). The results for Factor 4: EXPANSION OF FRONTIERS—PARTNERSHIPS WITH INDUSTRY AND THE COMMUNITY reveal that the 15 universities, in descending order, that stood out the most for the perception of "various partnerships", based on 8 indicators in the survey (See Table 8), are as follows:

Table 8. The top 15 universities in the results for Factor 4.

FACTOR 4—EXPANSION OF FRONTIERS—PARTNERSHIPS WITH INDUSTRY AND THE COMMUNITY		
TOP 15 UNIVERSITIES	UNIVERSITY	AVERAGE RATING OF THE RESPONSES OBTAINED FROM THE QUESTIONS RELATING TO FACTOR 4
1	UFV	5.60
2	UFF	5.07
3	UERJ	3.58
4	PUCRIO	3.50
5	UTFPR	3.19
6	UNICAMP	3.13
7	UFES	3.09
8	UFSM	3.05
9	UECE	3.00
10	UFTM	2.84
11	UNB	2.83
12	UFJF	2.83
13	UFG	2.82
14	UNISC	2.76
15	FURG	2.76

Source: Drawn up by the authors (2023).

For Factor 4, the 15 universities listed as outstanding showed a high level of arithmetic mean from the ratings of the answers to the interviews. At the Federal University of Viçosa (UFV), the TecnoPARQ, a body linked to the Viçosa Technological Center for Regional Development (Centev), intends to host technology-based companies, research and/or technological development units, companies graduated from the Technology-Based Business Incubator, anchor companies and business support structures for insertion within the region's innovation ecosystem, through university-industry partnerships (CENTEV, 2023).

E) FACTOR 5: EXPANSION OF FRONTIERS & TECHNOLOGY TRANSFER

This factor can be evaluated according to the structures within the universities that handle technology transfers, where some of their policies and practices are described (Tornatzky & Rideout, 2014). The results for Factor 5: EXPANSION OF FRONTIERS—TECHNOLOGY TRANSFER reveal that the 15 universities, in descending order, that stood out the most for the perception of "various technology transfer activities", based on 8 indicators in the survey (See **Table 9**), are as follows:

The State University of Campinas (UNICAMP) had a rating close to the maximum value obtainable in this survey. It is considered to be the most innovative

Table 9. The top 15 universities in the results for Factor 5.

FACTOR 5—EXPANSION OF FRONTIERS—TECHNOLOGY TRANSFER		
TOP 15 UNIVERSITIES	**UNIVERSITY**	**AVERAGE RATING OF THE RESPONSES OBTAINED FROM THE QUESTIONS RELATING TO FACTOR 5**
1	UNICAMP	4.61
2	UFPE	4.33
3	UFRGS	3.83
4	UNB	3.36
5	UFES	3.27
6	UFSM	3.19
7	UNICENTRO	3.17
8	UFRJ	3.06
9	UFV	3.06
10	UFSCAR	2.95
11	INESP	2.93
12	UFSC	2.71
13	UEM	2.66
14	UFPEL	2.61
15	UFOP	2.58

Source: Drawn up by the authors (2023).

university in the country and can help you to become an entrepreneur. The TTO at UNICAMP is called the Innovation Agency (Inova Unicamp) and was established in 2003, for the purpose of setting up a network of relationships between Unicamp and society, to boost the research, teaching and knowledge progression activities; it also manages the lodging of patents and computer program registrations and the partnerships between companies and universities and the transferring of technology, in addition to working with international and local partners to promote an entrepreneurial ecosystem and technological innovation. It is responsible for managing technological innovation at the university and presents a variety of initiatives to drive technological innovation (INOVA, 2023).

F) FACTOR 6: INNOVATION ENVIRONMENT

FACTOR 6—INNOVATION ENVIRONMENT uses the model proposed by Etzkowitz (2004) as an indicator for analysis of the stage of maturity of entrepreneurial universities, which may be classified as "mature", "intermediate" or "nascent" (See Table 10). The results for Factor 6: INNOVATION ENVIRONMENT—STAGE OF MATURITY OF THE ENTREPRENEURIAL UNIVERSITY reveal the 15 universities that evaluated themselves as Mature and attained the maximum rating (5.59) in the perception of "innovative environment", based on the

Table 10. The 15 universities considered to be MATURE in relation to Factor 6.

FACTOR 6—INNOVATION ENVIRONMENT—MATURITY		
UNIVERSITY POSITION	UNIVERSITY	AVERAGE RATING OF THE RESPONSES OBTAINED FROM THE QUESTIONS RELATING TO FACTOR 6
1	PUC-RS	5.59
2	PUCRIO	5.59
3	UNISC	5.59
4	UFSCAR	5.59
5	UERJ	5.59
6	UNICAMP	5.59
7	UESC	5.59
8	UENF	5.59
9	UFLA	5.59
10	UFMS	5.59
11	UFMG	5.59
12	UFSC	5.59
13	UFU	5.59
14	UFABC	5.59
15	UFRJS	5.59

Source: Drawn up by the authors (2023).

3 indicators in the survey: 1. NASCENT: if it has innovation infrastructure, 2. INTERMEDIATE: if it has infrastructure and an ST&I policy and sells its research results, 3. MATURE: if it has infrastructure and an ST&I policy, sells its research results and operates regionally (mainly through licensing).

Table 10 shows the stage of implementation of the ST&I policy at the university, as proposed by Etzkowitz (2004) and described in this study as Factor 6. The 15 universities mentioned above, which represent 22% of the sample of 68 universities analyzed, are considered to be MATURE, which is to say, they have: infrastructure, an ST&I policy and market the knowledge produced (mainly through licensing), whether through services, products or other items, and operate regionally. The remaining 78% were classified as INTERMEDIATE or NASCENT. PUC-RS owns the Science and Technology Park of the Pontifical Catholic University of Rio Grande do Sul (TECNOPUC), whose mission is to be an innovation ecosystem driving transformation of the university and society. It acts collaboratively in the transformation of knowledge into social and economic development, promoting a world-class business environment, involving people & creativity & innovation & impact (Tecnopuc, 2023).

Finally, Table 11 below shows a summary of the universities that appear simultaneously among the top 15 positions, noting the 6 Factors for analysis of the research into the 68 universities that were the object of this study:

Table 11. Summary of the top 15 universities in relation to Factors 1, 2, 3, 4, 5 and 6.

UNIVERSITY	UNIVERSITY POSITION PER FACTOR AND AVERAGE RESPONSE RATINGS					
	1	2	3	4	5	6
1. UNICAMP			2 (3.82)	6 (3.13)	1 (4.62)	6 (5.59)
2. UFV				1 (5.61)	9 (3.06)	
3. UFRGS	1 (4.89)	11 (4.73)	12 (3.35)		3 (3.84)	
4. PUC/RJ			1 (3.85)	4 (3.50)		2 (5.59)
5. UFSM		6 (4.73)	6 (3.55)	8 (3.01)	6 (3.20)	
6. UFES		8 (4.73)	9 (3.43)	7 (3.10)	5 (3.28)	
7. UERJ	9 (4.52)			3 (3.58)		5 (5.59)
8. UENF		1 (4.73)				8 (5.59)
9. FEEVALE	8 (4.53)		7 (3.48)			
10. UFF				2 (5.08)		
11. UFSCAR			4 (3.58)		10 (2.96)	4 (5.59)
12. UFPE	7 (4.59)	5 (4.73)			2 (4.34)	
13. UF ABC			8 (3.45)			14 (5.59)
14. UNISC		12 (4.69)		14 (2.77)		3 (5.59)
15. UFJF				12 (2.83)		

Source: Drawn up by the authors (2023).

This Table 11 shows the positions of the universities, as proposed by Tornatzky & Rideout (2014) for Factors 1 to 5 and by Etzkowitz (2004) for Factor 6, ascertaining that 13 universities, i.e. 20% of all the 68 universities analyzed, which were considered by the MEC to be the best in the country, according to the IGC 4 and 5, where the TTOs meet the requirements of the MCTI relating to FORMICT, stood out among the top 15 in at least 2 factors of the analysis: UNICAMP, UFRGS, UFSM and UFES—in 4 factors; UERJ, UFSCAR, UFPE, UNISC and PUC/RJ—in 3 factors; and UFV, UENF, FEEVALE and UF ABC—in 2 factors.

5. Final Remarks

This paper addressed a very important dimension of Brazil's innovation and technology ecosystem: the role of Brazilian universities. Brazilian universities are increasingly playing a larger role in Brazil's quest towards entrepreneurship, innovation and technology.

It should be recognized that, despite the enactment of innovation laws in Brazil as recent as 2004, that have changed the Brazilian ST&I scenario, the speed of adaptation of Brazilian institutions, in terms of the organizational platform for compliance with these new standards, is still gradually moving forward. Moreover, constant changes in leadership and changes in the organizational culture, mainly in relation to the academic function of economic development, known in the country as outreach tends to affect this process negatively.

Since Factors 1 and 2, respectively UNIVERSITY CULTURE, OBJECTIVES AND ASPIRATIONS and LEADERSHIP, have the lowest ratings (See Table 11), it is believed that in future, the institutional efforts to raise awareness within the academic community regarding the importance of innovation and the fruitful performance of the leadership, in relation to the ST&I indicators for an entrepreneurial university, may depend upon certain activities, such as: a) setting up community projects, b) involving multidisciplinary teams, to strengthen the collaborative environment; c) investment in internal training; d) conducting benchmarking studies; e) disclosure of exemplary cases of success at the institution; f) improvement of the organizational atmosphere; g) motivating teams by introducing reward programs to retain talent and stimulate productivity; h) investing in the transparency of the activities, through internal and external communication programs; i) dissemination at all levels of the institution's strategic planning and periodic production; j) dissemination of statistics showing the effectiveness of the management's results; k) investment in comfort and security in the working environment; l) reducing the level of bureaucracy; m) investment in management software that facilitates performance of the institutional procedures; n) using a holistic approach; among other measures.

The management of the university TTOs is of great importance, with regard to entrepreneurship, university-industry interaction and the transferring of technology from universities to society, particularly in relation to the activities of

academic research groups, the so-called "quasi-firms", which enhance the opportunities for technology-based business, with a view to innovation. As most scientists in Brazil carry out research at universities and research institutes, their organization to perform technology transfer is a way to leverage innovative solutions that can change the paradigms in society and generate financial returns for the people involved in the projects and for the regions where they work. Moreover, when there are clear policies regarding rewards, the amount of patents, licensing, service provision, companies founded and other ST&I activities will grow.

The results of this study shows that the indicators identified in the literature, proposed and validated by means of the questionnaire applied to the 68 best Brazilian universities, according to the MEC's IGC and participating in the MCTI's FORMICT program, can be used in support of institutional innovation policies. Furthermore, it can be understood that the government activities determining the internal regulation in Brazilian universities of matters provided for under the Innovation Law and, subsequently, the Legal Framework for Science and Technology have been creating a favorable environment for entrepreneurial activities, since the system's participants, professors, technical researchers and students, feel more confident about engaging in entrepreneurship, as they become increasingly aware of the legal and administrative structure supporting innovation and entrepreneurship and their activities in this field can yield incentives for professional growth and financial income.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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