



THE SCENARIO OF PUBLIC INNOVATION POLICIES IN BRAZIL

Gerciane Cordeiro da Costa¹

Marília Dione Salvador Shibayama²

Robson Antonio Tavares Costa³

ABSTRACT

For the construction of a knowledge-based economy to take place, it is essential to use technological innovation as a lever for economic development. This study sought to carry out a bibliographic survey of what is happening in the country, in terms of science, technology and innovation, listing the strategies, challenges and trends of the last decade, in order to visualize how the public policy scenario is. innovation in Brazil. Therefore, the actors involved in this process were sought, as well as the incentives available from the competent bodies, such as the Ministry of Science, Technology, Innovation and Communication, Science and Technology institutions, Innovation Centers, Open Laboratories and Technology Parks. It was found that the economic and scientific development of Brazil, has occurred in a sustainable way and with the aim of improving the quality of life of Brazilian society, through the strengthening, expansion, consolidation and integration of the National System of Science, Technology and Innovation. However, economic growth is linked to intrinsically to interaction between government, companies and universities / research centers, requiring a closer look at the policies developed and the way they will be developed, given future trends and global and local challenges.

Key words: Triple helix. Innovation. Public policy. Business incubator. Technological parks.

1. Introduction

The central factor of a knowledge-based economy is technological innovation, the main ingredient for leveraging economic development. Due to their importance, several governmental, educational and research, development and business institutions are involved in carrying out actions that allow the use of the generation of innovations and the dissemination of knowledge through greater interaction between companies and universities / centers of research, being the intersection between the threefold propellers of innovation and entrepreneurship.

In this context, the Brazilian National System of Science, Technology and Innovation (SNCTI), has sought to match the most advanced systems in the world, through high investments, with the aim of accelerating the national scientific and technological development, which highlighted the Brazil in sectors ranging from internet

¹ gercordeiro@gmail.com - Master's student in Intellectual Property and Technology Transfer for Innovation - PROFNIT / UNIFAP

² marilia.shibayama@unifap.br - Master's student in Intellectual Property and Technology Transfer for Innovation - PROFNIT / UNIFAP

³ ratcosta@gmail.com - Federal University of Amapá-UNIFAP-PROFINIT

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network infrastructure, with the Ipê Network, to one of the five best ocean research platforms, with the acquisition of the Navio Vital de Oliveira.

These actions are part of a range of strategies developed by the Ministry of Science, Technology, Innovation and Communication (MCTIC), with the aim of fulfilling the mission of “producing knowledge and wealth and contributing to the quality of life for Brazilians” (MCTIC, 2019). To develop such activities, it relies on research units, related entities and social organizations. The main actors in the process of promoting ST&I in Brazil are the political entities, that is, the executive, legislative and society, the development agencies and the science and technology operators, namely: Universities, Research Institutes of the MCTIC, Federal and State CT&I Institutes, National CT&I Institutes, CT&I Institutions, Business Incubators, technology parks and innovative companies.

In this study, we will address each of these actors and their contributions to the Brazilian ST&I scenario, seeking to highlight what has been done so far for the country's technological development, what incentives exist in these fields and what is intended to be done with the existing indicators and trends.

1.1 Triple Helix

Triple helix, this was the term coined by Henry Etzkovitz and Loet Leydesdorff in the mid-1990s, to describe the innovation model based on the government-university-industry relationship. Only through the interaction of these three actors is it possible to create a sustainable and durable innovation system in the era of the knowledge economy. The main actors that lead to the dynamic development of society, by articulating universities, companies and governments, in collaborative practices (LEYDESDORFF, 2012).

Universities, as promoters of the development of science and technology, generating technology transfer and spin-off (when something derives from an element first, be it product, company or business model). When undertaking models of products

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and services derived from these technological transfers, bringing products and services with better performances to society. And governments, by regulating, by public policies, the advances and pertinent legislation so that the new models are consolidated, in addition to fostering such actions (LEYDESDORFF, 2012).

According to Etzkowitz (2017) the Triple Helix has become an internationally recognized model, which is at the heart of the emerging discipline of innovation studies, and a guide to policies and practices at the local, regional, national and multinational levels. The Triple Helix provides a methodology for examining local strengths and weaknesses and filling gaps in relations between universities, industries and governments, with a view to developing a successful innovation strategy. Identifying the generative source of knowledge-based socioeconomic development is at the heart of the Triple Helix innovation project to enhance university-industry-government interactions.

The triple propeller model contributes to consolidate the strategic positioning process of Micro and Small Enterprises - MSEs with a focus on product and process innovation, as they play a strategic role in the national economy (SCHREIBER et al, 2013). The triple helix for the formation of new enterprises and economic development stands out in the benefits provided in the interaction of this model in organizations.

1.2 Business incubator

As is the case of business incubators that became an example of triple helix activities in Brazil, being an organizational adaptation that internalized the relationships between institutional spheres creating a space for interaction and an environment for the development of entrepreneurial education (ETZKOWITZ et al, 2008).

According to the National Association of Entities Promoting Innovative Enterprises - ANPROTEC (2016), business incubation programs have spread across the world and found a fertile field to develop, adapting to local realities and helping entrepreneurs access knowledge, resources and markets. Thus, they have become an important tool in the development of the business ecosystem and in the generation of innovative businesses, becoming potential job and income generators.

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The development of a business activity has a series of effects and impacts on an economy. These impacts occur in "waves" with effects on production, employment and household income. This cycle of "impact waves" occurs due to the companies' expenses with production, with inputs and suppliers and with the employees employed (ANPROTEC, 2016).

The economic impact study carried out by ANPROTEC analyzed 03 major contributions to the economy, such as: contribution to socioeconomic development, contribution to the formation of the business ecosystem and contribution to the development of more solid and innovative entrepreneurs and enterprises.

The generation of direct and indirect economic impact on production, income and job creation are quite tangible elements to measure the importance of the sector for the national economy. However, more than that, these businesses are important for generating income and jobs, favoring the local economy, since almost all incubated businesses employ and generate revenues in the market where they were incubated, with a high retention rate (ANPROTEC , 2016).

Another finding is that international studies indicate that companies that undergo incubation programs are better able to survive in the highly competitive market since, by qualifying entrepreneurs and enterprises, graduated companies have competitive advantages that provide them with greater survivability over time (ANPROTEC, 2016).

The upward growth curve of companies that participate in incubation programs and the shortening of the entrepreneurs' learning curve are benefits directly associated with company incubation programs. The interviews with managers indicate that when an entrepreneur goes through an incubation process, even if he fails in his original idea, there is a high rate of return of these individuals to the market with other companies, created from the knowledge generated in the incubation program (ANPROTEC, 2016).

For Moraes (2019) the studies recently published by the Ministry of Science, Technology and Innovation - MCTI, Sebrae, Anprotec and GEM (Global Entrepreneurship Monitor) indicate an increase in entrepreneurial activity in our country. In order for this growth to be sustained, the need for mechanisms that help and provide

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conditions for entrepreneurs to create, develop and make their businesses prosper is of fundamental importance, and incubators function as a habitat for innovation and an instrument to support and structure these ventures. , making them viable and generating urban and regional impacts.

Barbosa and Hoffmann (2011) identified that the most attractive to entrepreneurs, when they consider joining the incubation programs, are the guidelines that they can receive by the incubator, since they describe the consultancies and infrastructure as the most attractive. In the second moment, already as incubated, they realize that the network of relationships (partnerships with other incubated companies) is one of the most important factors for the consolidation of your company.

There is also a concern for survival of organizations that are not structured and prepared to compete globally. One of the actions that has made it possible to provide more subsidies for the creation of new businesses is the initiatives resulting from the cooperation between different organizations, such as technology parks. These initiatives aim to promote the innovation environment, enabling growth and gaining competitive advantages for businesses that are being started or that have recently started (CONTO; FEIL, 2017).

Brazil really needs to prioritize innovation. It is the passport for the 21st century and for building sustainable development. In this scenario, innovation habitats are part of an ecosystem that becomes increasingly relevant to the strengthening of technology-based entrepreneurship in the territories (BRASIL., 2019).

1.3 Technology Parks

According to ANPROTEC (2007), Technology Parks have the mission of providing the “intelligence”, infrastructure and services necessary for the growth and strengthening of technology-intensive companies. It is a model of concentration, connection, organization, articulation, implementation and promotion of innovative ventures aimed at strengthening this segment within a perspective of globalization and sustainable development. Brazilian Technology Parks should make a significant contribution to consolidating the formation of a strong and competitive “knowledge

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industry” as well as to add technology and innovation to the already established industrial, agricultural and services sectors.

Thus, Technology Parks are organizations whose role involves providing a favorable environment for the innovation of new products, services and processes through a synergistic relationship between three main agents: industry, university and government. This interaction reflects the concept of a triple helix (BRASIL., 2019).

The benefits of Technology Parks for members of the triple-helix are reflected in several dimensions. Studies abroad have shown the positive impact of parks, such as regional economic development, the generation of a greater number of patents obtained by companies installed in the parks and the opening of a greater number of job vacancies available to recent graduates and for highly qualified professionals (BRASIL., 2019).

Like many other countries, Brazil seeks better results through the reinforcement and expansion of scientific, technological and innovation policies that emphasize the mobilization of the processes of acquisition and use of knowledge and innovative training as an integral and fundamental part of its development strategies. Public policies have emerged in order to guide national efforts, since there is a broad consensus among businessmen, government officials and the scientific community that innovation processes are directly responsible for leaps in competitiveness and in the quality of the production system. Not always explicitly these policies have promoted the development of Innovation Ecosystems (SPINOSA, KRAMA, HARDT, 2018).

As challenges of the Technology Parks for the further development of these innovation environments are highlighted by some managers, such as obtaining financial resources, the shortage of professionals with experience in managing innovation environments, the need to create a culture focused on innovation and the closer approximation between science and the market (BRASIL., 2019).

Another challenge is the implementation of a Public Policy to guide and support Technology Parks, as it is a fundamental step to ensure the optimization of the application of resources, the definition of relevant investment programs and the orientation of projects to meet the country's strategic priorities. (ANPROTEC, 2007).

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For the economic and scientific development of Brazil, the Ministry of Science and Technology has the mission of guaranteeing and promoting the advancement of science, technology, innovation and communications aiming at sustainable development and improving the quality of life of Brazilian society (BRAZIL, 2019).

2 Ministry of Science, Technology, Innovations and Communications (MCTI)

MCTIC is one of the actors involved in the National System of Science, Technology and Innovation (SNCTI) in Brazil. Its area of competence was established by Decree No. 9,677, of January 2, 2019, dealing with matters⁴strictly linked to the innovation and technology process, such as national telecommunications, radio broadcasting, scientific and technological research, information technology, automation, biosafety, space, nuclear policies, as well as the planning, coordination, supervision and control of these activities. Another responsibility of this body is to promote the articulation with the state, municipal governments and the Federal District, in order to foster the innovation ecosystem, through sustainable development and the improvement of the quality of life of Brazilian society.

As mission MCTIC⁵it is based on producing knowledge, producing wealth for Brazil and, consequently, contributing to the quality of life of Brazilians. To achieve these activities, the ministry relies on research units, related entities and social organizations.

In recent years, several actions are taking place to promote the ministry's objectives, including:

2.1 Science

In the field of sciences, the themes considered strategic by the MCTIC are: Antarctica, biomes, bioeconomics, biotechnology, Human and social sciences, climate, oceans, health, food and nutritional security, as well as social technologies, especially in 2019, for the SIRENE project. This computational system, developed by MCTIC, aims to make the results of the National Inventory of Anthropic Emissions by Sources and Removal by

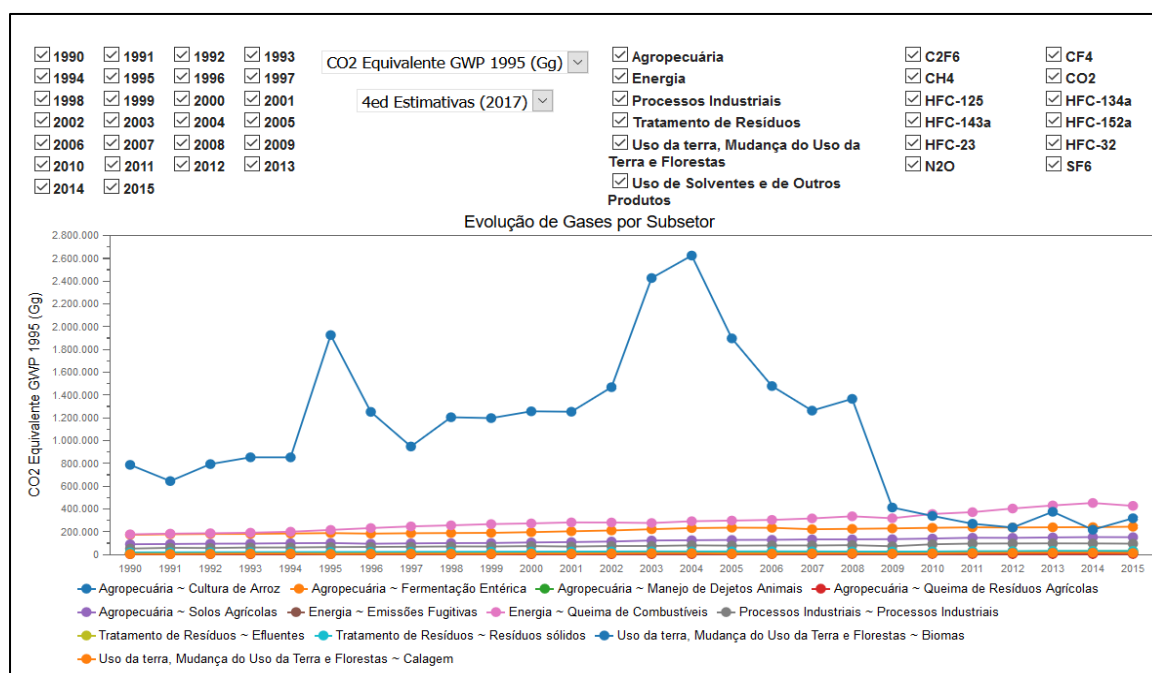
⁴ Decree nº 9.677, of January 2, 2019. http://www.planalto.gov.br/ccivil_03/_Ato2019-2022/2019/Decreto/D9677.htm

⁵ <http://www.mctic.gov.br/mctic/opencms/institucional/paginaInstitucional.html>

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Sinks of greenhouse gases not controlled by the Montreal Protocol available, as well as to provide information related to other emissions accounting initiatives. , such as the Annual Estimates of Greenhouse Gas Emissions and the inventory of the Biennial Update Report.

Graph 1 - Evolution of gases by subsector



Source: SIRENE website⁶

Graph 1 is an example of the different graphs generated by the program. This specifically shows the percentage of emissions of various gases, by sub-sectors in the last two decades.

The system aims to provide security and transparency in the preparation of inventories and support decision making within the scope of policies, plans, programs and projects in the area of climate change, in order to generate scientific knowledge and adopt mitigation measures. The sectoral references report is available in the National Inventory, the graphs and tables generated in the system can be exported to Excel, facilitating its handling.

⁶ https://sirene.mctic.gov.br/portal/opencms/paineis/2018/08/24/Gases_por_Subsetor.html

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2.2 Technology

In the technological field, MCTIC has, through FORMICT, a consolidated data report, prepared using an electronic form, which, in turn, is made available to Scientific, Technological and Innovation Institutions (ICTs), on an annual basis, with information relating to the management of intellectual property within these institutions. FORMICT's focus is on public and private ICTs benefited by the government.

The work of the Ministry of Science, Technology, Innovations and Communications in biofuels permeates actions to support research, technological development and innovation, with the aim of consolidating the technological base and strengthening competitiveness in major strategic themes (Figure 1), the know: biodiesel, ethanol, biogas / biomethane and biokerosene. The actions of MCTIC, in partnership with other government actions underway in 2019, are RenovaBio and the Biofuture Platform, which will seek to provide the development and consolidation of biofuels in the national energy matrix, as well as ensuring new markets for national biofuels.

Figure 1



Source: Prepared by the authors, based on the MCTIC.

In the context of renewable energy, MCTIC promotes scientific knowledge, technological development and innovation in the production chains of renewable energy sources, aiming to strengthen competitiveness and increase the diversification of the energy matrix, guaranteeing energy security and efficiency according to its importance economic, social and environmental for Brazil. Furthermore, they are looking for continued investments in traditional sources and in new technologies for operation, maintenance, energy storage,

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reversible plants, transmission, distribution, smart grids, energy efficiency and energy consumption management systems.

For the Ministry, minerals are strategic, and have focused efforts in priority areas, with emphasis on rare earths and agro-minerals, clean technologies for the production and use of coal and non-metallic mineral production chains. Among the actions carried out is the participation of MCTIC and other federal government bodies (MME - Ministry of Mines and Energy, MDIC Ministry of Industry, Foreign Trade and Services, MP - Ministry of Planning, Development and Management, ABDI - Brazilian Agency for the Industrial Development, CETEM - Mineral Technology Center) and companies in the sector, in the formulation and structuring of the Innovation Program for the Mineral Sector, entitled INOVA MINERAL,

The program is intended for the selection of Business Plans for Brazilian companies that include themes committed to the activities of research, exploration, mining, processing and mineral transformation, inputs, machines, equipment, software and systems, thus contributing to innovation policies, competitiveness and sustainability in these segments. Within this program, thematic line 1 is focused on strategic minerals - Future Carriers, which include rare earths and other elements such as cobalt, graphite, lithium, platinum group metals, molybdenum, niobium, silicon (Solar Grade), thallium, tantalum, titanium and vanadium; line 2 for strategic minerals with a high commercial deficit - phosphate and potassium; and line 3 covered the topic coal in Mining Technologies, subitem 3.5:

Regarding tax incentives, according to Law No. 11,196, of November 21, 2005, known as Lei do Bem, in its Chapter III, regulated by Decree No. 5,798, of June 7, 2006, instituted the use of tax incentives by legal entities that operate under the taxable profit regime, who carry out technological research and development of technological innovation, automatically. To this end, investments are being made to accelerate national scientific and technological development.

The Basic Productive Process (PPB), is an example of this incentive, defined by Law No. 8,387, of December 30, 1991, as being "the minimum set of operations, in the factory, which characterizes the effective industrialization of a given product". O PPB are the minimum manufacturing steps necessary for companies to comply with the manufacture of a certain product, having one of the counterparts to the tax benefits established by law. PPBs are

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established through Interministerial Ordinances, signed by the Ministers of Industry, Foreign Trade and Services (MDIC) and Science, Technology, Innovations and Communications (MCTIC). The Ministers of State for Industry and Science and Technology are responsible for setting and changing the PPB's.

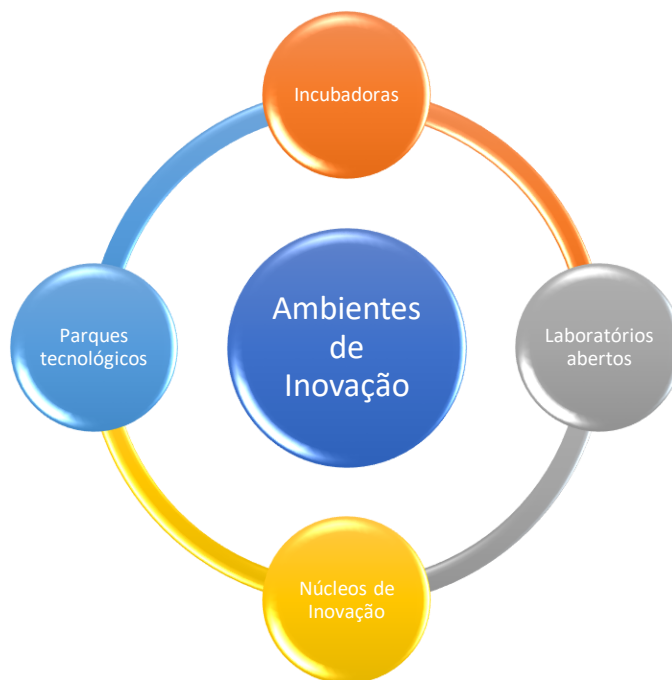
Another example of tax incentives is the Manaus Free Trade Zone - ZFM. Created in 1957, as Porto Livre, where trade in imported goods was encouraged. This year, the legislation was reformulated establishing incentives for the implementation of an industrial, commercial and agricultural pole in Manaus, aiming to integrate the Amazon into the country's economy. In 1991, with the opening of the Brazilian market to foreign trade, quality and productivity encouraged a new approach to manufacturers, along with their products. Over the years, products have become more competitive and technologically better. In 2005, 103 Interministerial Ordinances were issued for the production of various products in the Manaus Industrial Park.

Furthermore, there are several tax incentives established, such as those extended to the Digital TV equipment industry and electronic components, intellectual protection of integrated circuit topography, the automobile industry, which are exclusive regional incentives for companies that settle in the Northern regions, Northeast and Midwest, aiming to reduce regional asymmetries, among many others. All examples of actions, mentioned so far, have the sole purpose of promoting the strengthening, expansion, consolidation and integration of the National System of Science, Technology and Innovation in Brazil.

2.3 Innovation

MCTIC has focused its efforts on fostering innovation environments (Figure 2), on business innovation, digital policies and innovative entrepreneurship.

FIGURE 2 - Innovation Environments



For MCTIC (2019)

“(…) we consider innovative environments, spaces conducive to innovation and entrepreneurship, constituting environments characteristic of the new knowledge-based economy, articulating companies, different levels of government, Scientific, Technological and Innovative Institutions (ICTs), development agencies and society, involving two dimensions:

I - innovation ecosystems: spaces that add infrastructure and institutional and cultural arrangements, which attract entrepreneurs and financial resources, constituting places that enhance the development of the knowledge society, including, among others, scientific and technological parks, smart cities, innovation districts and technology hubs;

II - business generation mechanisms: mechanisms that promote innovative enterprises and support the development of nascent technology-based companies, involving innovative businesses, based on technological differentials and seeking the solution of social or environmental problems or challenges, offering support to transform ideas in successful ventures, including, among others, business incubators, business accelerators, open spaces for cooperative work and open prototyping laboratories for products and processes.

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With regard to innovations in companies, in addition to tax incentives and available financing, there is the iTEC platform, which aims to develop open innovation with technology transfer between research institutions and business sectors. In the field of cooperation, the Brazilian Company for Industrial Research and Innovation (EMBRAPII) works through cooperation with scientific and technological research institutions, public or private, focusing on business demands and targeting risk sharing in the pre- competitive edge of innovation. By sharing project risks with companies, it aims to stimulate the industrial sector to innovate more and with greater technological intensity, thus enhancing the competitive strength of companies both in the domestic and international markets.

Another type of incentive is the researcher program in the company that uses different types of technological development grants, to add highly qualified personnel in Research, Development and Innovation (RD&I) activities in companies, in addition to training and qualifying human resources who work on projects applied research or technological development. The technological bonus is another type of incentive, with subsidies to small and medium-sized micro and small companies, instituted by the legal framework of innovation and intended for the payment of sharing and use of technological research and development infrastructure, of hiring specialized technological services. , or technology transfer, when it is merely complementary to those services, under the terms of regulation.

For products that have already been designed or are only in the field of ideas, the Brazilian System of Technical Answers (SBRT) was created, a network formed by institutions of great national recognition and provides free technological information so that entrepreneurs can improve the quality of their products. products or production processes.

With regard to innovative entrepreneurship, there is the spark program, which aims to stimulate the creation of innovative ventures, through training, financial resources and the dissemination of entrepreneurial culture in Brazil. Furthermore, the Nexos program, which focuses on contributing to innovation and increasing competitiveness by connecting small and large companies, aiming at generating business and developing new technologies. Finally, there is Start-up Brasil, a program that aims to support Brazilian and international startups that develop software, hardware, IT services or that use these

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technologies to innovate, thus contributing to the country's sustainable economic development and the increase in Brazilian competitiveness in this sector.

2.4 National Science, Technology and Innovation Indicators⁷

The National CT&I Indicators gathers data from different sources to provide a global view of the national system of Science, Technology and Innovation and its various actors, linked or not to the federal government, in its various dimensions, allowing comparison with other countries and the realization analysis of ST&I policies. Although they are merely an attempt to apprehend a complex reality, they allow us to visualize future scenarios of the country. These represent what has been accomplished by the public authorities and society in the field of scientific and technological knowledge that condition the pace, scope and direction of a country's social and economic development. According to MCTIC (2019), the main objective of these indicators “(...) is to provide specialized information to the scientific community, to policy makers,

2.5 National Strategy for Science, Technology and Innovation (ENCTI)

ENCTI is a medium-term strategic guidance document (2016-2022) for the implementation of public policies in the area of ST&I, as well as serving as a subsidy for other policies of interest, created by the MCTIC. Its elaboration starts from a public consultation, widely debated with the actors of the CT&I sector. This reinforces points of success yet to be pursued, by correcting directions and establishing new actions regarding the present and the future. The main objective of ENCTI is to outline the science, technology and innovation strategy, demonstrating the state of the art of the CT&I Policy promoted in the country, justifying the choices made to date, as well as synthesizing the various understandings on the theme, in order to have cohesion for stakeholders, promoting economic and social development. The document is divided into 4 parts, namely: Contextualization of the National policy of the sector, with the advances in the ST&I policy and strategic proposals that will guide the next initiatives over the envisaged

⁷ In October 2018, the publication National Indicators of Science, Technology and Innovation - Edition 2018 was launched. Available at: https://www.mctic.gov.br/mctic/export/sites/institucional/indicadores/arquivos/Indicadores_CTI_2018.pdf

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years; the main global trends of CT&I; national challenges within the global perspective, structural axes and fundamental pillars, listing priority actions; strategic themes for Brazil, ending, in the monitoring and evaluation through 10 indicators. national challenges within the global perspective, structural axes and fundamental pillars, listing priority actions; strategic themes for Brazil, ending, in the monitoring and evaluation through 10 indicators. national challenges within the global perspective, structural axes and fundamental pillars, listing priority actions; strategic themes for Brazil, ending, in the monitoring and evaluation through 10 indicators.

3. Final considerations

Given the information exposed in this study, it is evident how much Brazil, through public policies aimed at innovation, tinvested to achieve the strengthening, expansion, consolidation and integration of the National Science and Technology System. Indicators referring to the number of highly educated researchers within ICT's in Brazil have increased over the years, mainly in the North, Northeast and Midwest regions, which in turn, meets the challenge of reducing disparities In this regard, what is not evident is how this knowledge was transformed into innovation and consequent economic and social development, which is the mission of the MCTIC. This fact that despite having perfectly elaborated strategies, it presents flaws in the management of these intangibles.

Furthermore, such actions leave something to be desired in the return to society, requiring greater monitoring by the actors involved, as well as greater collaboration from them so that there is indeed economic and social development in our country. For this reason, the State / society articulations must not only consider the global reality, but also allow it to be appropriated by local realities, in order to recover the capacity for planning and promoting development, through the formation and articulation of public health policies. national, regional and local level.

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