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Entrepreneurship process in biotechnology: a proposal based on entrepreneurial journey

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Abstract: The global stage has been the setting for prominent studies and debates on entrepreneurship, innovation, and biotechnology. It becomes relevant to assess innovation and its implications for the entrepreneur, as innovation stands as a fundamental requirement for the success of the entrepreneur, especially in the field of biotechnology. Innovation holds the potential to conceive a new product, achieve market success, and generate economic benefits for the company. In this context, this work aims to understand, through a bibliographic research, how the integration of innovation into entrepreneurship can contribute to the field of biotechnology. In order to gain the necessary understanding of the subject, the methodology adopted involved bibliographic research, with the purpose of collecting and synthesizing existing knowledge. The results found highlighted the existence of gaps between entrepreneurship and the process of seeking innovation, the selection of ideas, and the challenges related to the changes necessary for the entrepreneur's initiatives to succeed. In the field of biotechnology, entrepreneurship can play a fundamental role in innovation processes and in strengthening competitiveness. Thus, this research fosters debate around the relevant aspects of entrepreneurship, the innovation process in the field of biotechnology, and its impact on the economy and society.

Keywords: Entrepreneurship. Innovation. Development. Biotechnology.

Introduction

Entrepreneurship is a common term in the business world, but it is crucial to understand that being an entrepreneur doesn't necessarily require ownership of a business. Being an entrepreneur also involves innovating in the way you work, having diverse ideas to solve problems, and putting them into practice, creating opportunities that drive the company to a competitive position in the market.

Currently, we are in the midst of a technological revolution, known as the 4.0 revolution, which is transforming how society is perceived and experienced, while also intensifying global competition. Organizations are seeking qualified professionals and entrepreneurs to explore the new opportunities offered by the internet, with the support of artificial intelligence. The field of biotechnology stands out in this scenario due to its potential in applying new technologies to create innovative solutions capable of revolutionizing approaches to disease treatment, environmental preservation, and social interactions.

When discussing entrepreneurs, it is important to emphasize that, in addition to keeping pace with the 4.0 revolution and digital transformation, they play a pivotal role in shaping innovative solutions, thereby contributing to the economy and job creation. However, this prompts the following questions: What is the significance of technology and innovation in entrepreneurship? What role does innovation play in the advancement of entrepreneurship within the field of biotechnology?

To address these inquiries, this article conducted bibliographic research to introduce the concepts related to the innovation process, entrepreneurship, and the field of biotechnology, delving into their significance for the economy and national development

Therefore, the aim of this article is to understand, through bibliographic research, how the integration of innovation into entrepreneurship can contribute to the field of biotechnology, conceptualizing the term entrepreneurship and reconstructing a parallel between entrepreneurship and innovation in the biotechnology field.

Methodology

Based on the context and motivation of this work, as mentioned in the introduction, a bibliographic research was carried out with the objective of gathering evidence to discuss the integration of innovation in biotechnological entrepreneurship. The research was based on a search in academic journals, books, websites, and magazines. Consultations were made in the databases of the Coordination for the Improvement of Higher Level Personnel (CAPES), the Scientific Electronic Library Online (SciELO), and the Digital Library of Theses and

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The bibliographical research was carried out from the perspective of the theme and as suggested by Tachuzawa and Mendes with "the pretension of being a simplified and sensible systematization of thoughts from consecrated sources about a specific subject[1]. To search the available scientific literature, the following keywords were defined: entrepreneurship, innovation, development, and biotechnology.

As an initial analysis of the selected articles, a quick elementary reading of the title was carried out, with little involvement, to observe whether the selected material would be able to contribute to the problematizing questions. Thus, this filter sought to select research that dealt directly with the theme.

In this phase of the research, a qualitative approach [2] was used, seeking to understand the phenomenon, in this case, to inform the overview of various researchers on the subject of entrepreneurship, innovation, and biotechnology, and to provide greater familiarity with the problem, with a view to making it clearer.

The selected material was used for the development of the theoretical framework. After applying the established and described criteria, a dynamic reading of the selected material was carried out, followed by a more detailed reading that sought to answer the problematic questions, and finally to consolidate the information that answered the proposed objectives.

Entrepreneurship and innovation: defining concepts

Entrepreneurship

Entrepreneurship involves initiative and refers to individuals who possess the ability to identify opportunities from problems and the determination to implement new ideas. It is important to mention that not every entrepreneur needs to have their own business.

Thus, the entrepreneur is responsible for driving change processes and plays a central role in developing and consolidating the survival of an organization. Chiavenato[3] highlights that the entrepreneur is not only the owner of an enterprise, but also responsible for driving talent and competence, taking advantage of all opportunities, taking risks, starting something new, or collaborating to the growth of an existing business.

Studies and analyses about entrepreneurship have been highlighted, and many theorists have contributed over the years, as described in Frame 1.

Frame1– Contributions to the Vision of Entrepreneurship.

AUTHOR/YEAR	CONTRIBUTION
Richard Cantillon [4]	The Entrepreneur is a rational man capable of facing the challenge of risk, particularly in the market economy.
Joseph Schumpeter [5]	Argues that innovation and change occur through a spiral of mutual attraction where successful entrepreneurs attract other entrepreneurs and the effects are multiplied.
David McClelland [6]	Business success consists not only of developing specific skills such as finance, marketing, production, but also of entrepreneurial attitudinal skills.
William Baumol [7]	The Entrepreneur is the organizer of the business and the innovator.
Peter Drucker [8]	The Entrepreneur reflects the desire to put his career and financial security on the front line and take risks in the name of an idea, which depends on time and capital.
Casson [9]	Being an entrepreneur is about making careful decisions and skillfully coordinating scarce resources.
William Baumol [7]	The Entrepreneur is like an innovation machine that operates in the free market.
Joseph Tidd, John Bessant, Keith Pavitt [10]	Being an entrepreneur is about doing something new that adds social value or wealth, developing new values and increasing the competitive position of an organization.

Source: The authors (2023)

According to Baumol[7] the entrepreneur is responsible for organizing the business, based on innovative ideas, promoting innovative environments, investing in the development of applications that benefit society with quality. Therefore, from the information in Frame 1, innovation has taken on a leading role in the development of the economy and influences the growth and success of the entrepreneur. In this way, it is also noted that innovation involves an important process of sharing knowledge, through the interaction of entrepreneurs with innovation habitats and the establishment of partnerships, which help reduce development risks and collaborate in accelerating results, bringing together resources, talent, technology, and knowledge.

Innovation and Entrepreneurship: the path to success

Entrepreneurship involves the sensitivity of the entrepreneur, an essential quality for perceiving problems and searching for new solutions and innovation, in addition to traditional characteristics such as initiative, persistence, self–confidence, and leadership.

It is important to highlight that innovation depends on the entrepreneur's ability. Therefore, he/she must always be attentive to market growth. The entrepreneur must seek innovation, as it is the differential that can offer more value to the market. Innovation in entrepreneurship is also associated with novelty, change, or transformation, but innovative products must be significant for consumers.

Thus, the success of the entrepreneur also depends on business planning and monitoring the market and competitors to ensure knowledge of advances in science and technology maturity to be applied as products for society. Entrepreneurship has a clear link with innovation, as entrepreneurs pave the way for new businesses and seek to strengthen innovation development.

"Innovation ecosystems" are great allies for entrepreneurship, as they are spaces where various actors who could be potential partners to collaborate with business creation are found. The main actors are entrepreneurs, companies, suppliers, researchers, government, and investors, who together reduce the risks of innovation development by sharing their skills and generating new knowledge [11]. The innovation ecosystem focuses on interaction and collaboration between its actors, which strengthens as successful projects are developed and become a reference for other partnerships. Granstrand and Holgersson[11] state that for an innovation ecosystem to be consistent, the set of actors must act integrated to achieve good results and innovative performance.

The Triple Helix innovation model focuses on university–industry–government relations. The Quadruple Helix adding the 'media–based and culture–based public' and 'civil society'. The Quintuple Helix innovation model adding the 'natural environments of society' [12]. Each actor in the innovation ecosystem has its role, responsibilities, and functions, but under the governance of a core responsible for managing the innovation generation process continuously. Innovation ecosystems can be understood from innovation helix models, helping to provide a broader vision of the interaction of participating actors necessary for the development of knowledge and innovation. Frame 2 presents all the components of the helix model:

It is understood that knowledge is a dynamic process for human beings, generating values, skills, and new knowledge. Thus, the innovation process also needs to be interactive to assist in the search for new information and knowledge, which are often shared by innovation habitats [13].

Frame 2 – Innovation Helix Models.

HELIX	RESPONSIBILITY
Government	Promotes programs, regulations, policies, and incentives, hence this helix is responsible not only for innovating but also developing and investing in companies.
Enterprise	This helix combines technical vision with business vision to bring novelty to the market and is responsible for driving the ecosystem.
Funding	Provides repayable and non–repayable resources to foster innovation, allowing access to the necessary capital for entrepreneurship and innovation development and growth.
Institution	These organizations can be public, private, or independent and act with innovation, working to drive the interests of diverse niches.
Innovation Habitats	These are conducive spaces for innovation and entrepreneurship to occur. They promote an environment for knowledge sharing to maximize results and minimize risks for entrepreneurs.

Source: The Authors (2023).

Machado[6] points out that "in an organization, knowledge can be widely constructed and can take on various forms, but its quality is revealed in the diversity of capabilities that the company possesses as a result of that knowledge."

In the proposal of the helix model, it is noted that public policies and legislation to establish legal certainty in the relationships between university, industry, and government are fundamental. They involve the type of partnerships and agreements that define how projects will be developed and how these actors can receive the benefits of the joint project so that innovation habitats function as a knowledge–sharing environment.

Innovation habitats involve processes that influence the creation of innovations, through the union of elements that take into consideration the macroeconomic[1] and microeconomic[2] conditions of each region and the focus of the habitat itself [13].

According to the aforementioned author, innovation habitats have been built over the years; in 1970, the importance of innovation and its inclusion in the educational system was already being discussed, with a focus on university structures [13]. The university structure seeks to integrate empirical aspects of knowledge to bring the entrepreneur of the future experiences, pragmatic knowledge to assist in application, and new knowledge developed in academic research.

Thus, the innovation process does not have only one path, but can be understood by following the process of training a professional, to which their cultural baggage, experiences, and new academic knowledge can be added to transform these competencies and skills into ingredients to finalize the process of creating a business[13].

Innovation habitats are surrounded by academic actions and focus on economic development. These environments enable the emergence of new forms of entrepreneurship, as they differ from traditional locations by bringing together talent and investments that synergistically act to develop innovative projects.

For Burkhalter and Curtis [14], innovation habitats represent a fundamental element for maintaining a company's competitiveness in the market. Innovation habitats are places that enhance innovation and support new and small businesses.

There are different types of innovation habitats, such as smart cities, technology parks, innovation centers, incubators, and accelerators. There are strategically located environments, such as the Guamá Science and Technology Park in the city of Belém (PA), where the Federal University of Pará, in the biotechnology segment, offers support for technological innovation with a structure that offers entrepreneurs pre–incubation, incubation, and acceleration of companies.

The Uberaba Technology Park, whose objective is to create, install, and develop technology–based and knowledge–intensive companies, is formed by the Federal University of Triângulo Mineiro and the Secretariat of Economic Development of Uberaba. The park operates in the biotechnology, information and communication technology, energy, and agribusiness segments, offering support services for attracting and installing higher education institutions, technical institutions, and science, technology, and innovation institutions, as well as support for the internationalization of companies, access to municipal tax incentives, and participation in the Uberaba Innovative Program.

Thus, innovation habitats constitute places that contribute to entrepreneurs starting their journey, opening up paths so that they can leverage their ideas and put the creation of new businesses into practice.

Entrepreneurship in biotechnology – a path to innovation

Brazil is a country with entrepreneurial potential. The number of new businesses is increasing, for example in 2021, the number of companies with 3.5 years of existence grew, showing an increase of 1.2 percentage points compared to 2020. With this growth, the country went from 13th to 7th position in the world entrepreneurship ranking [15] , which is also reflected in the biotechnology sector.

Entrepreneurship in biotechnology still faces many challenges in the country, although it has been growing in recent years, with many startups being created with a focus on projects in this area. According to ANAHP [9], it is still difficult to estimate how many entrepreneurs are working in biotechnology activities.

A survey conducted by Biominas [16] revealed the profile of biotechnology companies, such as the majority being small, with a maximum of 10 employees, in the process of market stability, with scientists on staff and innovative biotechnological development, as well as interaction between university and industry. Amaral et al. [17] highlight that:

Biotechnology has shown to be an area of many opportunities to contribute to advances in science, opening a promising path for the future. It offers solutions for the benefit of human health (in the diagnosis, prevention, and treatment of diseases).

Biotechnology has been standing out for new solutions to assist in the development of technologies for the benefit of society, collaborating with the treatment of diseases, vaccines, new medicines, diagnostic techniques. Biotechnology also develops important applications in the area of food production, such as transgenic varieties, which have increased the quality and productivity of soybeans, corn, for example. Biotechnology is also

[4] Analyzes the economy in a broad sense, dealing with factors that affect the national, regional, or global economy as a whole.

[5] Analyzes the economy on a smaller scale and deals with specific entities such as companies, families, and individuals.

applied to the production of food such as bread, cheese, fermented beverages. Other areas, such as biofuels, nanotechnology, bioinformatics, treatment of pollutants and toxic waste, bioremediation processes, biomaterials.

According to IBGE [18], companies in the country are increasingly seeking innovation. A survey conducted by the Innovation Survey (PINTEC) in 2017 presents data that confirms the growth in innovation in Brazilian companies.

The data shows that out of the 116,962 companies in the country, 39,329 (33.62%) have implemented product and/or process innovations. Regarding the transformation industries, out of the 100,216, a total of 34,396 (34.32%) have implemented product and/or process innovations. The percentage of innovative companies indicates that many enterprises do not invest in innovation, but they probably should seek incremental improvements as it is a necessity for survival. The government has collaborated with the innovation system, and Frame 3 shows the number of innovations that occurred in 2017 with government support.

Frame 3 describes the role of the government in encouraging innovation and how it can contribute to the development of strategic areas for the country. The government's assistance with incentive programs, such as the Centelha Program, which seeks to encourage entrepreneurial culture by supporting new ideas until they reach maturity to be launched in the market [19], is crucial.

Based on the innovation system approach, it is essential to highlight that many biotechnological innovations are developed in innovation habitats, which involve universities responsible for basic research and new discoveries, and companies that provide complementary skills. Modern biotechnology (genetic material manipulation techniques and cell fusion) requires advanced technologies and the interaction of many areas.

The entrepreneurship process in biotechnology requires special care in the early stages of business creation, as they are generally conducted by researchers, with little experience in companies. We verified the need to include in the trajectory of the entrepreneur in biotechnology, the stages of exploration of the entrepreneurial work, as an immersion phase in the entrepreneurial life, the participation in events of the area, to develop a network of contacts, very important for the future business. Understanding the sources of government support is also relevant information for the entrepreneur to be able to manage the new business until the launch of the product on the market. In all stages of the entrepreneurial process, the main actors are mentioned in Figure 1. Therefore, the biotechnology entrepreneur, must have a solid knowledge base as a foundation for technology development, followed by financial support, as the innovation process is lengthy. The path of innovation in biotechnology in Brazil is not straightforward and requires determination to overcome risks and find partners and investors for a favorable journey. According to Bistrizki [20], when it comes to biotechnology entrepreneurship, science is not yet a priority because high investment is necessary for biotechnological products to develop.

Final considerations

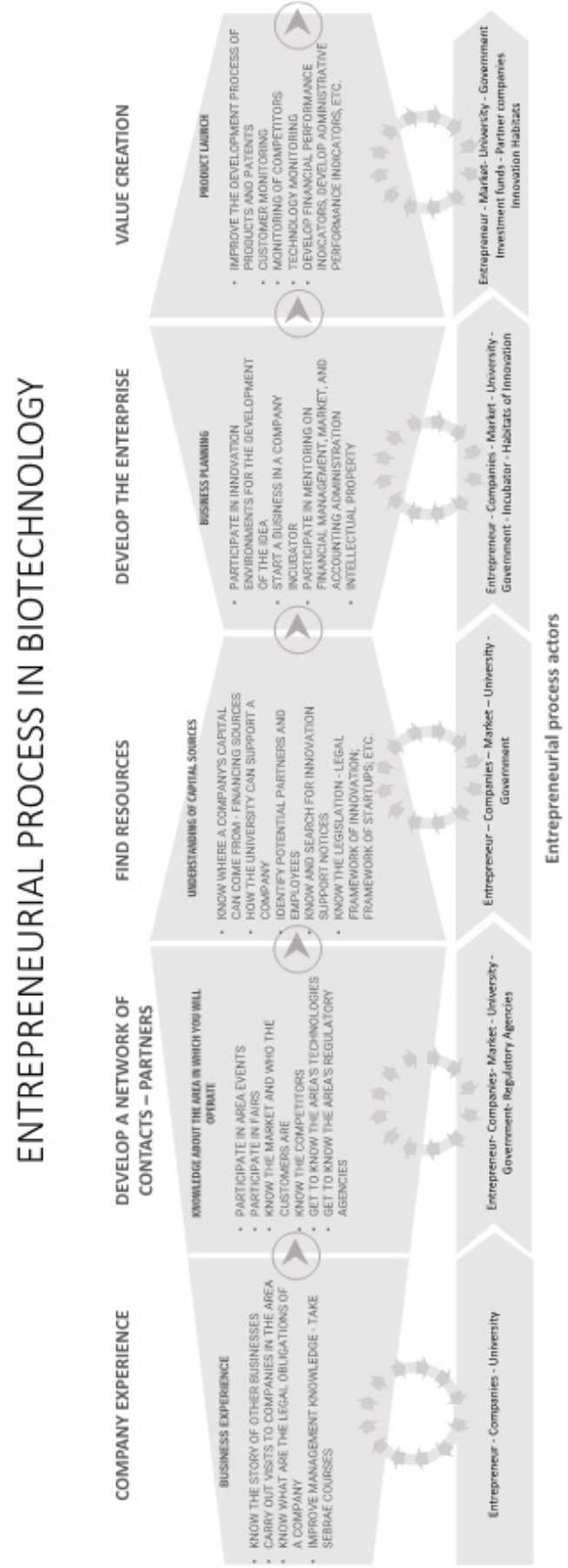
This study allowed us to verify that the biotechnology field has received differentiated attention compared to other areas of science, both in academia and industry, mainly due to the potential for innovation and new products, also promoting new applications and solutions

Frame 3 – Number of companies that implemented innovations with Government support by type in 2017.

Type of government support program	
Total	10290
Tax incentive for research and development	1861
Tax incentive – Information technology law	507
Economic subsidy	491
Financing of research and development and technological innovation projects without partnership with universities or research institutes	930
Financing of research and development and technological innovation projects in partnership with universities or research institutes	516
Financing for the purchase of machinery and equipment to innovate	5086
Scholarship offered by research support foundations (FAP) and RHAE/CNPq for researchers in companies	259
Venture capital contribution	318
Public purchases	1008
Others	2368

Source: Ibge [18]

Figure 1 – Entrepreneurial Process in Biotechnology.



Source: The Authors (2023).

that directly benefit society.

However, there is a lack of incentives and investments in infrastructure because advanced research requires professional training and equipment availability. Thus, to ensure that innovative ideas thrive, a growing and permanent base of research funding initiatives, from basic to advanced, seeking to expand the frontiers of knowledge, needs to be strategically implemented to benefit society.

On the other hand, we see universities investing more and more in generating entrepreneurs, disseminating knowledge and highlighting the importance of completing the innovation process, which begins with the construction of new knowledge required to solve real problems, proposing solutions, and their development in line with ethics and sustainability values. Universities are environments for research and development and a source for creating new talents, who can be protagonists in the emergence of academic spin–offs, startups, or new research groups.

21st–century universities play a relevant role in disseminating technological entrepreneurship, especially in biotechnology, by expanding innovative environments that collaborate with the integration between companies, researchers, and the public sector, making the advantages of partnerships and collaboration between innovation process actors a reality.

However, it is important to note that entrepreneurship in the biotechnology field needs to grow because despite its potential, there are also difficulties in developing products until they are launched in the market. Even with innovative processes, biotechnology requires high investments and time to complete the product or service, in addition to facing rigorous regulation necessary to ensure the safety of the population.

The path to innovation entrepreneurship is not simple or fast, but we know the relevant elements for its conduct and the results we want to achieve, which is the progress of science for the benefit of humanity and life on the planet.

Referências

[1]. Tachizawa, T. and Mendes, G. (2006). Como fazer monografia na prática. 12 ed. Rio de Janeiro: Editora FGV, (2006).

[2]. Gil, AC. (2008). Métodos e Técnicas de Pesquisa Social. 6. ed. São Paulo: Atlas.

[3]. Chiavenato, I. (2012). Empreendedorismo: dando asas ao espírito empreendedor. 4ª ed. Barueri, SP. Editora Manole Ltda.

[4]. Cantillon, R. (1735). Ensayo sobre la naturaliza del comercio em general. Editora Moneda.

[5]. Schumpeter, J. (1934). The Theory of Economic Development. Harvard University Press, Cambridge Massachusetts.

[6]. Maccelland, DC. (1961). A Sociedade Competitiva: Realização & Progresso Social (original: The Achieving Society. Editora Expressão e Cultura. Rio de Janeiro. (1961).

[7]. Baumol, W. (1968). Precursors in Mathematical Economics: an Anthology. Houghton Street, Adlwycg, London, W.C.2.

[8]. Drucker, P. (1970). Inovação e Espírito Empreendedor. Práticas e Princípios. Editora São Paulo.

[9]. Casson, M. (1982). The entrepreneur: an Economic Theory. Edward Elgar Pub.

[10]. Tidd, J, Bessant, J. and Pavitt, K. (2008). Gestão da Inovação. Editora Bookman, 3ª Edição.

[11]. Granstrand, O. and Holgersson, M. Innovation ecosystems: A conceptual review and a new definition. Technovation, pp. 90–91, (2020). http://dx.doi.org/10.1016/j.technovation.2019.102098

[12]. Carayannis, EG. and Barth, T. D., and Campbell, D. F. (2012). The Quintuple Helix innovation model: global warming as a challenge and driver for innovation. Journal of innovation and entrepreneurship, 1, 1–12.

[13]. Machado, AB. (2018). Habitat de inovação: construção do conhecimento em incubadoras. Disponível em: http://btd.egc.ufsc.br/wp–content/uploads/2018/05/Andreia–de–Bem–Machado.pdf, Acesso em: 28 jan. 2023.

[14]. Burkhalter, B B. and Curtis, JP. (1989). New opportunities for entrepreneurs with disabilities to start their own businesses. The Journal of Rehabilitation, 55(2), 17–20.. Disponível em: https://www.proquest.com/openview/6eb380adeaf17fa3a544754426a8e02b/1?pq–origsite=gscholar&cbl=1819158. Acesso em: 10 jan. 2023.

[15]. Sebrae. Pesquisa mundial de empreendedorismo divulgada no Projeto Sebrae 50+50. (2021). Disponível em: https://www.sebrae.com.br/sites/PortalSebrae/sebrae50mais50/noticias/a%E2%80%93mundial%E2%80%93de%E2%80%93empreendedorismo%E2%80%93divulgada%E2%80%93no%E2%80%93projeto%E2%80%93sebrae%E2%80%9350mais50. Acesso em: 30 jan. 2023.

[16]. Abahp. Brasil Inova em Biotecnologia. (2020). Disponível em: https://www.anahp.com.br/noticias/brasil–inova–em–biotecnologia/#:~:text=Isso%20se%20reflete%20no%20setor,quantas%20est%C3%A3o%20trabalhando%20com%20biotecnologia. Acesso em: 12 jan. 2023.

[17]. Amaral, CST., Souza, O., Souza, LH., da Silva, GJ. and Trevizan, LNF. (2020). Novos caminhos da biotecnologia: As inovações da indústria 4.0 na saúde humana. Revista Brasileira Multidisciplinar, 23(3), 203–231.

[18] Ibge. (2017). Instituto Brasileiro de Geografia e Estatística. Pesquisa de Inovação. 2017. Disponível em: https://www.ibge.gov.br/estatisticas/multidominio/ciencia-tecnologia-e-inovacao/9141-pesquisa-de-inovacao.html?=&t=sobre. Acesso em: 30 jan. 2023.

[19] Brasil. (2021). Serviços e Informações do Brasil. Governo Federal lança programa para estimular empreendimentos inovadores no país. Disponível em: https://www.gov.br/pt-br/noticias/educacao-e-pesquisa/2021/10/governo-federal-lanca-programa-para-estimular-empreendimentos-inovadores-no-pais#:~:text=Governo%20Federal. Acesso em: 14 jan. 2023.

[20] Bistrizki, VN. (2017). Empreendedorismo Acadêmico: um desafio para transferência de biotecnologia na Universidade Federal de Minas Gerais. Disponível em: https://repositorio.ufmg.br/bitstream/1843/BUOS-ARLJTD/1/victor_bistritzki_final_version2.pdf. Acesso em 20 jan. 2023.