

AGTECH MOVEMENT IN BRAZIL: QUALI-QUANTI ANALYSIS OF NATIONAL AGTECH INNOVATION ECOSYSTEMS



<https://doi.org/10.56238/arev7n1-244>

Submitted on: 12/30/2024

Publication date: 01/30/2025

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ABSTRACT

The article qualitatively explores the Brazilian tech innovation ecosystems from a bibliographic analysis of secondary data. It is justified by the growing importance of innovation ecosystems as engines of economic and technological development in agribusiness, in addition to the relevance of Agro 4.0. The research adopts an exploratory, descriptive, and quali-quantitative approach, analyzing data from innovation organizations. The results highlight the rapid expansion of tech startups in Brazil, with significant growth in the

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number of companies and a predominant concentration in the Southeast and South regions. The analysis reveals regional disparities in the distribution of innovation ecosystems, with the Southeast and South leading in technological infrastructure, while the North and Northeast present greater development opportunities. The study concludes that, although there is a favorable innovation environment, greater regional equality, and public policies that encourage the balanced growth of tech innovation ecosystems across the country are needed. Future in-depth analyses of the structure, impact, and challenges of these ecosystems are recommended to maximize the potential for agricultural innovation in Brazil. The research was supported by CNPq, INÊS, and Agro Labs, which provided funding, technical support, and technological resources.

Keywords: Agro 4.0. Innovation Ecosystems. Agtech. Hubs. Startups.

INTRODUCTION

Agribusiness has been the main vector of the Brazilian economy, which is updated data reached R\$ 2.58 trillion or 23.8% of GDP, divided into 72.1% in the agricultural sector, R\$ 1.859 trillion, and 27.9% in the livestock sector, R\$ 721 billion (CEPEA, 2023). According to an analysis by CNA (2024) with data from MDIC and AgroStat, the sector's trade surplus has more than surpassed the trade deficit of the other sectors of the Brazilian economy, and guaranteed successive surpluses in the Brazilian Trade Balance.

With the projection of the ninth world economy (IMF, 2024), Brazil has become one of the global leaders in agriculture due to its unique soil and climate characteristics, combined with public policies for investment in ST&I and the promotion of entrepreneurship in agribusiness (CONTINI; ARAGON; NAVARRO, 2022). These initiatives resulted in the development of new production systems, the adoption of good practices through certifications, and the incorporation of advanced technologies in machinery, equipment, biological inputs, and genetically improved seeds – demonstrating the country's potential as a protagonist in agro 4.0.

Technologies coming from industry 4.0 and growing rural connectivity are driving digital transformation in agriculture by integrating data from sensors, satellites, drones, GPS, equipment, and smartphones. This integration, with technologies such as artificial intelligence, cloud computing, blockchain, IoT, augmented reality, machine learning, and robotics, characterizes the fourth agricultural revolution. Agriculture 4.0 promotes a more digitized and connected production throughout the production chain, aiming at food security, sustainability, and efficiency. Digital technologies optimize the use of natural inputs and resources, improve traceability, increase profitability and competitiveness, and support managerial decisions through machine learning platforms and data analysis from sensors, drones, and robots (RADAR AGTECH, 2023).

In this context, innovation ecosystems play a crucial role in driving tech innovation, promoting a collaborative environment that integrates various actors in the agricultural sector to foster technological advances and the implementation of sustainable practices. They offer the necessary infrastructure, financial resources, and institutional arrangements for startups to innovate and expand their operations. Participation in innovation programs and specialized hubs makes it easier for these companies to connect with investors, mentors, and other critical resources, fostering a collaborative and knowledge-sharing environment. These ecosystems not only accelerate regional technological and economic

development, generating jobs and promoting social inclusion, but also encourage sustainable agricultural practices.

The relevance of this study is based on the growing importance of innovation ecosystems as essential engines for economic and technological development, framed in the context of Brazilian agribusiness. Although there are significant advances driven by public policies for investment in ST&I, the literature points to a critical gap in the in-depth understanding of the distribution, impact, and effectiveness of these ecosystems in the ag-tech context. Innovation ecosystems provide a collaborative environment that integrates various actors, including startups, universities, research institutions, and investors, facilitating the exchange of knowledge, resources, and technologies. This integration is vital to foster innovation, increase competitiveness, and promote sustainable agricultural practices. However, the lack of comprehensive studies on how these ecosystems are structured and operate in Brazil prevents an accurate assessment of the opportunities and challenges faced. Based on the theory of innovation, which highlights the need for favorable environments for the creation and diffusion of new technologies, this study aims to fill this gap, offering an analysis that can guide public policies and future investments, in addition to contributing to the consolidation of Brazil as a global leader in agricultural technology.

PROBLEMS

In this context, the tech movement is on the rise, emerging as a crucial transformational factor for the sector. The digital technologies and innovative solutions brought by agtech startups have the potential to revolutionize agriculture, from field to table, promoting a more efficient integration of data and processes throughout the production chain. However, the effectiveness and impact of these innovations strongly depend on the existence of well-structured innovation ecosystems, which provide a favorable environment for the development and dissemination of new technologies. These ecosystems, composed of innovation hubs, incubators, accelerators, and other support mechanisms, are essential for promoting collaboration between startups, universities, research centers, investors, and government agencies. Currently, there is a lack of comprehensive and systematic studies that analyze in detail the configuration and functioning of these innovation ecosystems in Brazil. Specifically, there is a lack of information on the geographical distribution of innovation hubs, the impact generated by

these hubs in the regions where they are inserted, and the main barriers and opportunities faced by tech organizations. This knowledge gap prevents a full understanding of the current scenario and makes it difficult to formulate effective public policies and investment strategies.

Therefore, the central problem of this study lies in the need to map and analyze the scenario of agtech innovation ecosystems in Brazil, to have an overview of the innovation environment of Brazilian agribusiness.

OBJECTIVE

GENERAL OBJECTIVE

The guiding question is: how are AgTech innovation ecosystems distributed in Brazil? This study aims to answer this question, offering a comprehensive view of the current scenario, which can serve as a basis for informed decision-making and for the development of strategies that promote innovation and sustainability in Brazilian agribusiness.

SPECIFIC OBJECTIVE

Thus, the goals were set: i) to collect data on ag-tech actors, and ii) to map the growth and distribution of Agtechs in Brazil; to answer the guiding question.

THEORETICAL FRAMEWORK

TRAJECTORY OF BRAZILIAN AGRIBUSINESS

The country is advancing more and more in productivity, breaking records thanks to efforts aimed at innovation – The accelerated Brazilian agricultural technological development began in the 60s and 70s, driven by public policies aimed at increasing agricultural production and productivity, aiming to ensure food security for the increasingly urban population and reduce food prices. At that time, Brazil was going through a phase of industrialization and urbanization, accompanied by significant economic growth. However, the agricultural sector still had very low productivity, requiring imports to make up for the deficit in domestic supply. From the 1980s onwards, the effects of investments began to be visible, including public investments in research and development, rural extension, and abundant credit. According to a study by EMBRAPA (2018), grain production grew more than six times, from 38 million to 236 million tons between 1975 and 2017, while the

planted area only doubled. According to research by Gasques et al. (2018), between 1976 and 2016, about 80% of the increase in Brazilian agricultural production was attributed to advances in productivity, driven mainly by sectoral policies and investments in research and development, both public and private. The growth was about 400% in the period from 1974 to 2020, with a TFP higher than the world average, positioning Brazil among the countries that have grown the most in the agricultural sector since the 1970s.

In Brazil, such innovations in the sector emerged and developed at an accelerated rate, based on a strong legal foundation provided by the innovation framework – the Innovation Law in Brazil, instituted by Law No. 10,973/2004 and later improved with the introduction of Law No. 13,243, also known as the Legal Framework for Science, Technology, and Innovation – and by the formation of a national innovation system.

AGRICULTURAL REVOLUTIONS

Understanding agricultural revolutions – understood as technological revolutions, according to chart 1 – throughout history is essential to understand the evolution of the agricultural sector and the context in which agro 4.0 is inserted, consequently elucidating innovations.

Table 1 – Technological eras of agriculture, technologies, and production

Technological phase	Period	Production
Agriculture 1.0	Early 20th century	Workforce provided by the labor of families; Use of manual instruments and animal traction; Low agricultural production; Self-consumption agriculture with surpluses to sustain a growing population.
Agriculture 2.0	Post-Industrial Revolution	Application of the scientific method and advanced technologies; Introduction of machines for fertilization, planting, and harvesting; Use of genetically modified seeds, advanced fertilization techniques, and pesticides; Agricultural mechanization with combustion engines; Significant increase in productivity.
Agriculture 3.0	Late 20th century to early 21st century	Precision agriculture with the use of sensors, satellite images, and drones; Collection and analysis of temporal, spatial, and individual data; Improvement in the efficiency of the use of resources, productivity, quality, and sustainability; Use of technology for soil, climate, plant, and animal monitoring; Development of automated production and data collection systems.
Agriculture 4.0	21st century	Digital transformation with disruptive technologies; Massive data collection to support decision-making; Use of technologies such as the internet of things, artificial intelligence, and big data; Data

		integration for monitoring and predictions; Development of sustainable and biotechnology-based solutions; Advances in integrative genomics and synthetic biology; Greater precision in management and decision-making in agricultural production.
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Source: Prepared by the authors (2024), based on MASSRUHÁ et al. (2020).

Agricultural revolutions represent moments of significant change in agricultural practices, driven by technological advances and social changes, which have transformed the way we produce food and use natural resources. By analyzing these revolutions, we can identify the challenges faced by farmers in the past, the solutions found, and the impacts of these changes on agricultural production, productivity, and society as a whole. This provides us with essential insights into the trajectory of agriculture and helps us understand the importance of innovation and adapting to the new realities of the sector.

Agro 4.0

Agriculture 4.0 represents a revolution in agribusiness management, integrating advanced technologies such as the Internet of Things (IoT) and Big Data to optimize and automate agricultural practices. This approach relates to precision agriculture solutions, which include the use of sensors for soil and climate monitoring, artificial intelligence for data analysis and crop prediction, robots for automating repetitive tasks, and drones for mapping and monitoring crops. In addition, Agriculture 4.0 incorporates the concept of Smart Farming, which uses advanced farm management software tools, real-time data analysis, and cloud storage systems, allowing for a holistic and integrated view of agricultural operations. This set of technologies and practices aims to develop more efficient, sustainable, and productive agricultural processes and techniques, promoting agriculture that not only maximizes yields and crop quality but also reduces environmental impacts and improves the management of natural resources.

In this way, digital technologies play a crucial role in modernizing and optimizing the agricultural sector, offering a range of benefits ranging from improved use of inputs to large-volume data collection to support decision-making processes. These technologies allow for more efficient use of inputs, such as fertilizers and water, optimizing their use and contributing to the reduction of operating and labor costs. Additionally, the adoption of digital technologies results in a significant improvement in the quality of products and services, while minimizing environmental impacts through more sustainable agricultural practices. Agriculture 4.0, therefore, represents a significant transformation from the

traditional agricultural model based on empirical experience to a smart and data-driven agriculture model. This new agricultural paradigm is driven by innovative solutions and open innovation actions, which have been instrumental in facilitating the transition to Agriculture 4.0. Such innovations include the use of sensors, drones, geographic information systems (GIS), and Internet of Things (IoT) technologies, which together create an interconnected and efficient ecosystem. Thus, Agriculture 4.0 not only addresses the challenges inherent in this transition, but also opens up new possibilities for a more productive, sustainable, and technologically advanced agricultural future.

AGTECH MOVEMENT

The agtech movement is the term designated in this article to describe the rise and development of organizations that develop technologies for the agricultural sector – The Agtech sector, which encompasses technologies aimed at agriculture, has seen significant growth worldwide, driven by the need for innovative solutions to address challenges such as food security, labor shortages, climate change, and the demand for sustainable agricultural practices. This growth is evidenced by the growing number of companies, businesses, and investors in the area (PitchBook).

In recent years, global investment in Agtech startups has been robust, with venture capital investors pouring billions of dollars into the sector. This is due, in part, to the growing awareness of the importance of technologies that can help solve the sustainability and efficiency issues facing global agriculture. Innovations in agtech not only help improve return on investment for farmers, but also address consumer concerns about food traceability, ethical supply chain practices, and the environmental impacts of crop production (Crunchbase News).

INNOVATION ENVIRONMENTS IN THE AGRICULTURAL SECTOR AND RELATED CONCEPTS

Innovation

Innovation is one of the fundamental pillars for the advancement and evolution of societies, organizations, and individuals. The concept of innovation, in its most primordial essence, refers to the introduction of something new or significantly improved that generates value and positively impacts the environment in which it is inserted. This

definition encompasses not only products and services, but also processes, business models, organizational methods, and even social change.

According to Joe Tidd, a renowned researcher and author in the field of innovation, innovation is not merely the introduction of new ideas, but a strategic and systematic process that involves creating value through the implementation of novelties that respond to emerging needs or significantly improve existing practices (JOE TIDD, 2022) – Applied to the context of agtech innovation ecosystems, We can highlight the importance of a systematic and collaborative process for the creation of sustainable value and the resolution of complex agricultural challenges.

Innovation environments

Table 2: Innovation Environments

SEGMENT	COMPOSITIONS	DESCRIPTION
AREAS OF INNOVATION (INNOVATION ECOSYSTEMS)	Science and Technology Parks	Science and Technology Parks (PCTs) are organizations that foster the growth of innovative companies by managing the flow of knowledge and technology between universities, R&D institutions, companies, and markets. They provide an environment conducive to innovation and regional economic development.
	Smart Cities	Smart Cities use modern technologies to optimize the efficiency of urban services, improve the quality of life of citizens, and promote sustainable development. These environments stimulate the interaction between people and technologies to solve urban challenges).
	Clusters	Clusters are geographical agglomerations of companies and institutions that operate in similar or complementary areas. They facilitate collaboration and synergy between participants, increasing efficiency and regional competitiveness through continuous interactions.
	Innovation Districts	Innovation Districts are compact urban areas where anchor institutions and clusters of technology companies connect with startups, incubators, and accelerators, fostering a dynamic environment for innovation and economic development.
	Innovation Communities	Innovation Communities are environments that encourage collaboration between businesses, universities, government, and citizens to promote innovation. They are characterized by a dynamic and continuous interaction between various actors, facilitating the emergence of new ideas and technologies.
	Other areas of	They include different types of environments designed to

	innovation	promote innovation, varying according to the specific needs and characteristics of each region or sector. They are designed to attract talent and investments focused on innovation.
SEGMENT	COMPOSITIONS	DESCRIPTION
MECHANISMS FOR GENERATING ENTERPRISES	Business incubators	Incubators offer support to startups in their early stages by providing the infrastructure, mentoring, and resources necessary for the development and growth of companies.
	Accelerator	Accelerators are short-term, intensive programs that drive the growth of startups by offering mentorships, funding, and access to a network of strategic contacts.
	Coworking	Shared workspaces that promote collaboration and networking between professionals from different areas, offering flexible infrastructure and support services.
	Living labs	Real test environments where new products and services are developed and validated with the active participation of end users, promoting user-centered innovation.
	Other mechanisms	They include a variety of tools and programs that support the development of innovative ventures, such as startup competitions, capacity-building programs, and investor networks.

Source: Adapted by the authors (2024) based on Audy and Piqué (2016).

Innovation environments are physical or virtual spaces designed to promote interaction, collaboration, and the development of new ideas, technologies, and ventures. They are crucial for technological and economic advancement, as they bring together diverse actors, such as companies, universities, research institutions, government, and citizens, in a large environment that facilitates the exchange of knowledge and resources. According to Audy and Piqué (2016), an innovation environment is formed by Innovation Ecosystems and Entrepreneurship Generation Mechanisms, two spheres that complement each other.

In the agricultural context, the concept of Innovation Ecosystem has been used to define and study the advent of the transformation of the agricultural sector from the generation of new knowledge, technologies, and innovation.

3.4.3 Innovation Hubs

Innovation hubs are spaces that promote the connection between startups, companies, investors, universities, and other entities to foster innovation. It can be both a physical and virtual space, where stakeholders meet to share knowledge, develop

technologies, and form strategic partnerships. This concept of organization is strongly based on Open Innovation, whose reference researcher in the area is Henry Chesbrough and his book Open Innovation (2003).

METHODOLOGY

The study was conducted using the methodological model of exploratory, descriptive, and quali-quantitative research, with a survey of documentary and statistical data, such as articles in journals, studies published by research institutions, and a search for information on the websites of the target organizations.

According to Snyder (2019), literature reviews provide a framework through which it is possible to collect, synthesize, and systematically analyze existing research, helping not only to consolidate existing knowledge but also to identify significant gaps in the literature, suggesting directions for future investigations. They help navigate the vast amount of research available, synthesizing past findings, identifying trends, and suggesting new research directions. Given the rapid production of knowledge, which becomes increasingly fragmented and interdisciplinary, it is difficult for researchers to keep up with the state of the art. The literature review facilitates the understanding of vast and complex areas of knowledge, promoting the integration of interdisciplinary information and offering a more cohesive and comprehensive view of the available literature.

PHASES OF THE RESEARCH

The research design, with Gil (2021) as a reference, was based on 12 stages, as presented below:

- a) choice of theme;
- b) preliminary bibliographic survey;
- c) formulation of the problem;
- d) preparation of the provisional research plan;
- e) identification of sources;
- f) location of sources;
- g) obtaining the material of interest for the research;
- h) reading of the material;
- i) taking notes;
- j) file;

- k) logical construction of work; and
- l) drafting of the report;

Data Sources

Chart 3: Sources analyzed by the survey.

STUDIES	SOURCES
Agtech Report 2020-2021: National mapping of actors in the tech ecosystem	EMBRAPA; SP Ventures; Homo Ludens. Agtech Brasil Radar 2020/2021: Mapping of Startups in the Brazilian Agro Sector. Brasilia, 2021. Available at: https://www.radaragtech.com.br . Accessed on: 26 Jul. 2024.
Agtech Report 2022: National mapping of actors in the tech ecosystem	EMBRAPA; SP Ventures; Homo Ludens. Agtech Brasil 2022 Radar. Brasilia, 2022. Available at: https://www.radaragtech.com.br . Accessed on: 26 Jul. 2024.
Agtech Report 2023: National mapping of actors in the tech ecosystem	EMBRAPA; SP Ventures; Homo Ludens. Radar Agtech Brasil 2023. Brasilia, 2023. Available at: https://www.radaragtech.com.br . Accessed on: 26 Jul. 2024.
Agro Hub Brazil: National platform of ag-tech actors by the Ministry of Agriculture and Livestock	AGRO HUB BRAZIL. Annual Report on Innovation and Technology in Brazilian Agribusiness. 2024. Available at: https://www.gov.br/agricultura/pt-br/assuntos/inovacao/agrohub-brasil . Accessed on: 26 Jul. 2024.
Inova Hub Paraná: State platform of innovation ecosystems in Paraná	INOVA HUB PARANÁ. Annual Report on Innovation and Technology in Agribusiness in Paraná. 2024. Available at: https://www.inovahub.pr.gov.br/ . Accessed on: 26 Jul. 2024.

Source: Prepared by the authors based on the explicit reference.

The following data sources were used for this work: Radar Agtech Brazil, a collaborative initiative of Embrapa, SP Ventures, and Homo Ludens, which maps and analyzes the ecosystem of agricultural technology innovation organizations in Brazil; Agro Hub Brazil, developed by the Ministry of Agriculture and Livestock to promote innovation in the agricultural sector; and Inova Hub Paraná, a platform of the Government of the State of Paraná that centralizes government innovation initiatives. These sources were chosen because they provide detailed and relevant information on the development and technological innovation in agribusiness, facilitating the connection between different actors in the innovation ecosystem.

Radar Agtech Brasil is a collaborative initiative launched by Embrapa, SP Ventures, and Homo Ludens, with the objective of mapping and analyzing the ecosystem of agricultural technology startups in Brazil. Announced in the context of the growing interest in innovations in the agricultural sector, Radar Agtech aims to promote innovation as an

essential pillar for the sustainable and economic development of Brazilian agribusiness. This platform gathers detailed information about startups, including their profile, segment of operation, and geographic location, in addition to disclosing data on investments and partnerships in the sector. Through this initiative, it seeks to foster the connection between entrepreneurs, investors, and other actors in the agricultural innovation ecosystem, facilitating the development of advanced and sustainable technologies for agriculture.

Agro Hub Brasil is an initiative developed by the Ministry of Agriculture and Livestock of Brazil, launched to strengthen and unify efforts in favor of innovation in the Brazilian agricultural sector. Coordinated by the Secretariat of Innovation, Sustainable Development, and Irrigation, Agro Hub Brasil aims to promote the adoption of new technologies and innovative practices in the field. This hub serves as a central point to connect different parts of the innovation ecosystem, including governments, research institutions, startups, and investors, thus facilitating access to resources, knowledge, and networks that can accelerate technological development in agribusiness (Serviços e Informações do Brasil) (Serpro).

Inova Hub Paraná is a platform created by the Government of the State of Paraná, launched during the Viasoft Connect 2022 event, to promote innovation as an essential pillar for the social and economic development of the state. Coordinated by the General Superintendence of Innovation (SGI), linked to the Civil House, the Inova Hub brings together in a single environment all government initiatives related to innovation, in addition to publicizing events and projects of the Paraná innovation ecosystem (AEN PR Gov).

RESULTS AND DISCUSSIONS

EVOLUTION OF THE AGTECH MOVEMENT IN BRAZIL: GROWTH AND DISTRIBUTION

Distribution and Growth Time Series of Agtech Startups

In 2023, Radar Agtech identified 1,953 active startups, representing a growth of 14.7% compared to the previous year. Most of these startups – according to the profile of the report's sample, organized in Table 1 – are located in the Southeast region (56.9%), followed by the South (26%), Midwest (5.8%), North (5.9%) and Northeast (5.2%). São Paulo stands out as the state with the highest number of agtechs, concentrating 43.2% of the national total. The mapped startups are distributed in three major segments: before the farm (16.95%), inside the farm (41.73%), and after the farm (41.32%). Among the most

representative categories are "Innovative Foods and New Food Trends", "Rural Property Management Systems", and "Integrative Platform for Systems, Solutions and Data".

Table 1: Agtech concentration by sample profile

Region	Percentage
Southeast	56,9%
South	26%
Midwest	5,8%
North	5,9%
Northeast	5,2%

Source: prepared by the authors with data from Radar Agtech 2023 et al.

From this mapping, it is possible to see that the agtech ecosystem in Brazil is expanding rapidly, with remarkable growth in all segments of the agricultural production chain. The increase in the number of "Before the Farm" startups suggests greater innovation in the area of agricultural inputs, essential for initial productivity. The "Inside the Farm" segment reflects the growing adoption of technologies that optimize daily operations on farms, while the "After the Farm" segment highlights the importance of improving logistics and commercial efficiency to maximize the benefits of the entire production chain.

Table 2: Amount of techs in the last 4 years

Year / Segment	Before the Farm	Inside the Farm	After the Farm	Total techs
2023	331	815	807	1953
2022	242	705	756	1703
2020-2021	200	657	717	1574

Source: prepared by the authors with data from Radar Agtech 2023 et al.

The significant percentage growth observed between 2020-2021 and 2023 indicates an increasingly favorable innovation environment in Brazil, with agricultural startups growing rapidly and attracting investments.

According to Table 3, the sharpest growth in 2023, especially in the "On-Farm" and "After-Farm" categories, indicates an intensification of the adoption of agricultural technologies that improve productivity and efficiency directly in the field and the post-production value chain.

Table 3: Agtechs growth in the last 4 years

Year / Segment	Before the Farm	Inside the Farm	After the Farm
2023	-	21,00%	36,78%
2022	-	07,30%	15,60%
2020-2021	-	05,44%	06,75%

Source: prepared by the authors with data from Radar Agtech 2023 et al.

Distribution of Agtech Ecosystems

Agtech Radar

The analysis of the distribution of tech ecosystems by macro-region in Brazil reveals large disparities, reflecting the economic and infrastructural characteristics of each area. While the Southeast and South lead in terms of technological infrastructure, the Midwest stands out for the practical application of technologies in the field. On the other hand, the North and Northeast present great opportunities for growth and development, needing greater support and investment to match the more advanced regions. These insights are crucial to direct public policies and private investments in the promotion of agricultural innovation throughout Brazil.

Table 4: Distribution of tech ecosystems by macro-region

Region	Hubs	Incubators	Accelerator	Smart lab and smart farm	Technology parks	Sum
Southeast	58	17	8	1	37	121
South	9	12	5	2	34	62
Midwest	7	2	2	3	8	22
North	5	3	1	1	2	14
Northeast	5	5	3	1	11	25

Source: prepared by the authors with data from Radar Agtech 2023 et al.

The analysis of the distribution of tech ecosystems, table 4, made by Radar Agtech (2023), by macro-region in Brazil reveals large disparities, reflecting the economic and infrastructural characteristics of each area. While the Southeast and South lead in terms of technological infrastructure, the Midwest stands out for the practical application of technologies in the field. On the other hand, the North and Northeast present great opportunities for growth and development, requiring greater support and investment to

match the more advanced regions – Table 5 shows the concentration in percentage, where the disparity is even more evident.

Table 5: Concentration in % of tech ecosystems by macro-region

Region	Hubs	Incubators	Accelerator	Smart lab and smart farm	Technology parks
Southeast	69,05%	43,6%	42,1%	12,5%	40,2%
South	10,71%	30,8%	26,3%	25,0%	37,0%
Midwest	8,33%	5,1%	10,5%	37,5%	8,7%
North	5,95%	7,7%	5,3%	12,5%	2,2%
Northeast	5,95%	12,8%	15,8%	12,5%	12,0%

Source: prepared by the authors with data from Radar Agtech 2023 et al.

Agro Hub Brazil

On the official platform of the Brazilian Government, it is possible to see the Agtech ecosystems that are registered, so they were quantified and organized by regions in Table 6.

Table 6: Mapping of agtech innovation ecosystems, Agro Hub Brasil.

Region/ Organization	Hubs	Incubators	Accelerator	Smart Farms Lab	Technology Parks	Total by region
Southeast	9	5	0	1	5	20
South	8	5	0	1	5	19
North	0	2	0	0	0	2
Northeast	1	1	0	0	2	4
Midwest	5	1	0	1	1	8

Source: prepared by the authors based on Agro hub Brasil.

The regional distribution is similar to that of the Radar Agtech mapping (2023), with the Southeast and South regions leading the concentration of ecosystems, and the North and Northeast being the regions where there are fewer organizations focused on innovation in agriculture. The numbers are much lower than reality, demonstrating that the Government institution has not yet had enough traction to mobilize Agtech organizations.

Inova Hub Paraná

Among the mappings studied, Inova Hub Paraná presents incredible data and results, despite being a state mapping. Its numbers surpass national mappings and highlight what may be one of the largest innovation environments in Brazil.

Table 7: Mapping of the innovation ecosystem of Paraná Inova Hub Paraná.

Type of Organization	Total	Percentage
Startups	598	53,22%
Technology Parks	14	1,25%
Universities	207	18,42%
Accelerator	46	4,09%
Incubators	64	5,70%
Investor Fund	27	2,40%
Regional Ecosystem	25	2,23%
Municipal Representative	111	9,88%
Coworking	113	10,05%

Source: prepared by the authors with data from the Inova Hub Paraná website.

According to table 7, startups represent the largest share, constituting 53.22% of the total. This high percentage indicates a highly favorable environment for the emergence and growth of new technology-based companies. Universities occupy the second position in terms of representativeness, with 18.42% of the total. Coworking spaces represent 10.05% of the ecosystem, spaces that allow different professionals and startups to share ideas, resources, and networks, facilitating open innovation and inter-company cooperation. Municipal representatives (9.88%) and regional ecosystems (2.23%) play a significant role in the decentralization of innovation, ensuring that technological development is not only concentrated in metropolitan areas but is distributed throughout the state, crucial local support to adapt innovation initiatives to the specific needs of each region. Incubators (5.70%) and accelerators (4.09%) are vital for the support and growth of startups in their initial and expansion phases. While incubators provide basic resources and technical support, accelerators help startups scale their operations quickly through mentorship, capital, and strategic networks. Finally, investment funds (2.40%) and technology parks (1.25%) complete the ecosystem, offering high-quality financing and infrastructure for the development of advanced technologies. Technology parks, although they represent a small percentage, are fundamental to providing a structured environment that facilitates collaboration between companies, universities, and research centers.

FINAL CONSIDERATIONS

The agtech movement in Brazil is rapidly expanding, with significant opportunities for innovation in all regions, the current outlook suggests a continued growth of agtech ecosystems, with the potential to further enhance Brazil's competitiveness in the global agricultural market. However, there is a continuous need for public policies and private investments aimed at balancing development between regions and maximizing the potential for agricultural innovation throughout the country, given the large concentrations of innovation ecosystems in the Southeast and South and very few in the North and Northeast regions.

In this way, this work achieves its objective of bringing an overview of Brazilian innovation ecosystems. As recommendations for future work, more in-depth analyses of how these ecosystems are structured, their impacts, and analyses of challenges and opportunities are indicated.

Finally, thanks to CNPq, INES, and Agro Labs for the fundamental support to this scientific research – CNPq helped to fund the research through the scientific initiation scholarship. The National Institute of Software Engineering - INES for technical support and academic collaboration, integrating essential knowledge. Agro Labs, its innovation environment, and technological resources. Without the help of these institutions, this work would not have achieved the results presented here.

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