BRAZIL BIOTECH MAP 2011

PARTNERSHIP

This study is an initiative of BRBIOTEC Brasil (the Brazilian Association of Biotechnology) within the scope of Brazilian Biotechnology Promotion Project – a partnership between Fundação BIO-RIO (Rio de Janeiro Biotechnological Park) and Apex-Brasil (the Brazilian Trade and Investment Promotion Agency). It is part of the strategic plan for the sector with the aim of promoting the internationalization of Brazilian biotechnology companies and aims to position the Brazilian biotechnology in the world biotech map. Brazil Biotec Map 2011 will be released at BIO Convention 2011. The team responsible for the research is from CEBRAP (Brazilian Centre for Analysis and Planning), a nonprofit research institution, with 40 years of experience in research in social sciences, public policies studies and economic development.

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The Cebrap team would like to thank everyone who contributed to this study.

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Professionals who, with their unique expertise, contributed to this publication: Fernando Sciarra, Andre de Freitas Gonçalves and Marcio Rubens S. Gomes.

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EXECUTIVE SUMMARY

Bioeconomy fosters the development of countries in the 21st century. It refers to a set of economic activities in which biotechnology is at the core: whether it is energy production or the promotion of health or the provision of foodstuffs. In bioeconomy, Brazil is a global player: we are leaders in ethanol research and production; scientific advances have transformed agriculture in the last few decades, e.g. soya and sugar cane; and cutting-edge Brazilian medicine, coupled with a structured public healthcare system, provides the conditions for the development of the country's health sector.

All of this coupled with our biodiversity, like a unique source of new molecules, can boost the pipeline of companies and thrust Brazil to the forefront of innovation in biotechnology.

Biotechnology is key to the productive chain of the bioeconomy, but, in addition to that, other activities are essential and are increasingly gaining ground in Brazil, e.g: the production of medical and hospital equipment, hospitals and medical diagnostics laboratories, cosmeceutics companies, biofuel mills, companies involved with seed distribution and sale, environmental consulting services are but a few of the examples of the broad spectrum of the bioeconomy.

In order to identify the different positions of the companies in the bioeconomy chain, we started from a list with approximately 1.000 names, of companies, business incubators, institutions as well as other players related to the bioeconomy, which had been originally compiled by the Ministry of Development, Industry and Foreign Trade (MDIC)[1], from information obtained from the Ministry of Science and Technology[2] (MCT), Apex-Brasil, Brazilian Support Service for Micro and Small Sized Businesses[3] (Sebrae) and different associations that represent biotech clusters in Brazil[4]. This shows the commitment of several governmental agencies in collaborating to Brazil Biotech Map 2011.

Therefore, the main goal of this study is to provide a map of biotech private sector, identifying companies in Brazil whose main activity is biotechnology as well as companies that are developing biotechnology major projects. In addition, the research provides a general picture of academic production in knowledge areas related to biotechnology.

This work comprises an initial analysis of data which will be further analyzed and published with more details in the future. Here we attempt to answer questions such as:

→ How many biotechnology companies exist in Brazil?
→ Where are they located?
→ What field of biotechnology are they working in?
→ What are their revenues and employee numbers?
→ Regarding their businesses: Do they export, import, have patents, collaborate with research institutions?

Based on a methodology explained all through this publication, we have estimated 237 biotech companies in Brazil. This population of companies does not represent the whole bioeconomy chain, but it paves the way to an understanding of its complexity focusing on a part of it: biotechnology activities.

THE RESULTS PRESENTED HERE SHOW

→ The private sector is concentrated in the Southeastern region of Brazil, especially in the States of São Paulo (40.5% of total) and Minas Gerais (24.5%).
→ Others important States are Rio de Janeiro (13.1%) and Rio Grande do Sul (8%).
→ In the Northeastern region, the State of Pernambuco alone accounts for an impressive 4.2% of the companies in Brazil.

[1]Ministério do Desenvolvimento, Indústria e Comércio Exterior (MDIC) – [2]Ministério de Ciência e Tecnologia (MCT). – [3]Serviço Brasileiro de Apoio às Micro e Pequena Empresas (Sebrae) – [4]These clusters are known in Brazil as 'Arranjos Produtivos Locais' (APLs)

REGARDING ACTIVITY AREAS

- Human health stands out (39.7% of companies)
- Although animal health (14.3%), agriculture (9.7%) and environment and bioenergy (14.8%) are also strong areas, especially when we consider the whole bioeconomy chain.

Most of the Brazilian companies are young: 63% were founded in or after the year 2000 (40% after 2005).

The majority of Brazilian biotech companies are micro-companies or small-sized ones:

- 56% have annual revenues of no more than R$ 2.4 million reais (around 1.5 million dollars)
- 20% have no revenues
- 85% have up to 50 employees: one fifth of them have between 1 and 5 employees and one quarter of them has between 6 and 10.

Biotech companies rely upon highly educated professionals: for companies with 1 to 10 employees, 40% are PhDs and around 20% are MScs.

CONCERNING INTERNATIONAL TRADE

- 25% of the companies export
- On the other hand, 86% of them import, especially reagents and equipment for the production and development of technology.

The incubators and the technological parks are key to the development of the sector: half of the companies in the country have benefitted or still benefit from their infrastructure.

Of great importance are the universities and research centers, given that 95% of companies have an ongoing relationship with these institutions, and most of them have established formal partnerships to co-develop products or processes, to use infrastructure, to hire services or to train personnel.

REGARDING FUNDING

- Public funding takes center stage when it comes to the development of the private sector: 78% of companies use it, showing how important the policies concerning science, technology and innovation are in Brazil.
- On the other hand, venture capital financing is still small: only 14% use of companies have this kind of investment.

The effort to patent technologies is significant: 40% of the companies have patent applications or issued patents. Nevertheless, patent applications outnumber issued patents. And in respect of patents applications in Brazil or abroad, traditionally, companies that apply for patents in Brazil outnumber those that apply for patents abroad.

Regarding scientific production in different graduate programs related to biotechnology, the number of associated faculty and graduate students (Master's and PhDs) is very significant throughout the country. Some examples are:

- Agronomy (around 8,000 researchers, considering both faculty members and graduate students)
- Veterinary medicine (3,300)
- Biochemistry, pharmaceutical sciences and pharmacology (5,100).
- Despite concentration in some cities, other specialized areas are also very important: genetics (2,000), infectious diseases (1,600) and immunology and microbiology (1,500).

The Brazilian system of graduate studies (or post-graduate studies, as they are referred to in Brazil) is well structured, though such studies are mostly concentrated in some regions. One concern is how to develop a better interaction between science and the private sector in order to increase the number of companies in some regions of the country.

Finally, we need to emphasize a few very important topics about the methodology in this study:

- For lack of a consensus regarding what a biotechnology firm is among national and international statistical institutions, it was necessary to employ definitions that are well-known and widely used internationally.
- The data regarding the Brazilian biotechnology sector must be carefully gathered if it is to be compared to similar data from other countries.
- The criteria to define a biotechnology firm had to be clear and rigorous so as to create a basis that can be coherently repeated in the future (either by us or by other groups interested in the sector).
- There are other important companies in Brazil which are part of the so-called bioeconomy. However, they have not been included in the list of biotech-companies because they do not fit the definitions of biotech companies, as set out by the OECD and Nature Biotechnology, which we have chosen for the purposes of this first research. For example, companies that develop and design medical equipment and devices have not been included in the biotech list but could equally well have been included in other research using life sciences or bioeconomy ideas. Nevertheless, the risk in these cases is that defining a life science firm or the bioeconomy sector is a very difficult task, since these definitions are still controversial in both the international and the national literature. Therefore, a study using a broader definition of biotech firm could reach a more numerous population of companies than the 237 estimated here.
- Despite the difficulty in defining what a biotech firm is, some examples of biotech around the world help us measure the Brazilian biotech sector. The *OECD Biotechnology Statistics 2009* estimates 587 companies in Germany (using data from 2007), 777 in South Korea (2006), and 3.301 in USA (2006). According to the *Nature Biotechnology* figures on private companies, the USA had, in 2004, 1,500 biotech companies, and the United Kingdom had 261. In a study by *Global Bioeconomy Consulting LLC*, from 2006, Brazil, New Zealand and France counted around 350 companies in life sciences each. A recent study about life sciences in Belgium (2010) estimated 136 companies in that country. Many other examples could be given to comparatively position Brazil in the biotech world.
- This is by no means the first report on the biotechnology sector to be carried out in Brazil. The first step was taken by Fundação Biominas, which published a report in 2007, identifying 181 life sciences companies and 71 biotech companies. The same institution estimated 253 life sciences companies and 109 biotech companies in another study done in 2009. In May 2011, during the first Latin America Burrill Conference, the number mentioned was that there were 350 life sciences companies in Brazil.
- In this Brazil Biotech Map we have identified 237 biotechnology companies in our country, a number coherent with the examples mentioned above.

With all the incentives from the Brazilian government, a growing economy and good science, we strongly believe that our Biotechnology sector is bound to improve.

We hope that this study brings a better understanding of the Brazilian biotechnology and turns out to be useful for the development of the private sector, new investments, policy formulation and new research on biotechnology in Brazil.

INTRODUCTION

The aim of this study is to present a picture of the biotechnology sector in Brazil. The main task in this research is to identify companies in Brazil that have biotechnology as their main activity and companies that are developing important biotechnology projects.

The increase in the production and manufacture of goods and services, and in knowledge production related to biotechnology in Brazil, is well known. However, in spite of the growth in biotechnology activity, data that can provide a good understanding of the economic, social and political aspects of the sector is still scarce and not readily available.

How many biotechnology companies exist in Brazil? Where are they located? In what fields of biotechnology are they working? What are their revenues and employee numbers? Regarding their businesses: Do they export, import, have patents, or collaborate with research institutions? How do they get funding?

The collection and analysis of data on a regular basis will help the formulation of policies and also with the development of companies, by stimulating businesses, creating jobs and contributing to the internationalization of products.

In addition to analyzing the private sector, we mapped the scientific production related to biotechnology. Research institutes and universities play a crucial role in the generation of knowledge that will make the industry flourish.

This study was carried out by Cebrap (Brazilian Center for Analysis and Planning)[5] in partnership with BRBIOTEC Brasil (Brazilian Association of Biotechnology Companies)[6] and Apex-Brasil (Brazilian Trade and Investment Promotion Agency)[7], a Brazilian government agency linked to the Ministry of Development, Industry and Foreign Trade (MDIC).

One of the our major concerns while discussing the goals of this project was the criteria of inclusion/exclusion of companies in the population searched, as well as the definition of biotechnology to be adopted. From the beginning, there was a consensus that both the definition adopted and the criteria to position biotech companies in the bioeconomy chain had to be clear and rigorous. A well-defined methodology would allow for consistency in future analysis, conducted by our team or by other groups interested in the sector. Besides that, by conducting studies on a regular basis, we hope to provide a much better picture of the size and development of the Brazilian biotechnology sector.

This publication is divided in five parts: (1) introduction, (2) methodology, (3) results, (4) references, and (5) institutions description. The results, in part 3, present the research findings, as described below:

→ Firstly, we outline the private sector landscape in Brazil, mapping the 237 companies present in the country, their respective area of activity and year of foundation.

→ The following section displays the data from a questionnaire answered by 145 companies: revenues, employees, patents, relationships with other institutions (incubators, universities and research institutes), details regarding exports and/or imports, use of public funding resources for R&D.

→ In the final section, we present data regarding the scientific production in areas related to biotechnology. We use the numbers of graduate programs and their associated faculty and researchers as proxies. The numbers are recorded every year by Capes[8], a Brazilian agency which monitors higher education in the country, and were organized by our team.

[5]*Centro Brasileiro de Análise e Planejamento (Cebrap)* – [6]*Associação Brasileira de Biotecnologia (BRBIOTEC Brasil)* – [7]*Agência Brasileira de Promoção de Exportações e Investimentos (Apex-Brasil)* – [8]*Coordenação de Aperfeiçoamento de Pessoal de Nível Superior* (Coordination for the Improvement of Higher Education Personnel Foundation).

METHODOLOGY

The first step taken to map the companies was to try to size the group in Brazil in order to identify our biotech-firm population.

Our starting point was a list with approximately 900 names that included companies, business incubators, institutions and other players related to the bioeconomy, that had been compiled by MDIC, from information obtained from the Ministry of Science and Technology[9] (MCT), Apex-Brasil, Brazilian Support Service for Micro and Small Sized Businesses[10] (Sebrae) and different associations that represent biotech clusters in Brazil[11].

Aiming to have a complete picture of the number of private companies in the country, we worked to improve our starting material by doing research in specialized sites and publications of institutions that could be related to biotechnology (associations, incubators, universities and research institutes). In addition, we researched news and scientific publications. Finally, we used a snow ball sampling technique in order to search new names of companies asking to the biotech-companies in our list.

The second step was to refine the list by identifying the companies that could be categorized as a biotechnology firm. In order to do that, we studied the specialized literature and decided to adopt two definitions, which together better reflect Brazil's biotechnology capacity. The two definitions are well known and widely used internationally: the first adopted was the one by the journal *Nature Biotechnology*, and the second was the definition, in list format, of the Organization for Economic Co-operation and Development (OECD).

Nature Biotechnology employs a quite narrow definition when compared to OECD, in that it defines a 'biotechnology firm' as such only if its main activity is biotechnology:

"The main commercial activity of all the companies included depends on the application of biological organisms, biological systems or biological processes, either as in internal research and development, in manufacturing or in the provision of specialist services."[12]

It does not consider companies that have biotechnology projects if these projects do not constitute their main activity and it also excludes bioinformatics companies and CROs.

OECD's definition is broader. First of all, it augments the spectrum by not restricting it to the main activity, in other words, companies that have important biotechnology projects (defined in the list that follows) can be included, even if the projects do not represent a major part of their business. In addition, their list includes companies that are very important for the sector, such as bioinformatics, which are excluded from Nature Biotechnology´s definition.

In our criteria, we also considered specialized consultancy companies and CROs. Although they represent a very small percentage in our sample, we believe they are important players in the development of the sector.

Our decision regarding definitions and inclusion/exclusion criteria was motivated by the following:

→ In the absence of a consensus concerning what a biotechnology firm is, among national and international institutions which work on classification and data gathering, it was necessary to employ definitions that are well-known and widely used internationally.

→ It was of fundamental importance that the data published about the Brazilian biotechnology sector could be compared to numbers from other countries.

→ The criteria to define a biotechnology firm had to be clear and rigorous so as to create a basis that may be repeated in a coherent man-

[9]*Ministério de Ciência e Tecnologia (MCT).* – [10]*Serviço Brasileiro de Apoio às Micro e Pequena Empresas (Sebrae)* – [11]*These clusters are know in Brazil as 'Arranjos Produtivos Locais' (APLs)* – [12]*It is worth mentioning that given the highly innovative nature of this field Nature Biotechnology is also changing its definitions. In their latest publication about the Biotech Public companies the article states; "As the industry has grown and changed, so has our definition of what constitutes a biotech firm, as have our methods for gathering the information that serves as the backbone to this piece". Hugget B. et al, 2010 "Public Biotech 2009 - The numbers" Nature Biotechnology 28(8):793-799. See also: "Private biotech 2004 – the numbers", John Hodgson. Nature Biotechnology, 24:635-641, 2006.*

OECD LIST-BASED DEFINITION OF BIOTECHNOLOGY TECHNIQUES

DNA/RNA: Genomics, pharmacogenomics, gene probes, genetic engineering, DNA/RNA sequencing/synthesis/amplification, gene expression profiling, and use of antisense technology.

Proteins and other molecules: Sequencing/synthesis/engineering of proteins and peptides (including large molecule hormones); improved delivery methods for large molecule drugs; proteomics, protein isolation and purification, signaling, identification of cell receptors.

Cell and tissue culture and engineering: Cell/tissue culture, tissue engineering (including tissue scaffolds and biomedical engineering), cellular fusion, vaccine/immune stimulants, embryo manipulation.

Process biotechnology techniques: Fermentation using bioreactors, bioprocessing, bioleaching, biopulping, biobleaching, biodesulphurisation, bioremediation, biofiltration and phytoremediation.

Gene and RNA vectors: Gene therapy, viral vectors.

Bioinformatics: Construction of databases on genomes, protein sequences; modeling complex biological processes, including systems biology.

Nanobiotechnology: Applies the tools and processes of nano/microfabrication to build devices for studying biosystems and applications in drug delivery, diagnostics etc.

Source: OECD (2005), A Framework for Biotechnology Statistics, OECD, Paris.

ner in the future (by us or by other groups interested in the sector).

To obtain more information on these companies, between March and May of 2011, we called each of the 237 companies explaining the aims of the research and requested a response to an online questionnaire. In addition to the general information (address, contact, products and area of activity), the questions covered several topics such as: revenues, employees, relationships with other institutions (business incubators, universities and research institutes), details regarding exports and/or imports, and use of public funding resources for R&D and patents.

Regarding the area of activity and the most common biotech projects in Brazil, the companies were divided as follows[13]:

→ **Agriculture:** biological pest control and biofertilizers, transgenic seeds and plants, genetic improvement and cloning.

→ **Animal health:** genetic improvement and cloning, drugs and vaccines, development of new technologies in animal reproduction.

→ **Bioenergy:** development of new technologies for biofuels.

→ **Environment:** bioremediation, waste management and recovery of degraded areas.

→ **Human health:** drug development, vaccines, cell therapy, stem cell research, development of new vectors and formulations, diagnostic, recombinant proteins.

→ **Reagents:** enzymes, reagents for diagnostic kits, bioactive molecules, antibodies.

The category "other areas": include companies dedicated to the development of molecular diagnostic tests for different areas, bioinformatics companies, specialized consultancies and CROs[14].

[13] *Other interesting studies use similar classifications, which were important for us in choosing our own sectorial classification for this research: ABDI, 2010; Biominas, 2007; Biominas, 2009.* – [14] *We considered biotech-firm specialized consultancies, CROs and pharmaceutical companies that have research and development projects in biotechnology. Multinationals are included only if they have research and development in Brazil.*

BIOTECHNOLOGY IN BRAZIL

Mapping the biotech private sector in Brazil: location, area of activity and year of firm's foundation[15]

WHERE ARE THE BIOTECHNOLOGY COMPANIES IN BRAZIL?

Our data indicated a higher density of companies in the most developed regions of the country (Map 1 and Graph 1):

MAP 1 **Biotechnology companies in Brazil by city, 2011**

Source: BRBIOTEC Brasil / Cebrap, "Brazil Biotech Map 2011".

→ Of the 27 States in Brazil, 11 have biotechnology companies but only 6 of them have more than 10 companies;

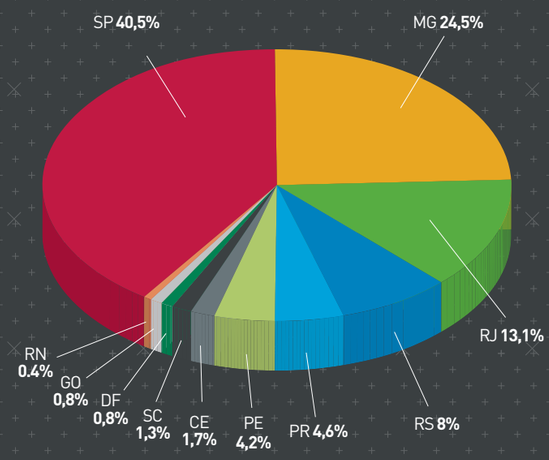
→ The State of São Paulo is home to 40% of the total number of companies (corresponding to 96 companies)

→ Minas Gerais has one quarter of the of companies in Brazil (24.5% or 58 companies)

→ Other important States are Rio de Janeiro, which accounts for 13.1% (31 companies), and Rio Grande do Sul (8% or 19 companies)

→ In the North and Northeastern regions of the country, the State of Pernambuco has a relevant number of companies (4.2%; 10 companies).

GRPAH 1 **Biotech companies by Brazilian state** (%)



Source: BRBIOTEC Brasil / Cebrap, "Brazil Biotech Map 2011". (n=237).

[15] *Information regarding location, area of activity, and firm foundation year not provided through the questionnaire was obtained from other sources (companies' websites, official registers of companies* CNPJ *and incubators) or talking to the companies directly over the phone.*

When we analyzed the number of companies per city we also observed some agglomerations (Map 2):

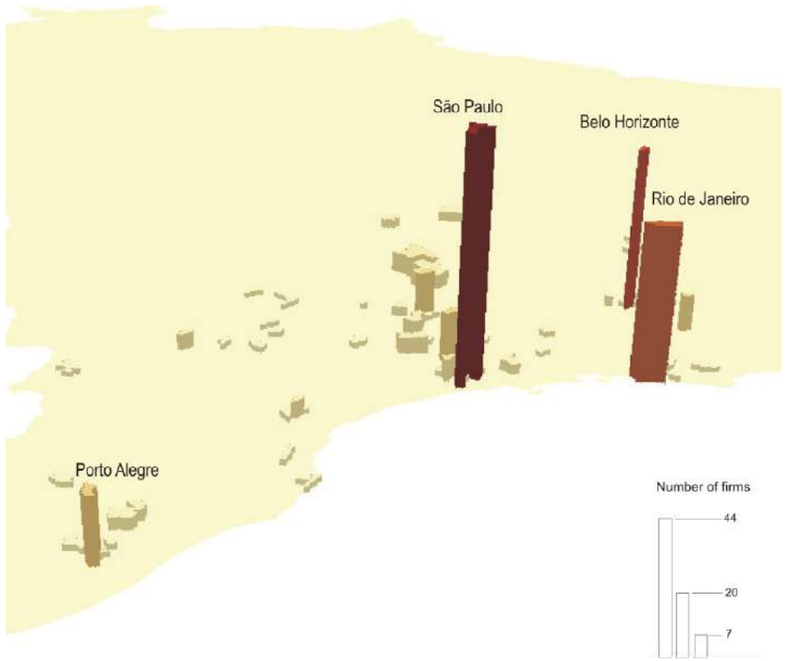
➔ São Paulo city has almost one fifth (18%) of the total number of companies (43);

➔ The second most important city with respect to number of companies is Belo Horizonte, Minas Gerais' state capital, with 13% (31 companies);

➔ In the next tier are other State capitals, such as the city of Rio de Janeiro with 12% (28 companies), Porto Alegre, in Rio Grande do Sul, with 5% and the capital of Pernambuco, Recife with 3%.

➔ The strength of São Paulo and Minas Gerais States is also observed by the presence of several companies in other cities besides their capitals: Campinas (4%) and Ribeirão Preto (4%) in SP; and Viçosa (3%) and Uberlândia (2%) in MG..

MAP 2 **Biotech companies in Brazil by city (Southeast and South regions), 2011**



Source: BRBIOTEC Brasil / Cebrap, "Brazil Biotech Map 2011".

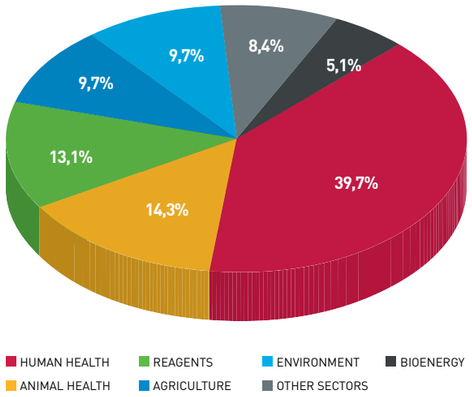
WHAT ARE THE AREAS OF ACTIVITY OF BRAZILIAN BIOTECHNOLOGY COMPANIES?

Regarding the companies' areas of activity (Graph 2), we observed the following:

➔ The majority of activity is concentrated on human health (39.7%);
➔ Animal health, a strong sector in Brazil, and reagents, correspond to 14.3% and 13.1% of the total, respectively.
➔ Biotechnology companies that focus on agriculture make up 9.7%.
➔ Environment and bioenergy, which can converge in some activities, add up to make 14.8% of the total number of companies[16].

[16]*The area called Bioenergy may be under-represented in this analysis, since we did not include biofuel plants. The distribution of sugar cane and ethanol producers can be observed on Map 9.*

GRAPH 2 **Biotechnology companies by area of activity.**



Source: BRBIOTEC Brasil / Cebrap, "Brazil Biotech Map 2011" (n=237).

Finally, when we analyzed the geographical distribution of companies per area of activity (Maps 3 to 8), there was a clear predominance of companies in all areas for the States of São Paulo and Minas Gerais, as described below:

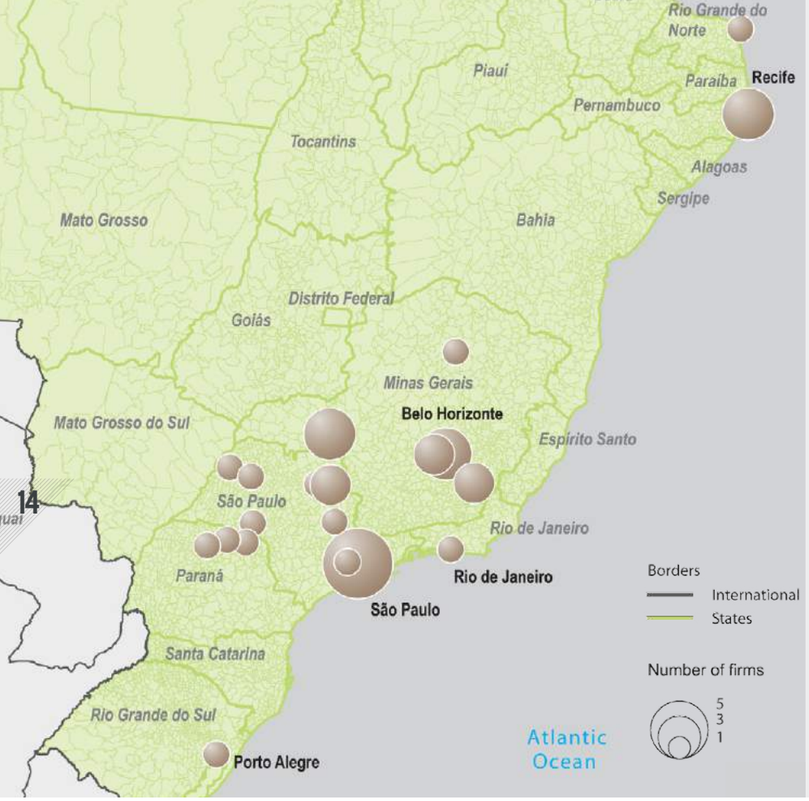
MAP 3 **Biotech companies in human health in Brazil by city, 2011;**

Source: BRBIOTEC Brasil / Cebrap, "Brazil Biotech Map 2011".

➔ Despite the fact that there are companies dedicated to human health in several States, almost half are located in the State of São Paulo (41 companies), one fifth in Minas Gerais (19 companies), and 16% in Rio de Janeiro (15 companies) (Maps 3 and 4).

MAP 4 **Biotech companies in human health in Brazil by city (São Paulo, Rio de Janeiro and Minas Gerais states);**

Source: BRBIOTEC Brasil / Cebrap, "Brazil Biotech Map 2011".



MAP 5 **Biotech companies in animal health in Brazil by city**

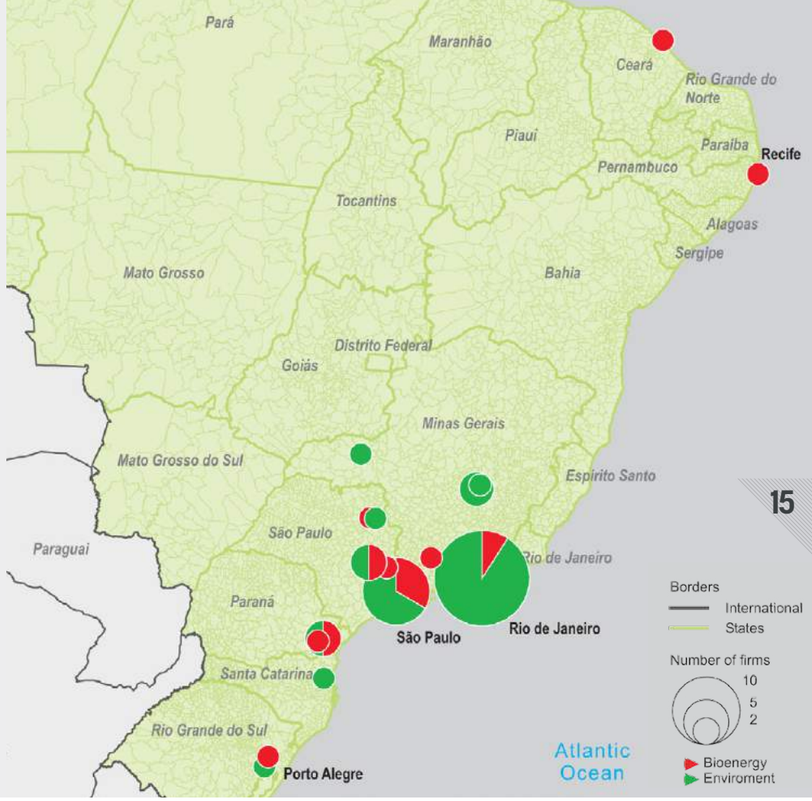
→ Regarding animal health, there is also a huge concentration of companies in the States of São Paulo (41.2%) and Minas Gerais (32.4%), and a low number of companies in the other States (Map 5).

Source: BRBIOTEC Brasil / Cebrap, "Brazil Biotech Map 2011".

MAP 7 **Biotech companies in bioenergy and environment in Brazil by city**

→ The environment category, which corresponds to 9.7% of the total, has companies concentrated in Rio de Janeiro (43.5%); and another part distributed in two States: São Paulo and Minas Gerais. With respect to Bioenergy, a minor category, the companies are clustered in São Paulo (Map 7).

Source: BRBIOTEC Brasil / Cebrap, "Brazil Biotech Map 2011".

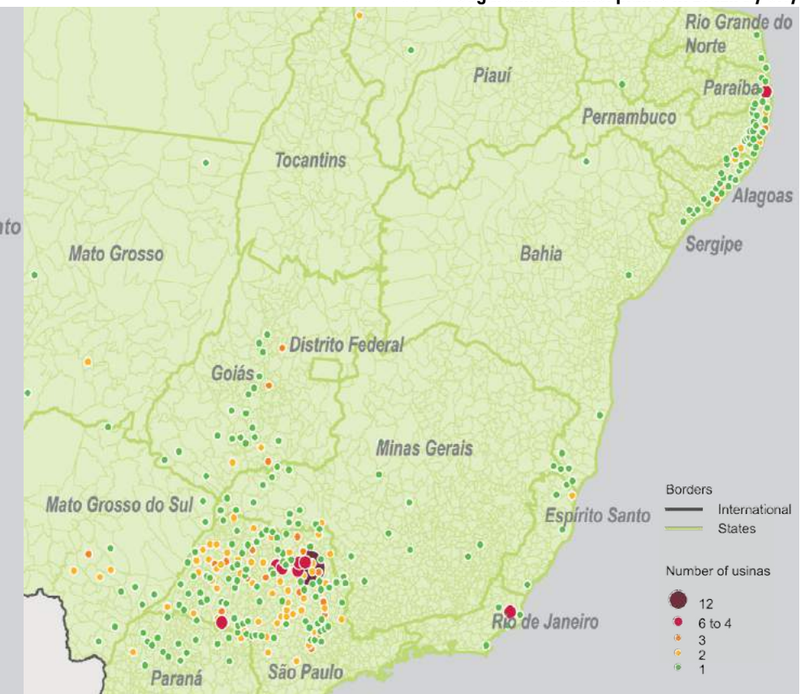


→ In Agriculture, 70% of the companies are clustered in São Paulo and Minas Gerais while the State of Paraná has approximately 10% (Map 6).

Source: BRBIOTEC Brasil / Cebrap, "Brazil Biotech Map 2011".

MAP 6 **Biotech companies in agriculture in Brazil by city**

MAP 8 **Sugarcane ethanol plants in Brazil by city**



→ In order to complete the information regarding companies whose area of activity is bioenergy, we present a map of the 490 sugarcane ethanol plants and biofuel plants in Brazil (Map 8). A great deal are located in the northern part of São Paulo State, in the region of Ribeirão Preto, with many distributed towards the State of Goiás. There are also several plants in the western part of São Paulo State, with many spread out towards the State of Paraná. Another cluster can be observed in the seaside area of the Northeast region of Brazil, in the States of Sergipe, Alagoas, Pernambuco and Paraíba.

Source: UNICA, Sindaçucar/AL e Sindaçucar/PE, 2011. Elaboration: Cebrap.

MAP 9 **Biotech companies in reagents in Brazil by city**

Source: BRBIOTEC Brasil / Cebrap, "Brazil Biotech Map 2011".

→ São Paulo and Minas Gerais together account for 70% of the companies dedicated to the production of reagents; Rio Grande do Sul is in the second tier with 16% (Map 9).

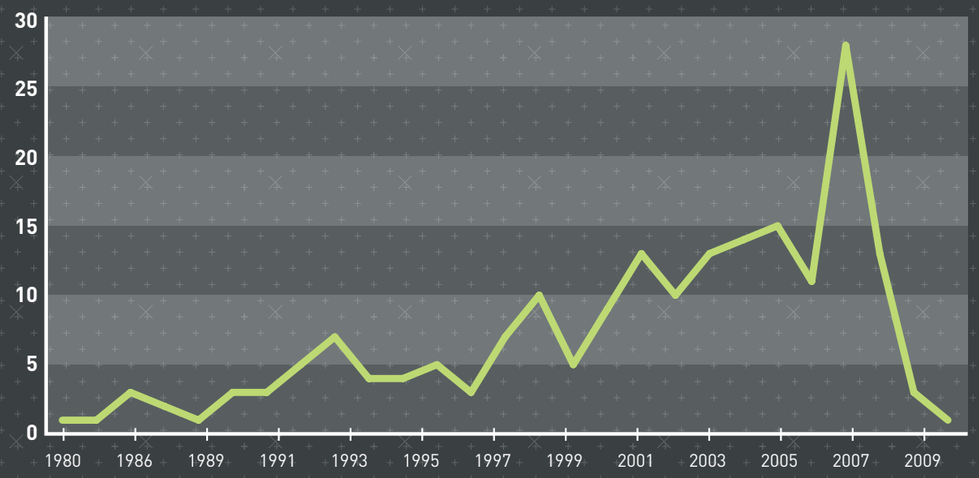
WHEN WERE THE BIOTECHNOLOGY COMPANIES FOUNDED?

The majority of biotechnology companies are very young: 63% were founded on, or after, the year 2000 (135 companies) and 37% were created in the previous decade (51 companies).

A growth trend in the number of companies has been observed since the mid 90s (with a peak in 2008).

In 2009, another kind of support was created for Brazilian start-ups. Finep, the Brazilian innovation agency, created the program "Prime", whose main goal is to provide conditions for a wide range of new businesses with high added value to face challenges in its initial phase and success in the market.

GRAPH 3 **Companies founded 1980-2009**



Source: BRBIOTEC Brasil/Cebrap, "Brazil Biotech Map 2011" (n=214).

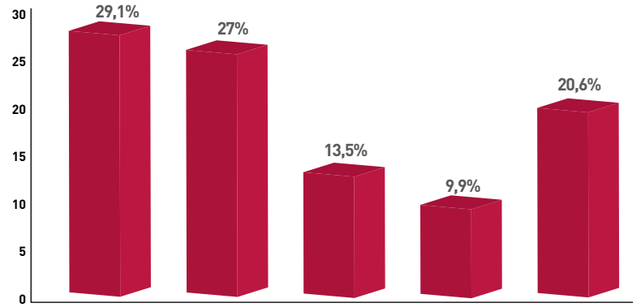
Information on Brazilian biotechnology companies

The information bellow was obtained from the on-line questionnaire answered by the companies. Of the 237 companies, 145 provided information, corresponding to 61,2% of the total. The data presented bellow came from 145 companies, but given that not all of them responded to every question, for each topic the number of participating companies can vary[17].

REVENUES

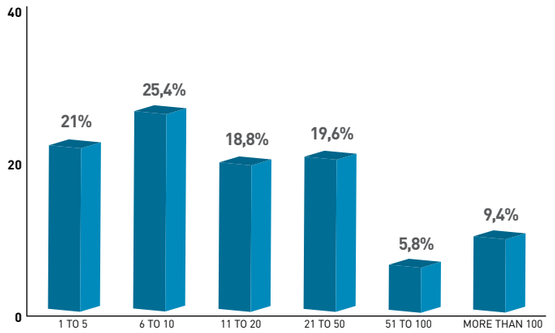
One characteristic of the private biotechnology sector in Brazil is that it is mainly composed of micro and small-sized companies, 56% of which have annual revenues of no more than R$ 2.4 million (around US$ 1.5 million)[18]. One fifth of the companies have no revenue, with their products or services still in development. Only 10% have annual revenues of more than R$ 12 million.

GRAPH 4 **Distribution of companies according to annual revenues**



Source: BRBIOTEC Brasil/Cebrap, "Brazil Biotech Map 2011" (n=141).

GRAPH 5 **Distribution of companies per number of employees**



Source: BRBIOTEC Brasil/Cebrap, "Brazil Biotech Map 2011" (n=138).

EMPLOYEES

If instead of using revenue, we considered the number of employees as an indicator of size we would reach the same conclusion: the private biotech sector in Brazil is composed, mainly, of micro and small sized companies: 85% of the biotechnology companies have up to 50 employees[19]. One fifth of the companies have between 1 and 5 employees and one quarter has between 6 and 10. In addition, only 9.4% of companies have more than 100 employees. These findings indicate that most companies have a lean structure and/or are in the process of forming a team.

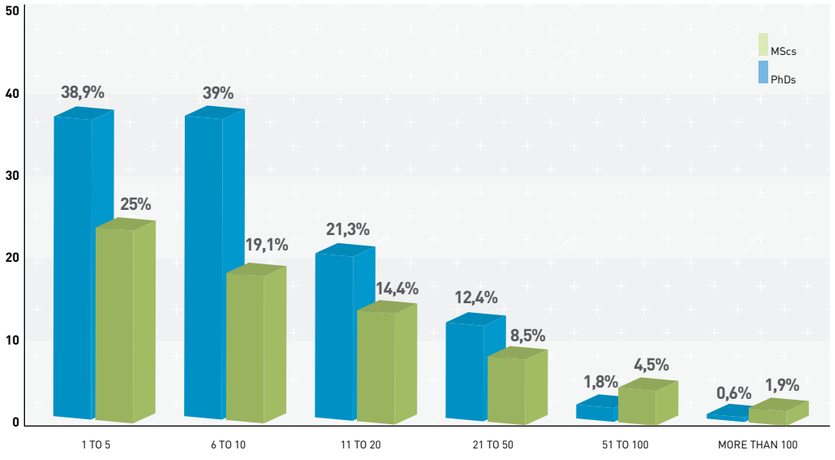
[17]The questionnaire was sent to all 237 companies. The 145 respondents correspond to a convenience sampling combined to a snowball sampling, which allows means of controlling the impacts of a non-random sampling, given that the companies that answered were the ones that decided to do so. – [18]The criteria of firm size according to revenue is based on Federal Law nº 123 (2006) that introduced the "Estatuto Nacional da Microempresa e da Empresa de Pequeno Porte", available at: http://www.planalto.gov.br/ccivil_03/Leis/LCP/Lcp123.htm; See also Morais (2008), "Programas especiais de crédito para micro, pequenas e médias empresas", in: Políticas de Incentivo à Inovação Tecnológica no Brasil. Ipea, Brasília. Available at: http://www.ipea.gov.br/sites/000/2/livros/inovacaotecnologica/capitulo10.pdf – [19]According to the Instituto Brasileiro de Geografia e Estatística (IBGE) and SEBRAE the size of a firm can be estimated based on the number of employees. In retail and services sectors, a micro firm is the one that has up to 9 employees and in the manufacturing industry up to 19 people. A small firm has from 10 to 49 people in retail and services sector and from 29 to 49 in manufacturing industry.

Regarding the level of education of the employees, it was to be expected that biotech companies should have a high percentage of people with higher education degrees: undergraduate (bachelor) and post-graduate (MScs and PhDs).

Considering companies with up to 50 employees (85% of the total), we observed a high level of education among workers. For companies with 1 to 5 employees, 90% have a higher education degree: approximately 40% have PhDs, 25% have MScs and 25% have undergraduate degrees. A similar situation can be seen for companies with 6 to 10 employees. Even for companies that range from 21 to 50 employees, which represent one fifth of the total, there is still a high percentage of PhDs (12.5%).

This data shows how these companies, especially the smaller-sized ones, can boast highly trained professionals.

GRAPH 6 **Percentage of MScs and PhDs in companies of different sizes.**



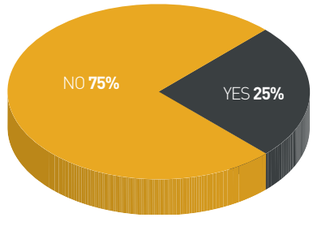
Source: BRBIOTEC Brasil/Cebrap, "Brazil Biotech Map 2011" (n=138).

EXPORTS

Regarding the international market, one quarter of the biotechnology companies in Brazil answered that they had exported in the last five years. The countries varied greatly but Latin America was the most common destination.

It is worth pointing out that 50% of the companies have strategic plans to export. This is an indication that the percentage of companies exporting will probably rise in the near future.

GRAPH 7 **Does the company export?**



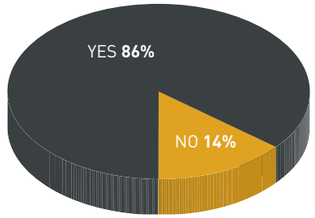
Source: BRBIOTEC Brasil/Cebrap, "Brazil Biotech Map 2011". (n=124).

IMPORTS

The biotechnology companies are highly dependent on the foreign market in terms of imports: 86% of the respondents mentioned that they use imported products or services.

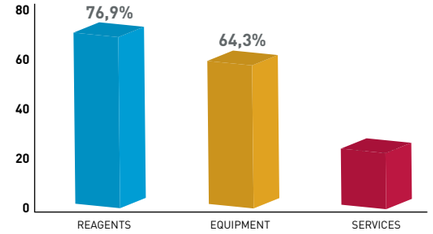
Of the total, 77% import reagents and 64% equipments. These numbers clearly demonstrate that imports are not only important for the development of the sector but crucial for its existence.

GRAPH 8 **Does the company import?**



Source: BRBIOTEC Brasil/Cebrap, "Brazil Biotech Map 2011". (n= 143).

GRAPH 9 **What does the company import?**

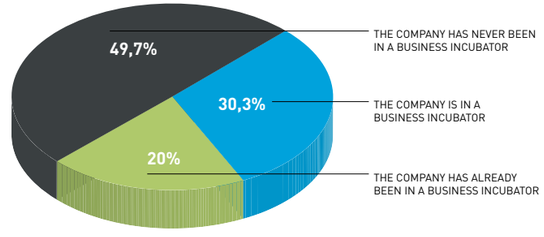


Source: BRBIOTEC Brasil/Cebrap, "Brazil Biotech Map 2011". (n= 143).

INCUBATION

Business incubators and technology parks are considered very important for the development of the biotechnology sector worldwide. Our data demonstrated that this is very true for Brazil. More than half of the companies are incubated (30%) or have graduated from a business incubator (20%)[20].

GRAPH 10 **Has the company been in a business incubator?**



Source: BRBIOTEC Brasil/Cebrap, "Brazil Biotech Map 2011". (n=145).

By providing an environment that is stimulating and supportive, business incubators provide the conditions for new businesses to grow and, as a result, they contribute to reducing the mortality rates of new enterprises. In many cases they offer not only infrastructure but also specialized services, management and financial support, training/courses and networking (with other entrepreneurs, governmental institutions and investors). We selected some important incubators that have biotechnology as one of their areas of interest. This selection was made from a list of 400 business incubators associated with the Anprotec (National Association of Innovative Enterprises Development Entities)[21]. It is the association that represents the interests of business incubators, technology parks and innovative projects in Brazil. With 22 years of experience, the association promotes training activities, coordination of public policies and knowledge diffusion. Around 400 business incubators, summing up 6,300 innovative companies, are associated to Anprotec.

[20]In addition to the information obtained in the interviews with 145 companies, we researched other sources and called 62 other companies. The total added up to 207 (belonging to the 237 biotechnology population). The results were similar: 52% were never incubated and 48% had been or were still in an incubator. – [21]This selection was made from a list of 400 business incubators associated with the Anprotec (National Association of Innovative Enterprises Development Entities). The criterion for selection was the incubator area of activity, biotechnology and related fields. In addition, we used other sources of information, such as publications about biotechnology in Brazil, and made phone calls to the business incubators.

BUSINESS INCUBATOR OR TECHNOLOGY PARK	LOCATION	AREA
BIO-RIO Pólo de Biotecnologia do Rio de Janeiro	Rio de Janeiro RJ	It was created in 1988 as the first tech-park in Latin America for high technology-based firms. It counts with more than 40 life sciences firms. The business incubator Fundação BioRio is located inside the tech-park and has in its portfolio 17 graduated firms and 23 incubated, many of which are dedicated to human health and environment areas.
CDT Centro de Desenvolvimento Tecnológico (Universidade de Brasília)	Brasília DF	Incubates companies that have activities in many areas, 11 of them are dedicated to consultancy in human health and nanobiotechnology.
CENTEV Incubadora de Empresas de Base Tecnológica (Universidade Federal de Viçosa)	Viçosa MG	Located in an important region for biotech in Minas Gerais, it hosts 45 entreprises in different areas. Approximately 10 are related to biotechnology, more specifically working on agriculture and animal health activities.
CIETEC Centro de Inovação, Empreendedorismo e Tecnologia	São Paulo SP	It is a multisetorial business incubator with 149 associated companies. Regarding biotech related areas, there are 18 in biotechnology, 30 in health and medicine, 13 in environment and 20 in chemistry.
HABITAT Biominas Brasil	Belo Horizonte MG	Linked to an important institution for the promotion of biotech sector (Biominas), this business incubator is specialized in life sciences: there are 20 companies incubated.
IE-CBIOT Incubadora Empresarial do Centro de Biotecnologia (Universidade Federal do Rio Grande do Sul)	Porto Alegre RS	Specialized in biotechnology, it has 7 companies incubated.
INCAMP Incubadora de Empresas de Base Tecnológica da Universidae Estadual de Campinas	Campinas SP	Business incubator associated to one of main universities in Brazil (Unicamp), it has 37 high technology companies, 7 of which are in life sciences.
INOVA Universidade Federal de Minas Gerais (UFMG)	Belo Horizonte MG	Incubates companies in several areas of activty, of the 50 associated companies, 10 are related to biotechnology.
PADETEC Parque de Desenvolvimento Tecnológico da Universidade Federal do Ceará	Fortaleza CE	Incubates companies that have activities in many areas. Its portfolio counts with 7 incubated, 5 associated and 32 graduated. Some of the companies focus on biofuels and environment.
TECHNOPUC Parque Científico e Tecnológico da PUCRS	Porto Alegre RS	Tecnopuc houses 66 organizations, from which 48 are companies, 8 institutions and 10 research units of PUCRS. It has significant production in software, besides housing companies in life sciences areas.
POSITIVA Universidade Federal de Pernambuco (UFPE)	Recife PE	Business incubator with companies in different areas. It hosts 5 biotech companies and other 2 are in incubation process.
PROSPECTA Incubadora de Empresas e Projetos Tecnológicos de Botucatu	Botucatu SP	Of 38 associated companies, 6 are biotechnology related with activities in environment and agriculture.
SUPERA Incubadora de Empresas de Base Tecnológica	Ribeirão Preto SP	With a focus on human health, it has 32 companies in total, 17 of which are in life sciences.

Source: Business incubators. Organization: Cebrap.

RELATIONSHIP BETWEEN COMPANIES AND UNIVERSITIES OR RESEARCH INSTITUTES

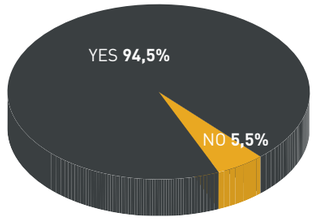
Working in collaboration with universities and research centers is another characteristic that is fundamental for Brazilian biotechnology companies: 95% of them have some kind of relationship.

Of the total, approximately 70% have a formal relationship with universities or research institutes.

It is worth mentioning that, for 77% of the companies, the aim of the partnership is the co-development of products or processes. In addition, more than half of these companies use the infrastructure of these institutions (laboratories or equipments) and 44% hire specialized services.

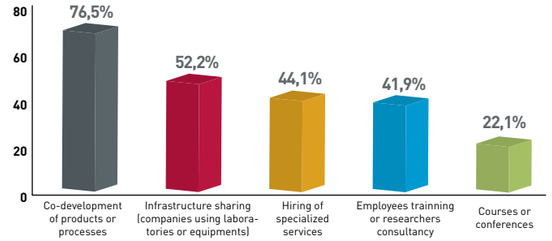
This data shows how universities and research institutes play a central role in the development of new technologies for the private sector in Brazil.

GRAPH 11 **Does the company has a relationship with universities or research intitutes?**



Source: BRBIOTEC Brasil/Cebrap, "Brazil Biotech Map 2011". (n=145).

GRAPH 12 **What is the aim of this partnership?**



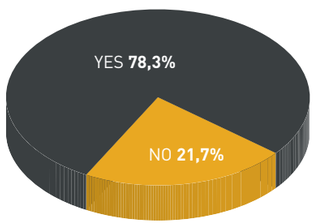
Source: BRBIOTEC Brasil/Cebrap, "Brazil Biotech Map 2011". (n= 136).

RESOURCES FROM PUBLIC INSTITUTIONS FOR INNOVATIVE PROJECTS AND RESEARCH AND DEVELOPMENT (R&D)

Public funding is essential for the development of the biotech private sector in Brazil: 78% of the companies use this type of funding for their projects (Federal or State sponsored).

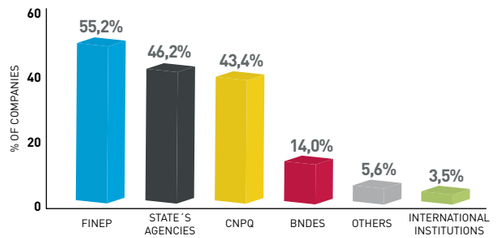
More than half of the companies have benefited from resources from Finep (Brazilian Federal funding agency for innovation)[22] and almost half of the companies have or had funding from another federal institution CNPq (Federal institution dedicated to funding research). Almost half the companies also take advantage of State sponsored funding for R&D, such as Fapesp (foundation that funds research in the State of São Paulo) and Fapemig (foundation that funds research in the State of Minas Gerais)[23].

GRAPH 13 **Does the firm use public resources for R&D&I?**



Source: BRBIOTEC Brasil/Cebrap, "Brazil Biotech Map 2011". (n= 143).

GRAPH 14 **Companies (%) that use public funding per institution**

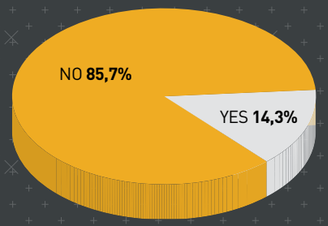


Source: BRBIOTEC Brasil/Cebrap, "Brazil Biotech Map 2011". (n=143).

[22] *Financiadora de estudos e projetos (Finep).*

[23] *Fundação de Amparo à Pesquisa do Estado de São Paulo (Fapesp) e Fundação de Amparo à Pesquisa do Estado de Minas Gerais (Fapemig).*

GRAPH 15 **Does the company use venture capital funding?**



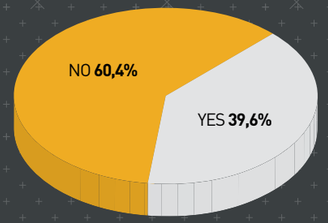
Source: BRBIOTEC Brasil/Cebrap, "Brazil Biotech Map 2011". (n=140).

If, on one hand, public funding is widely used by the biotechnology companies, venture capital is mentioned only by a small percentage of the total: 14.4% of biotech companies. This indicates both the lack of this type of investment in the private biotechnology sector in Brazil and the potential for developing venture capital funds in the country.

PATENTS

40% of the biotechnology companies in Brazil answered that they had patent applications or a patent issued. The percentage is very high when compared to other sectors of the Brazilian economy.

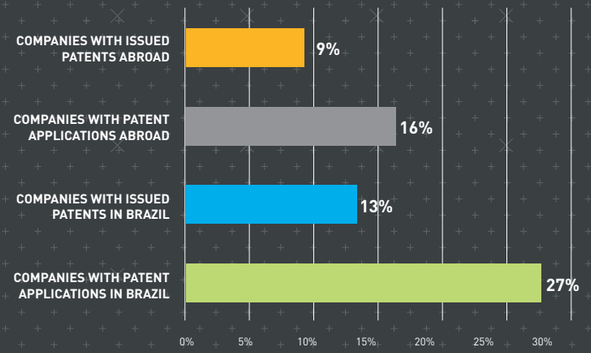
GRAPH 16 **Does the company have patents issued or patent applications?**



Source: BRBIOTEC Brasil/Cebrap, "Brazil Biotech Map 2011". (n= 144).

The percentage of the companies that have patent applications in Brazil is 27%; and 13% have patents issued by the Brazilian Patent Office (INPI). On the other hand, only 17% of the companies have patent applications or issued patents abroad.

GRAPH 17 **Companies that have patents in Brazil and offices abroad**



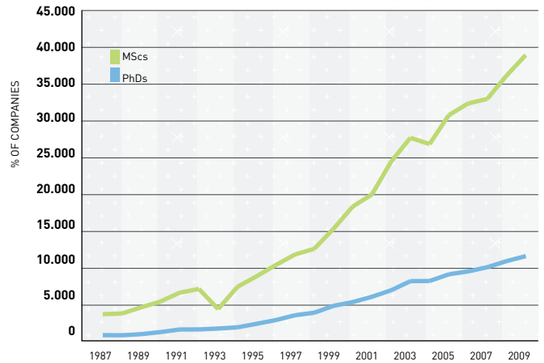
Source: BRBIOTEC Brasil/Cebrap, "Brazil Biotech Map 2011". (n= 144).

Scientific production in Brazil

The scientific production coming out of the universities and research institutes is one of the pillars of the biotechnology sector worldwide. Brazil has a well-structured system for graduate studies[24] which creates opportunities for the advancement of science in certain areas of expertise.

In the last 20 years the number of graduate researchers (Phds and MSCs) had an expressive increase (Graph 18). In 2009, of the 38,800 new graduated MSCs, 31.5% were from knowledge areas such as biological, health and agricultural sciences; regarding the new 11,368 PhDs, 42.4% were from these general areas related to biotechnology.

GRAPH 18 **Graduated PhDs and MSCs per year (Brazil)**



Source: CAPES

The analysis of the scientific production related to biotechnology that follows is based on information from graduate programs in Brazil (both from private and public institutions). The source of this data is in the official numbers published by Capes, which are collected periodically to evaluate the graduate programs spread across the country.

The main information selected for this analysis was the number of students enrolled (Master´s and Doctorate degrees) in graduate programs. This information can be treated as proxy regarding the production of science and technology in the country since these are the people actually doing research in Brazil (the percentage of post-doctoral fellows is low compared to the numbers of graduate students). In addition, we used data from the faculty body affiliated to those programs (requirements to affiliate are program dependent but usually require, among other things, scientific publications). The figures are for the year 2009.

We organized the data according to the categorization established by Capes: general areas of knowledge are divided into specific areas of knowledge. Each graduate program has its own specific area of expertise, which is in turn part of a general area.

Given the multidisciplinary nature of biotechnology, we selected several related programs: the ones that belonged to the specific areas of biochemistry, pharmaceutical sciences, pharmacology, genetics, immunology, microbiology (part of the general area of life sciences) and agronomy, veterinary medicine and zootechny (part of the general area of agricultural sciences); infectious diseases and food technology (part of the general area of health sciences).

We want to emphasize that we are not assuming that all faculty bodies affiliated to these programs are working on biotechnology. It is not possible, with the information available, to provide a more detailed analysis than what we will present here. This kind of data disaggregation can be done in a future study.

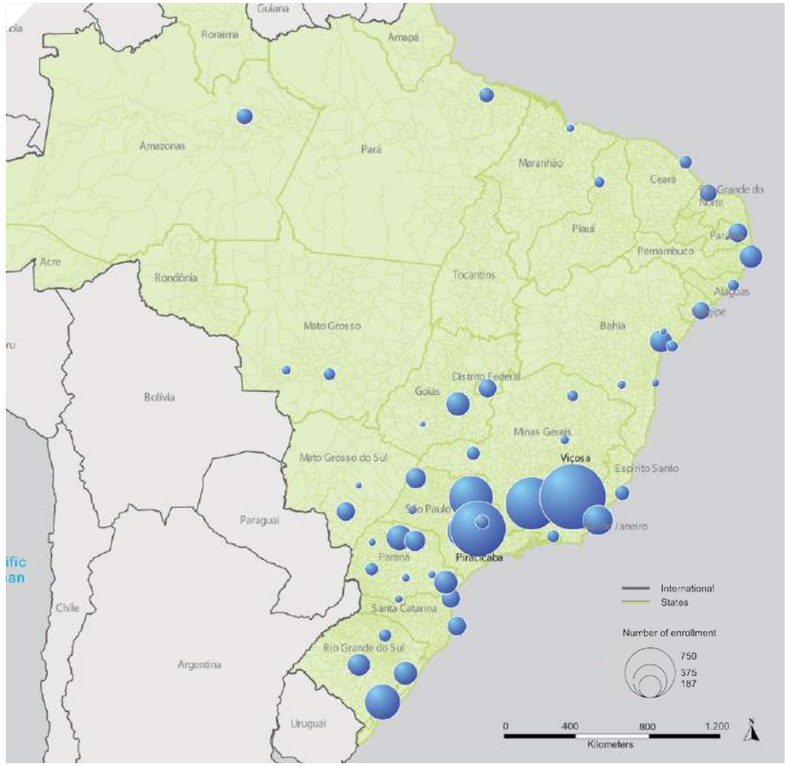
These programs were analyzed with the aim of pointing out the regions with a higher density of scientific production and their distribution around the country.

[24] *Graduate programs in Brazil are dependent on two Federal institutions: Capes (Coordination for the Improvement of Higher Education Personnel Foundation or 'Coordenação de Aperfeiçoamento de Pessoal de Nível Superior'), an agency of the Ministry of Education responsible for evaluating the programs and financing research; and the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), an agency from the Ministry of Science and Technology (MCT) responsible for financial resources for research and fellowships for graduate students. In addition to these federal agencies, there are several State sponsored foundations that play a central role in the development of science. Finally, there are, of course, all of the higher education institutions spread in the country.*

AGRONOMY; VETERINARY MEDICINE; BIOCHEMISTRY, PHARMACEUTICAL SCIENCES AND PHARMACOLOGY: Regional concentration of scientific production and reasonable national distribution.

The areas of agronomy and veterinary medicine, in addition to the cluster formed by biochemistry, pharmaceutical sciences and pharmacology, have the highest number of affiliated researchers (of the areas selected) and are well distributed throughout the country[25].

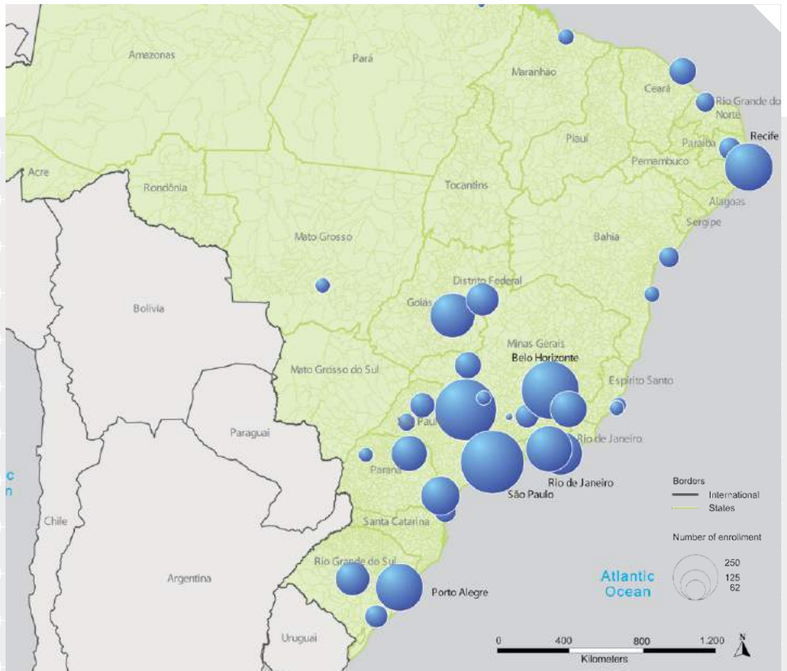
Among those quoted above, agronomy is the strongest field, with 2,220 faculty members supervising 5,871 graduate students (master´s or doctorate degrees) in 25 of the 27 Brazilian States. Despite its presence throughout the country, there is a high concentration in São Paulo State (26%, with 1,521 graduate students) where the city of Piracicaba stands out, and in the State of Minas Gerais (24%, with 1,427 graduate students), where the city of Viçosa stands out.



MAP 10 **Distribution of graduate students in Brazil: Agronomy (Capes, 2009).**

MAP 11 **Distribution of graduate students in Brazil: Veterinary Medicine (Capes, 2009).**

Another area that is very advanced in Brazil is veterinary medicine: 2,451 researchers in 17 States. The biggest clusters are in São Paulo (573), especially in the city of Jaboticabal, and in Minas Gerais (412). In this case, the concentration in the States of São Paulo and Minas Gerais is not so prominent; other states also have a significant number of students, as is the case of Rio Grande do Sul (279), Rio de Janeiro (269) and Paraná (219). It is important to point out the presence of graduate programs in animal health in other regions of the country, such as in the State of Pernambuco (in the capital, Recife) and in Goiás (in the capital, Goiânia).



Source: Capes.

[25]*It is worth mentioning the food sciences; there are a high number of graduate students doing research (1,869) and an expressive number of faculties (588) in 15 Brazilian States. São Paulo is a highlight (635), but Minas Gerais (327) and Rio Grande do Sul (254) are also important poles. –* [26]*Biochemistry, pharmacological sciences and pharmacology are three specific areas in Capes' classification that were put together here to facilitate data interpretation.*

MAP 12 **Distribution of graduate students in Brazil: Biochemistry, pharmacological sciences and pharmacology (Capes, 2009).**

Another important field of study in national science is the group of specific areas formed by biochemistry, pharmaceutical sciences and pharmacology[26], with 3,575 graduate students and 1,465 faculty members. In this case, the concentration in the State of São Paulo is very strong: 34% of students are in the cities of São Paulo, Ribeirão Preto and Campinas. Additional important cities, outside the State of São Paulo, are Rio de Janeiro (439); Fortaleza and Recife, in the Northeast; Belo Horizonte, in the Southeast; and Porto Alegre, in the South.

GENETICS AND ZOOTECHNY: Regional poles in São Paulo and Minas Gerais.

The State of São Paulo concentrates 40% of the 1,408 faculty members affiliated to genetics graduate programs in Brazil. Of the 18 municipalities with institutions that have graduate programs, 6 are in São Paulo: Campinas (160 students), São Paulo (156) and Ribeirão Preto (91). In addition, the cities of Botucatu, São Carlos and São José do Rio Preto are important. All these cities are considered important areas for science and technology, being home to important research centers, such as the following universities: Universidade de São Paulo (USP), Universidade Estadual Paulista (Unesp) and Universidade de Campinas (Unicamp). The region also has several Federal Universities.

There are also other cities outside the State of São Paulo that have significant numbers of affiliated faculty members in genetic programs, such as Belém, in the State of Pará; Belo Horizonte, in Minas Gerais; and Porto Alegre, in Rio Grande do Sul, which have graduate programs in genetics and approximately 100 affiliated faculty members each.

For programs in zootechny, the State of Minas Gerais is quite strong, having one quarter of Brazil's affiliated faculty zootechny graduate programs. The cities of Viçosa (182), Belo Horizonte (100) and Lavras (76) are those with the highest number of faculty members. In the State of São Paulo it is worth mentioning the cities of São Paulo, Piracicaba and Botucatu, as the science and technology poles of the State.

Other important cities are Recife (168), Maringá (117) and Campos dos Goytacazes (97).

MAP 13 **Distribution of graduate students in Brazil: Genetics (Capes, 2009).**

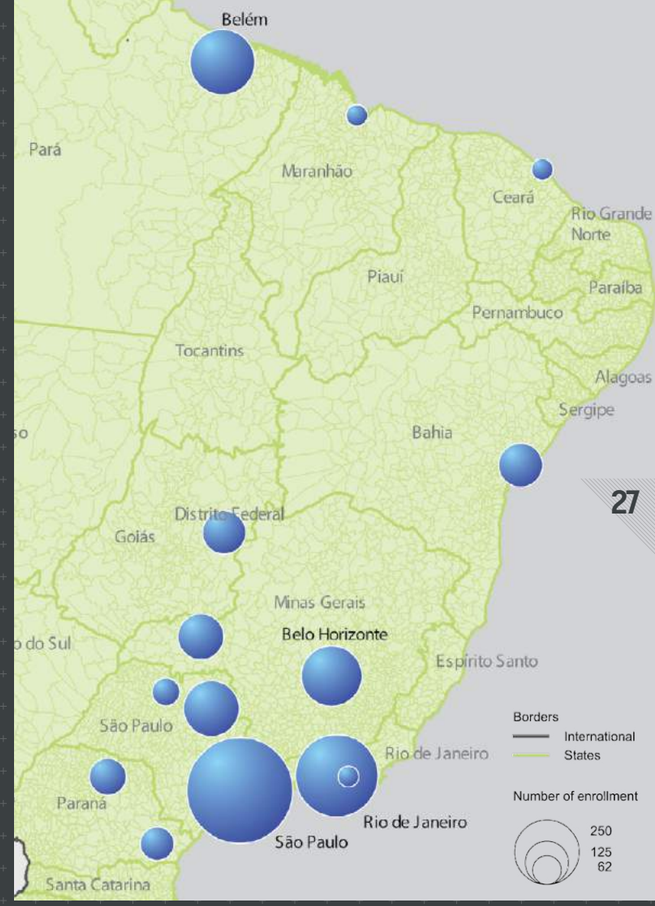
IMMUNOLOGY AND MICROBIOLOGY; INFECTIOUS DISEASES AND PARASITOLOGY: Municipal clusters in Brazil.

Immunology, microbiology, infectious diseases and parasitology are specific areas (Capes) which are important for biotechnologies, but which have a relatively smaller number of programs when compared to agronomy and veterinary medicine. Therefore, we will mention some municipal poles spread across the country.

With respect to immunology and microbiology, there are 1,074 affiliated faculty members, with some State's capitals being the most relevant locations: São Paulo (259), Rio de Janeiro (168) and Belo Horizonte (100), in the Southeast region and Belém (113) in the North. In addition, Ribeirão Preto in the State of São Paulo and Uberlândia, in the State of MG, are other important cities.

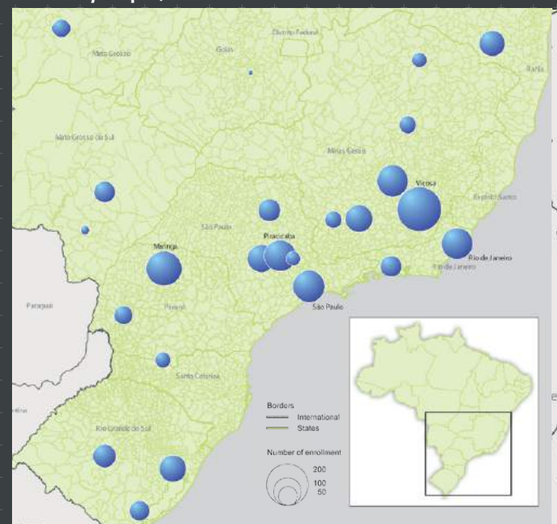
Regarding the specific areas of infectious diseases and parasitology, there are 1,047 graduate students, one quarter in the city of São Paulo and 12% in Belo Horizonte. Other cities with programs in these areas are Goiânia, Rio de Janeiro, Belém, Manaus, Recife.

Finally, it is worth mentioning the biomedical engineering studies, which are strongly linked to biotech, but whose number of researchers in graduate programs is still low. There 341 masters and PhD students in this area, distributed in three states: São Paulo (253), Rio de Janeiro (77) e Minas Gerais (11).

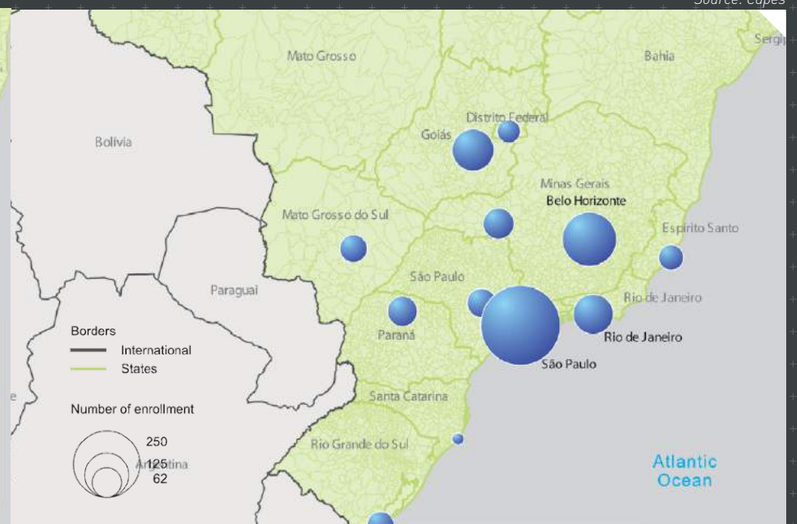


MAP 15 **Distribution of graduate students in Brazil: Immunology and Microbiology (Capes, 2009).**

MAP 14 **Distribution of graduate students in Brazil: Zootechny (Capes, 2009).**



Source: Capes



MAP 16 **Distribution of graduate students in Brazil: Infectious Diseases and Parasitology (Capes, 2009).**

IMPORTANT INSTITUTIONS IN BRAZILIAN BIOTECHNOLOGY

In order to complement our analysis regarding scientific production in biotech-related areas in Brazil, we selected some important institutions involved with research, development and innovation, in human resource training and in the production of goods and provision of services. This selection was based on information from the questionnaire responded by companies and on articles in national and international literature.

NAME	LOCATION	DESCRIPTION
Centro de Biotecnologia da Amazônia (CBA/AM)	Manaus AM	Founded in 2002, this centre is dedicated to the biodiversity of the amazon region. Administrated by SUFRAMA (the agency responsible for the free tax zone in Manaus), CBA has 25 laboratories that are grouped in the following units: Microbiology; Biochemistry and Molecular Biology; Pharmacology and Toxicology; Natural Products and Extract Production.
Centro de Biotecnologia da Universidade Federal do Rio Grande do Sul (CTbiot)	Porto Alegre RS	This center offers courses and training; develops biotech research projects in partnership with private and public institutions. Research areas: genetics and molecular biology of microorganisms; biological control; molecular diagnostic of diseases (humans, animals and plants); animal health and reproduction; plant biotechnology.
Centro de Referência em Farmacologia (CRF) - Fundação CERTI	Florianópolis SC	CRF conducts non-clinical studies, including pharmacodynamics, pharmacokinetics and toxicology. The center provides support to scientific research nationally and internationally, contributing to the development of pharmaceutical drugs and cosmetics production.
Empresa Brasileira de Pesquisa Agropecuária (Embrapa)	Units in several cities	Company owned by the Federal government, leader in development of bio and nanotechnology for agribusiness. It has units in many Brazilian States and it is also an incubator for new enterprises in agribusiness. Laboratories for cloning, molecular biology, tissue culture, bioremediation, genetic engineering, nanoparticles and transgenic organisms.
Escola Superior de Agricultura "Luiz Queiroz" da Universidade de São Paulo (ESALQ-USP)	Piracicaba SP	It offers undergraduate and graduate courses in bioinformatics, genetics, genetic improvement of plants, and phisiology and biochemistry of plants. It is well-known for R&D in biotechnology for agriculture.
Fundação Osvaldo Cruz (Fiocruz)	Rio de Janeiro RJ	Federal government research institute with many biotechnology-related departments and research projects. In addition to research, has units that develop and manufacture medicines and vaccines (Bio-Manguinhos and Far-Manguinhos).
Instituto Agronômico de Campinas	Campinas SP	Institute of São Paulo State department of agriculture, it has research centers dedicated to research on coffee, sugarcane and plant genetics. It provides inputs to the food industry.
Instituto Butantan	São Paulo SP	State Institution created in 1914, it is one of the biggest research centers in biomedicine, responsible for the production of 90% of the serum and vaccines made in Brazil. Develops research on biology and biomedicine, and manufactures products such as anatoxins and hemoderivatives.
Instituto de Ciências Biológicas da Universidade Federal de Minas Gerais (ICB - UFMG)	Belo Horizonte MG	ICB has 10 departments with several research laboratoris. It offers undergraduate and graduate courses; its laboratories have research in areas such as genetics, pharmacology, biochemistry, immunology and microbiology.
Instituto de Ciências Biomoleculares da Universidade de São Paulo (ICB - USP)	São Paulo SP	ICB has 7 departments with several research laboratories. It offers undergraduate and graduate courses in biotechnology in partnership with Instituto de Pesquisas Tecnológicas (IPT) and Instituto Butantan. There are several laboratories: anatomy, cell and development biology, pharmacology, physiology, biophysics, immunology, microbiology and parasitology.
Instituto de Tecnologia do Paraná (Tecpar)	Curitiba PR	This State-owned company was created in 1940 and is connected to the State Department of Science, Technology and Higher Education. It conducts research and development, manufactures and offers services in immunebiologicals, chemicals and biofuels. Manufactures viral and bacterial-based vaccines and antigens.
Instituto do Câncer do Estado de São Paulo (ICESP)	São Paulo SP	Founded in 2008, it is a partnership between the State government of São Paulo and the Fundação Faculdade de Medicina. Focuses on treatment of cancer and develops research in molecular oncology and regenerative medicine applied to oncology. In addition, conducts clinical trials.
Instituto Vital Brasil	Niterói RJ	It's a private institution which provides drugs, biological products, chemotherapy and other products for human health for the public sector. It conducts research in pharmaceutical and biological development.
Laboratório Nacional de Biociências (LNBIO)	Campinas SP	Founded in 2009, it has research and development in several biotechnology-related areas: structural biology, molecular biology, cell biology, proteomics, genomics, metabolomics and chemical synthesis. Offers the academic community laboratory infrastructure and has its own research projects. LNBIO Has laboratories for microarrays, bioinformatics and genetic engineering.
Laboratório Nacional de Ciência e Tecnologia do Bioetanol (CTBE)	Campinas SP	Created in 2010, has R&D in sugarcane-derived ethanol. It has different laboratories dedicated to hidrolysis and fermentation; prototypes for agriculture and is implementing two additional ones, for research on physiology and biochemistry.
Universidade Federal do Rio de Janeiro (UFRJ)	Rio de Janeiro RJ	UFRJ has many departments and research projects related to biotechnology. It integrates several institutes that collaborate and share infra-structure, such as: Medical Biochemistry, Biophysics, Biomedical Sciences, Biology, Microbiology, Macromolecules, Chemistry and the institute of graduate studies and research on engineering (COPPE).

Source: Institutions websites. Organization: Cebrap.

CONCLUSIONS AND NEXT STEPS

The main goal of this study was to present a picture of biotechnology in Brazil. It comprehends the first and summarized analysis of data gathered from our research and interviews with companies. What is presented here is just a glimpse of the country's bio-economy. Therefore, additional publications will provide newer and more detailed analysis as well as other parameters. The results have helped in the identification of Brazilian clusters in Biotech, which are a part of Life Sciences. It is our next step to broaden this analysis to Life Sciences and additional players of the bio-economy.

In these future publications we will, among other things, more thoroughly evaluate the potentialities of the different regions of the country, and understand better the interaction between the private companies and the scientific production from universities and research centers. For example, we would like to identify, regionally, the different actors and their relationship networks. We will also focus on how to better understand the role of actors such as hospitals with R&D centers, which are important in discovering new products, as well as the presence of the big international pharmaceutical companies in Brazil

Wider working definitions than those used until this phase of our research can contribute to increase the number of companies, showing how complex the sector is. One example is the list of practices from North American Classification System (Milken Institute, 2004) to define the life sciences industry group (which includes biotech sector). It includes activities such as: medicinal and botanical manufacturing; pharmaceutical preparation manufacturing; laboratory apparatus and furniture manufacturing; surgical, medical and dental instrument manufacturing; and electromedical apparatus manufacturing.

The results presented here show how the private sector is concentrated in the Southeast region, especially in the States of São Paulo and Minas Gerais. Regarding the areas of activity, human health stands out, although agriculture and animal health are also strong areas.

Most of the Brazilian companies are young and micro or small-sized and rely upon highly educated professionals (a high percentage of MScs and PhDs). Concerning the international trade, a minority of companies exports. On the other hand, the majority imports, especially reagents for the production and development of technology.

The incubators and technological parks are key the development of the sector, as well as the universities and research centers. Public funding also takes center stage when it comes to the development of the private sector showing how important the policies concerning science, technology and innovation are. Venture capital financing is still small; this research finding shows there is an open window for the growth of this kind of investment in Brazil.

The companies' effort to protect intellectual property through patents is significant; and the patent applications made in the patent office in Brazil are more common than depositing abroad.

Regarding the scientific production in different graduate programs related to biotechnology, the number of associated faculty and graduate students is very significant throughout the country. Despite the fact that the post-graduation system in Brazil is well structured, it is highly concentrated in some areas of knowledge and in some regions of the country. A better interaction between the science area and the private sector can help the development of Brazilian biotech in many regions.

BRBIOTEC Brasil is confident that this study brings a better understanding of the Brazilian private sector, contributing to the development, policy formation and research on biotechnology in Brazil.

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ATCGen Biotecnologia
Axonal Consultoria Tecnologica
Baktron Microbiologia
BCS Tecnologia e Indústria em Equipamento Médico Hospitalar
Beta 1-4 Consultoria e Desenvolvimento de Tecnologias Químicas e Biotecnológicas
Bio4-Soluções Biotecnológicas
Bioagency Biotecnologia
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Bioaptus Consultoria & Serviços de Biotecnologia
Biocancer Centro de Pesquisa e Tratamento do Câncer
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Biovetech
BLAU | Blausigel Farmacêutica
BR3 Agrobiotecnologia
Bthek Biotecnologia
BUG Agentes Biológicos
CATG Centro de Análise e Tipagem de Genomas

CellPraxis Bioengenharia
CellProtect Biotechnology
Celltrovet
Cellvet Medicina Veterinária Regenerativa
CELM Cia. Equipadora de Laboratórios Modernos
CEMA Agricultura Biológica
CEMSA Centro de Espectrometria de Massas Aplicadas
Cetma Comércio de Agentes para Controle Biológico
Champion Farmoquímico
Codon Biotecnologia
Cryopraxis Criobiologia
Dedini Industrias de Base
Diagene Diagnósticos Moleculares
Doles Reagente e Equipamentos para Laboratórios
ECCB Empresa Caxiense de Controle Biológico
Ecocycle Biotecnologia e Serviços Ambientais
ECOVEC
Einco Biomaterial
Eleva Biotecnologia
EMS
Engene Tech Farmacêutica e Biotecnológica
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Eurotrials Brasil Consultores Científicos
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GCTbio Global Ciência & Tecnologia
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GENEPRIME
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Apex-Brasil

The mission of the Brazilian Trade and Investment Promotion Agency (Apex-Brasil) is to promote exports of Brazilian products and services, contribute to the internationalization of Brazilian companies and attract foreign investment to Brazil. Apex-Brasil is a Brazilian government agency linked to the Ministry of Development, Industry and Foreign Trade (MDIC).

Apex-Brasil gives currently support to more than 13,000 companies in 80 productive sectors of the Brazilian economy exporting to more than 200 markets. Through initiatives undertaken in a partnership with industry organizations, the Agency organizes trade promotion activities and produces trade and competitive intelligence studies with the objective of guiding the decisions of domestic corporations on the entry into international markets.

Besides its headquarters in Brasilia, Apex-Brasil has Desks in the Brazilian states and Business Support Centers (CNs) around the world. These centers serve as platforms to assist the process of internationalization of Brazilian companies exploring business opportunities and increase their participation in key global markets, and serve as a benchmark for attracting foreign investment.

The agency also coordinates efforts to attract foreign direct investment (FDI) for the country, working to identify business opportunities and promoting strategic events and assuring support to foreign investors throughout the whole process in Brazil. Apex-Brasil co-ordinates important global forums and heads the World Association of Investment Promotion Agencies (WAIPA) and the Ibero-American Network of Trade Promotion Organizations (REDIBERO), consolidating Brazil as a regional reference in the promotion of exports and attraction of foreign direct investments.

BRBIOTEC Brasil

BRBIOTEC (Brazilian Association of Biotechnology – Associação Brasileira de Biotecnologia) is a private organization whose objective is to develop the biotechnology sector in Brazil through actions that strengthen the industry, thereby generating business, attracting investments and raising Brazil's international profile in biotechnology production. BRBIOTEC Brasil consists of:

- Companies involved in agriculture, the environment, energy and health that develop technology and seek to provide a global quality of life.
- Small and medium-sized businesses that fuel the growth of the industry;
- Business leaders, start-ups and spinoffs that produce innovative products and services
- Scientists and experts in high academic technology transfer and renowned institutions
- Network support in legal, accounting, finance and intellectual property matters for investors, government officials, and service providers who are committed to the development of biotechnology in Brazil
- Entrepreneurs from several fields who want to make something special happen in Brazilian biotechnology

BRBIOTEC Brasil is managed by a Board composed of company representatives and biotechnology sectors , and is supported in its co-management by the BIO-RIO Foundation; CIETEC (Center for Innovation, Entrepreneurship and Technology), and assisted by government entities, such as Apex-Brasil (Brazilian Trade and Investment Promotion Agency) and BNDES (National Development Bank). Furthermore, we have the active support of corporate, academic and government leaders.

- Promoting trade missions and fairs at national and international levels;
- Promoting technical training;
- Encouraging joint activities with other public or private law entities with an interest in the biotechnology sector;
- Approaching incubators and technology parks to identify the demands of associated companies;
- Mapping the sector; identifying who they are, where they are and what they do;
- Disseminating technological advances, opportunities, and national and international achievements in biotechnology;
- Raising funds to stimulate innovation and technological development;
- Establishing international offices to promote cooperative activities with organizations and enterprises in regions with an interest in developing business with Brazil.

Bio-Rio

Bio-Rio Foundation is the manager of Rio de Janeiro Biotechnology Park, a private nonprofit organization created in 1988, considered of public interest, located on the campus of the Federal University of Rio de Janeiro (UFRJ), near the Science Center Health (CCS) and University Hospital, having a prime location. It was the first Technology park of Latin America in the segment of Biotechnology and has the mission "Promoting entrepreneurshipin the fields of biotechnology and life sciences, integrating the scientific, technological, entrepreneurial communities in order to help develop technical, economic, social and sustainability of Brazilian society." Bio-Rio has now more than 30 companies in biotechnology and related areas.

Working for the development of innovative business solutions, Bio-Rio consists of the following units:

- **Business Incubator** - a protected environment for the development of start-ups or not, interested in investing in new projects in the area of biotechnology and related sectors.
- **Condominium** - area between the Business Incubator and Industrial lots with spaces for individual house biotechnology companies and related areas.
- **Industrial Lots** - urbanized area for the establishment of divisions of R & D and production companies working in biotechnology and related areas.
- **Central Support Unit** - provides services: Projects Management, Business Development, Organization Contest, Competitive Intelligence, Consulting and Training

Cebrap

The Brazilian Centre for Analysis and Planning (CEBRAP) is a nonprofit organization research institution, founded in 1969 by a group of professors, some of whom had been removed from the universities by the military dictatorship.

Throughout its 40 years of existence, the center has acted as a debating forum for major national and international problems and their solutions. Cebrap is a reference point for cutting edge research in social sciences and public policies studies, and has established itself in a wide range of fields, where sociologists, economists, political scientists, philosophers, anthropologists, demographists and geographers develop interdisciplinary studies in association with universities, government, private and public companies and international agencies.

The center is currently undergoing a process of internationalization, through the creation of long-lasting international partnerships and the undertaking of comparative research projects into the differences between countries.

Cebrap's main focus has been an analysis of 'the Brazilian reality', with a distinctive research style, through specialization and an interdisciplinary approach. This has made possible a constant dialog between different theoretical perspectives, methodologies and disciplines.

The team which developed this Brazil Biotec Map is called "Development and Labor". The main focus of the group is on socioeconomic studies, such as on regional inequality and metropolitan issues, knowledge diffusion, science, technology and innovation studies, economic growth and the labor market. The research group is mainly composed of sociologists and economists.

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