

1° German-Brazilian

INNOVATION

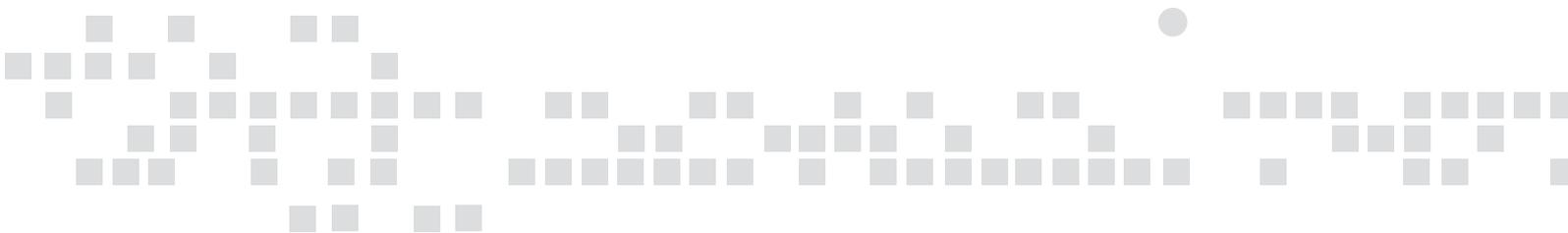
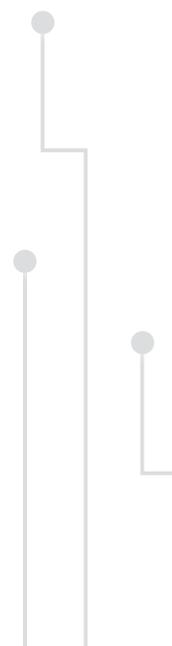
Guide



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INNOVATION

Guide



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Pre fa ce

In celebration of its centennial, the German-Brazilian Chamber of Commerce and Industry (AHK São Paulo) worked on a series of special projects, including this German-Brazilian Innovation Guide.

Since its Department of Innovation and Technology (DIT) was opened in 2012, AHK São Paulo has been investing in this important subject for Brazil and Germany, in order to promote investments in the sector.

The German-Brazilian Chamber understands that innovation is crucial for organizations and institutions that wish to incorporate the latest technological trends to move forward and seek leadership positions in their lines of business. Developed along with the German House of Science and Innovation – São Paulo (DWH-SP), the purpose of this Guide is to contribute to the decision-making process of professionals working in the public and private sectors, in addition to pursuing the work developed with the “2009 Brazilian-German Technology Transfer Manual.” It provides an overview of the incentives available to Brazilian and German organizations, maps out the most relevant Science, Technology and Innovation (STI) Institutions in both countries, and presents bilateral projects and business and cooperation opportunities currently in place between Brazil and Germany.

Thus, the German-Brazilian Chamber of Commerce and Industry reinforces its commitment to spreading know-how in certain areas of interest, which in this case is innovation one of the pillars of its operations.

I hope you enjoy the guide and forge great partnerships!



Dr. Wolfram Anders

President of the German-Brazilian Chamber of São Paulo and Executive Vice-President of Robert Bosch

Brazil and Germany: partners on several fronts. The two nations have enjoyed a long-standing relationship, which is reinforced by the fact that Brazil is Germany's main trading partner in Latin America, and Germany is an example to be followed for the tropical country.

In 2015, as part of an initiative to foster innovation, both countries launched a mechanism known as High-Level Government Queries. In parallel, the German-Brazilian Chamber signed an agreement for the same purpose with the Brazilian Ministry of Development, Industry and Foreign Trade, and is currently investing in the success of this first edition of the German-Brazilian Innovation Guide.

This publication aims to address the lack of important information and gather existing facts, which are much-needed for the development of innovation efforts between Brazil and Germany.

It was structured to address the following topics discussed by specialists from both countries:

- Overview of incentives available to Brazilian and German companies;
- Mapping of Science, Technology and Innovation (STI) institutions;
- Major bilateral projects carried out in both countries;
- Data and facts on the startup ecosystem;
- Major business and cooperation opportunities between both countries, and an overview of opportunities in the following sectors: Agribusiness, Industry 4.0, Biotechnology, Smart Cities, Mobility, Information Technology, Health, Energy and Infrastructure.

On behalf of the German-Brazilian Chamber of Commerce and Industry, I would like to thank all sponsors, supporters and partners who helped make this German-Brazilian Innovation Guide possible!



Paulo Ricardo Stark

Vice-president of the German-Brazilian Chamber of Commerce and Industry and President and CEO of Siemens in Brazil

Connecting and motivating researchers, research institutions and innovative companies from Germany and Brazil into working together is one of the functions of the German House of Science and Innovation – São Paulo (DWIH-SP). With this German-Brazilian Innovation Guide, published in partnership with the German-Brazilian Chamber of Commerce and Industry (AHK-SP), we hope to provide new impetus to the promotion of partnerships between research centers researchers and entrepreneurs from both countries. This first edition of the Guide aims to be an important source of information on Science, Technology and Innovation (STI) institutions from Germany and Brazil, whether or not associated with universities. By introducing themselves in this publication, showing their areas of expertise and disseminating their contact information, the organizations confirm their interest in participating cooperative ventures between both countries, both with businesses and other research institutions. In this publication, the reader will find articles on sectors that have strong potential for binational interactions between research and business. These are sectors that expect to face great demand for innovation, and in which research institutions can collaborate with companies to develop new projects. The Guide also contains articles that illustrate bilateral collaborative research projects developed with the help of businesses. German research centers and universities, in particular, have a long tradition of cooperating with the business sector, and are qualified and interested in contributing with this type of development in Brazil. We view this Guide as a practical tool to identify potential partners and to take the first step in contacting them. We hope that it becomes a popular print and online publication, and that it inspires many new cooperative efforts.



Dra. Martina Schulze

Director of the German House of Science and Innovation – São Paulo (DWIH-SP)

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Startups

1.1. Startups – The new opportunity for innovation in Brazil



When discussing innovation in Brazil, comparisons with other countries and other eras seem inevitable. The current debate on startups is just the tip of the iceberg of a much previous debate: how can Brazil create higher added-value products and stop being a mere commodity exporter? When it comes to innovation, many comparisons have been made with South Korea, a country that started investing heavily in innovation in the 1950s and still reaps the benefits of such policy to this date, with major technology companies like Samsung, Hyundai and LG. And when it comes to startups, comparisons are made with Silicon Valley (USA), the recent boom of European startups (Germany, Estonia and France), and Israel. Startups have emerged as the new hope for the innovation environment in Brazil, but why is this current trend different from the others, and what can we do to achieve better results than in the past?

First, we must understand the startup ecosystem in Brazil; and the first step is to understand what exactly a startup is. Startups are usually described as “a group of people looking for a repeatable and scalable model, working under extremely uncertain conditions.” Let’s break this sentence down in order to understand it a little better.





“A group of people looking for a [...] model...” – a startup is not a company, at least not yet. It is the early development stage of a project that may turn out to be a company, a non-profit organization or a new product.

“...repeatable and scalable model...” – unlike other companies, startups seek to create products that do not require major investments in order to be produced (repeatable) or sold (scalable), and which meet the demands of a wide range of markets and geographical areas. This is exactly why most startups are in the Information Technology sector, where companies can produce products and services at a low cost, then use the internet for large-scale distribution.

“...working under extremely uncertain conditions” – startups must feature some kind of innovation, whether regarding a product or a business model. Therefore, they work with something that has not yet been tested by competitors and which may or may not be accepted in the market.

Another relevant aspect of the ecosystem is the Brazilian educational system. Historically and culturally, Brazilians have always placed more value in building a career at a large company or in the public sector than following an entrepreneur's path. That has changed with the newer generations. According to data from Endeavor¹, 23.5% of college students have ran their own business, while 57.9% think about doing so in the future. The problem is that the educational system does not produce entrepreneurs, only employees. Over the last decade, most universities began to add entrepreneurship classes to their curriculum, and elementary and high schools started to address the subject within the classroom. In general, the world of entrepreneurship is still mostly made up of self-taught business owners.

If entrepreneurs are not learning at universities, where are they getting knowledge? Today, technological entrepreneurs (who may or may not be organized as a startup) have three main options: build their own path by learning from their mistakes, attend training and networking events, or seek help from accelerators and incubators.

Incubators – institutions that provide consultancy / mentoring on technical and management issues, work space and networking, and usually charge a nearly symbolic fee from entrepreneurs. Incubators are generally linked to universities or other research institutions. According to data from Amprotec², Brazil currently has approximately 400 registered incubators.

Accelerators – companies that provide mentoring on technical and management issues, work space, networking (with potential clients and investors) and, in general, financial investment. Accelerators usually get a percentage of the companies they help, which they intend to sell in the future. The data on the number of accelerators in Brazil varies widely. A survey conducted by Tropos Lab³ found approximately 60 different accelerators, with 25 of them being the most active. Accelerators receive support from the Federal Government through Startup Brasil, a program that provides financial incentive to the country's 13 leading accelerators. Several states have also created their own acceleration programs, such as Seed (MG), Startup Rio (RJ), and entrepreneurs can also rely on initiatives by SEBRAE throughout Brazil. Another type of accelerator that has become popular lately is the corporate accelerator, which is when large companies adopt an innovation strategy of creating their own acceleration program to generate startups in their market. Some of the industries that have adopted this initiative include: Banking (Itaú and Bradesco), Textile (ABIT), Information Technology (Stephanini, Google, Microsoft), Agriculture (Algar), Commerce (CDL). This entire movement is very recent, since Brazil's first accelerators emerged in 2011.

The first sales of companies that were born as startups only happened a few years ago. Some of these transactions include the sale of Moip Pagamentos to the German company Wirecard for BRL 165 million (2016), the sale of Globo.com to Telecom Itália for USD 865 million (2000), Zipmail and Zaz to PT Telecom for USD 365 and 240 million, respectively, in 2000 and 1999 and the Buscapé deal to Naspers for approximately USD 342 million (2009). The average time-to-sale of a startup in Brazil has been five to seven years. Therefore, the first success stories of startups that took advantage of acceleration programs have come up recently, with cases such as Easy Taxi, which was born out of a short program known as Startup Weekend, and then went through the Startup Farm program; Contentools, which participated in Seed (MG) and has been acquiring customers not only across Brazil, but even in Silicon Valley; and Zero Paper, which was accelerated by 21212 and bought by Intuit, from the U.S.

The main difference between past innovation movements and the current one, based on startups, is the figure of the entrepreneur. This is an individual who is empowered, restless, persistent, visionary and a team player, focused on putting his business out on the market, and who drives innovation, whether on their own or in corporations. The idea that entrepreneurs need much more than technical knowl-

edge has been gaining widespread acceptance recently. Developing an entrepreneurial behavior should also be a top concern. The reason why most startups fail is not because of a bad business idea, but because the team is not prepared. That is why we have seen the emergence of schools specialized in entrepreneurial behavior, such as Ginga – Aceleradora Escola⁴ and Clinton Education⁵.

Entrepreneurial behavior can be defined as the set of traits that, at some level, can be used to increase the probability of getting an enterprise off the ground, be it a business or another venture. Such traits can be identified as persistence, leadership, and risk-taking attitude, among others. However, all of these can be developed through a proper planning process aimed at providing the entrepreneur with adequate behavioral-level resources.

All of these initiatives contribute to the increasing number of startups in Brazil. By late 2015, there were 4,151 Brazilian startups registered with the Brazilian Association of Startups (ABStartups) – an 18.5% increase over six months. The three cities with the most startups in Brazil are São Paulo, Belo Horizonte and Rio de Janeiro, in that order. However, the number of startups in the country is much greater, since not all of them are registered with ABStartups. Each Brazilian region has created its own little ecosystem (environments that concentrate a large number of startups, and where many experience-sharing events take place). The best structured of these ecosystems is San Pedro Valley, in Belo Horizonte, but several others are spread across Brazil: Campinas Startups (SP), Jaraqui Valley (AM), Manguezal (PE), among others.

The startup market is currently on an upward trajectory, and could drive Brazil to a prominent position on the world market. However, there's a lot of glamour and smoke mixed in with solid business ideas. In order to become a leader in this market, Brazil needs to stand out from other markets, rather than trying to copy them. One way to go about this, and which is not being done successfully anywhere else in the world, is to invest in developing entrepreneurial behavior and training these entrepreneurs so that we can produce people who are better prepared to deal with this scenario of extreme uncertainty. We are not historically an enterprising nation, but this growing startup movement provides us with a great opportunity of using all of the diversity that our country offers to transform Brazil into a great school of entrepreneurs – in other words, we could turn our weakness into strength by creating something new that, in the future, may even be exported to other countries.

1.2. Current State of Private Equity and Venture Capital in Brazil

An overview of innovation in Brazil

Innovation is a corporate buzzword, being used by small businesses and large corporations alike. More than that, it's becoming increasingly important to innovate quickly in order to prevent competitors from stealing your customers.

There has never been so much talk about how companies need to promote a culture of innovation in order to generate innovative and sustainable solutions – be they products or services.

Many companies currently in operation will cease to exist within five to ten years. In the current global competitive environment, only truly innovative organizations will be able to stand out from the competition. This is the only way to achieve competitiveness.

The Brazilian Trade and Investment Promotion Agency (Apex-Brasil) seeks productive investments in priority sectors – Automotive, Renewable Energies, Oil and Gas and also in Research, Development & Innovation Centers in the country.

But, for five years now, the Agency has been working on a complementary strategy that has a strong impact on innovation: the strengthening of the Private Equity and Venture Capital sectors in Brazil.

The goal is to promote contact between global and local investors, while connecting startups and traditional companies to each other and to national and international investors. The goal of working with these three groups is to foster the investment and innovation ecosystem in every way possible.

It is important to emphasize that, even though Brazilians are natural entrepreneurs, business owners - especially those who own micro and small enterprises - have not yet realized that risk investment is an alternative to traditional long-term financing, and often a cheaper one.

According to the Brazilian Association of Startups (ABS), while in 2014 there were 3,500 startups in its database, in 2015 that number had risen to more than 4,100. In fact, some say that there are now more than 6,000 new companies, according to an unofficial count.

A survey conducted by Exame magazine with 170 entrepreneurs found out that 53% of startups were established between 2011 and 2012, 88% of them have between one

and seven partners, 27% participated in some incubation or acceleration program, 23% received investments by angels and accelerators, and only 2% received contributions in excess of USD 1 million.

But the scenario has been changing in recent years, especially due to the Brazilian market reaching a higher level of maturity, with the arrival of important players in this industry, such as Seed, Venture Capital and Private Equity funds, foreign Pension Funds, Family Offices, Development Agencies, Qualified Investors, among many others.

Brazil currently has more than 200 Private Equity and Venture Capital asset managers, as well as hundreds of direct investors, the so-called angels, and strategic investors, about 300 incubators and more than 25 startup acceleration programs. In the last decade, funds provided support to over 60 companies who made their IPO in the Brazilian stock market, generating a volume of approximately BRL 35 billion.

While in 2011 there was just over BRL 60 billion to invest, the capital available to Brazilian fund managers rose to slightly over BRL 150 billion in 2015. According to data from the Brazilian Association of Private Equity and Venture Capital (ABVCAP), about BRL 102 billion has been invested in businesses, and BRL 33 billion has already returned to the funds' limited partners.

In addition to Apex-Brasil's efforts to bolster the investment ecosystem in Brazil, it is important to highlight the role of private and public partners, such as ABVCAP; the Brazilian Association of Startups (ABStartups); the Ministry of Science, Technology and Innovation and Communication (MCTIC) and the Ministry of Industry, Foreign Trade and Services (MDIC); the Brazilian Development Bank (BNDES); and the Project and Investment Finance Company (FINEP).

In recent months, Apex-Brasil has also expanded its operations into Corporate Venture, launching an initiative known as Corporate Venture in Brasil. The first milestone is the annual event that gathers executives and investors from Brazil and abroad in São Paulo to discuss the country's corporate entrepreneurship scenario and opportunities.

The reality is that investing in research and development is very costly, and the future uncertain. We never know exactly when innovation will spark. By investing in a startup, venture capitalists accelerate this process.

According to data from Brasil Ventures⁶ on networks of investors, angels, accelerators and corporations who wish to debate and promote the subject, a survey conducted with approximately 70 corporations confirmed this growing interest on external and entrepreneurial innovation: 72% of the corporations have already attended entrepreneurship events, 88% have somehow been involved with accelerators, 49% have some kind of relationship with incubators and technology parks, and 59% have already held hackathons or similar activities.

One iconic example of a national company that has been investing in corporate venture is Votorantim Novo Negócios, the business arm of the Votorantim group. The corporation, which was established in 2000 has raised at least BRL 49.4 million raised from FINEP, invested at least BRL 6.4 million in two biotechnology companies, and then divested from the same companies in 2008 through a USD 290 million-sale to Monsanto⁷.

In 2014, it was Embraer's turn, as the aircraft manufacturer led the great movement for Corporate Venture Capital in Brazil by launching FIP Aeroespacial, which was managed by Portbank with the participation of multiple LPs. In 2016, with support from Apex-Brasil and joined by Microsoft Brasil, Monsanto Growth Ventures decided to invest in a fund that will provide as much as USD 92 million to invest in innovative IT and Agritech solutions.

The Algar Group, Bradesco, Braskem, Embraer, Intel, Monsanto, Siemens, Porto Seguro, Telefonica, Stefanini, TOTVS, Natura, Qualcomm and Senior Sistemas are some of the companies that have turned their attention towards Corporate Venture Capital investments in Brazil, and have started to offer acceleration, innovation and partnership programs for startups.

The country is currently experiencing an enterprising boom, driven by thousands of startups that are eager to raise capital for growth. In this context, Apex-Brasil believes that the fund-raising efforts through Corporate Venture investments have the potential to strengthen the national innovation ecosystem. The addition of new investors to the system should contribute to increase competitiveness and accelerate the industry's growth pace, setting the tone for a more efficient and productive economy. Apex-Brasil is open to facilitating access to Corporate Entrepreneurship programs in Brazil, by holding innovation contests, startup selection processes, setting up meetings, and more, in order to encourage corporations to make medium- or long-term investments in Brazil or in Brazilian startups. The motto is: it doesn't matter where innovation comes from, as long as it comes.



Maria Luisa Cravo

Wittenberg

Investment manager,
Apex-Brasil

1.3. The current state of startups in Germany

Through a joint effort, the German Startup Monitor (DSM) and the Bundesverband Deutsche Startups e.V. (startup association), established a national research foundation in Germany, which showcases the development and importance of German startups, and informs public discourse based on facts and data. In 2016, the 4th DSM represents 1,224 startups, 3,043 startup founders and 14,513 employees in Germany.

As in previous years, more than half of all startups are once again based in one of five hotspots within Germany: Berlin (17.0%), Rhine-Ruhr (14.1%), Stuttgart/Karlsruhe (8.9%), Munich (7.0%) and Hamburg (6.4%). However, other startup ecosystems have been on the rise – one such example is the Hannover/Oldenburg region, which in 2016 has joined the other hotspots with 6.9% of all new startups.

The average age of the startups in the 4th DSM is 2.5 years. When it comes to their development stages, 21.8% are still in the seed stage, 48.3% are in the launch stage, 23.0% find themselves in the growth stage, 1.6% are at a later stage and 2.6% are in a mature stage. As we can see, nearly half of all the startups in the 4th DSM are in their launch stage, and working on the completion of a ready-to-market offer and on making their initial sales.

Due to the high number of startups in the seed stage, 20.1% of all startups hadn't generated any revenue until last fiscal year. In all, half (53.8%) of all startups generated revenue ranging from 1 to less than 250,000 Euros, and one out of ten (10.0%) has already reached a turnover of 1 million Euros or more.

The 4th DSM shows that creating new businesses in the digital economy is once again an attractive option for startups. Fifteen percent of startups are in the IT and software development industries, while 10.2% offer software as a service (SaaS). These results confirm the leadership of the ICT sector and of the digital economy among German startups.

The main source of funding for startups continues to be the founders' own savings, helped by friends and family members. The majority (84.1%) of the DSM startups use their own savings as a source of funding, followed by government subsidies (35.5%) and family and friends (30.2%). Financing through business angels (22.6%), operating cash flow (19.4%), venture capital (18.8%), foreign capital through bank loans (14.6%), incubators or accelerators (8.3%) and crowdfunding (4.1%)

Less than half of the startups (47.0%) restrict their operations to the German market, and more than 80% of DSM startups plan an international expansion in the future. The most popular strategy is the direct export of goods or services (56.7%), followed by partnerships with local companies (31.4%).

When it comes to sex, the survey shows that 13.9% of startups were founded by women. Female founders are slightly older, averaging 36.4 years of age compared to 36.3 for male founders. That brings the overall average age of founders to 36.3 years old. The average age of founders for the first startup is 27.3, with men first going into business at a significantly younger age than women (26.8 compared to 31.0). Regardless of their sex, the vast majority of founders (92.0%) come from Germany. Other European Union (EU) citizens account for 3.8% of founders, and 4.2% are non-EU nationals.

The 4th DSM has demonstrated once again that startups are the engines of job creation. The 1,224 startups in DSM 2016 employed an average of 11.9 employees (or 14.4, including the founders). The makeup of the staffs is more international than the founders: 30.8% of startup employees are non-German citizens. Among them, 18.9% are from EU countries and 11.8% from countries outside the EU.

Even though the outlook was mostly optimistic, with 9 out of 10 founders rating their company's current status as satisfactory or good, German startups face major challenges. One in five startups (20.2%) identified sales and customer acquisition as their biggest challenge, followed closely by product development (18.2%). To 15.5%, growth (or its maintenance) is seen as a great challenge, while 12.4% mentioned the capitalization of resources.

Despite the challenges, almost three-quarters of DSM startups expect the situation to improve in the subsequent 6 months. Based on this optimism, four out of five founders (81.6%) believe it is quite or very likely that they will permanently remain startups, and 15.9% considered it (quite/very) likely that they will go public.

More facts and data about startups in Germany can be found at <http://www.deutscherstartupmonitor.de>.

Lisa Schreier – Director of Research and International Strategy, Bundesverband Deutsche Startups and **Lukas Gabriel Wiese** – International Strategy Manager, Bundesverband Deutsche Startups e.V

1.4. Success Stories of Brazilian Startups

StoryMax: book apps that enchant their readers

Making reading more attractive and engaging for the developing readers of this and the next generations – that is the mission of StoryMax, a publishing startup that develops book apps that combine text, image, animation, sound and interactivity to retell great classics of literature and provide children and young people with fuel for thought right in their favorite gadgets: tablets and smartphones.

The pleasure of embarking on a good story enticed Samira Almeida and Fernando Tangi at an early age. Before founding StoryMax, the duo worked for more than a decade in the traditional publishing market – as a publisher and an art director, respectively.

Upon realizing that the reader's behavior was changing and that none of the digital books in the market were able to convey stories to today's young readers in a compelling and creative way, they published an experiment at the end of 2012: *Frankie for Kids*, an app book that offers a new take on Frankenstein (in Portuguese and English). It has already received international awards for the quality of its interactive audiovisual content (ComKids Prix Jeunesse Iberoamericano) and for its educational approach to art and technology (Hypertext of Technologies in Education), and became a best-seller, after reaching a wide audience of students in U.S. schools.

The founders then began considering a move into the world of entrepreneurship, and were admitted to Seed-MG in 2014 – a public entrepreneurship program funded by the state of Minas Gerais – where they learned the first steps of the path they have been following.

The following year, they entered into their first corporate partnership: LiteraTour is a book app that was developed in conjunction with the Goethe-Institut, and offers a fun reading and storytelling experience based on classics of German literature. The collaboration with the Institute created a new business opportunity – which consists in bringing strategic issues related to large corporations up for discussion and reflection by young readers, their parents and educators, based on universal stories and additional content that is published in several languages and countries at the same time.

Still in 2015, StoryMax achieved important acknowledgments: it received the German-Brazilian Award for Innovation, was selected by the Ministry of Culture and the Ministry of Communications for the subsidized publication of a new title, chosen to represent the country in an international delegation, and was awarded the Jabuti Prize (the highest literature honor in Brazil) for the book app *Via Láctea de Olavo Bilac*.

In early 2016, after winning a competition for startups most likely to attract investments from large companies (100 Open Startups), it established a partnership with Danish company Novozymes to develop a collection of short stories on the UN's 17 Global Goals for Sustainable Developments for the next 30 years. In addition to Novozymes, the partnership also relies on support from Sesi PR and CRBio. The first title of the book app collection entitled *Novo Olhar* [New Look] comes to app stores around the world (in Portuguese, English and Spanish) in late September.

In August this year, StoryMax was selected out of more than 800 startups from all over Brazil to compose the first group of Residents of São Paulo Campus, a space that was set up by Google to connect and support the development of promising national startups.



Samira Almeida

Founding Partner of StoryMax

I.SYSTEMS

I.Systems was founded in 2007 by Danilo Halla, Igor Santiago, and Ronaldo Silva, all computer engineers and Unicamp graduates. From the onset, the partners were faced with a great challenge: to increase efficiency in projects lasting less than a month, using the client's equipment, regardless of the manufacturer. The technology took four years to develop, and the first project was executed in 2011, at Coca-Cola. The annual savings in the soft drink packaging process saves 500,000 liters of soft drinks and prevents the waste of 100,000 PET bottles every year. The project gave birth to I.Systems' advanced product control solution, known as Leaf.

Leaf has a unique technology that allows sophisticated process control systems that use artificial intelligence (AI) to be developed by people who do not have any previous knowledge of AI or programming. I.Systems applied for its first patent in the United States in 2015 in order to defend the innovation that allows Leaf to be so simple to use: the automatic generation of fuzzy rules. Industrial fuzzy controllers have been used in manufacturing since the 1980s, but their implementation is slow (could take months, or even years) and requires a fuzzy control specialist for deployment. The automatic generation of fuzzy rules developed by I.Systems allows the input of basic information, such as maximum, minimum and average of the pressure, temperature and flow sensors to generate advanced controls without the need for a large database or process modeling.

The implementation of the solution in less than a month and the use of equipment already installed at the customer's facility (regardless of manufacturer) allow I.Systems to offer

an innovative business model to its customers: guarantee a 6-month payback on the acquisition of Leaf. For one month, Leaf will be alternated with the customer's traditional control system: one day with Leaf, the next with the traditional control. The real benefit is calculated based on the data obtained from this period. The savings are projected for a 12-month horizon by using the customer's production plan; the license fee is 50% of the estimated savings (6-month payback). This business model eliminates the technological risk of an investment, and provides a guaranteed ROI (return on investment) for the customer.

I.Systems has already licensed more than 100 Leaf applications in Brazil and abroad, in industries as diverse as: Agribusiness, Cement, Mining, Petrochemical and Metallurgy. Some of its customers include Ambev (ABI), BHP, Raizen, Suzano and Vale. The goals for the next few years are: an international expansion through the company's own operations and partnerships, and to launch new products with the aim of increasing the efficiency of our customers.



Igor Santiago
CEO, I.Systems

Nanovetores Tecnologia S.A



Ricardo Ramos – CEO, Nanovetores

Dra. Betina Giehl Zanetti Ramos – Founding Partner, Nanovetores

Created in 2008, Nanovetores is a ground-breaking Brazilian multinational company, producing manufacturing supplies encapsulated in natural, water-based and rigid particle systems (in nano and micrometric size) for innovative and high-efficiency cosmetic applications.

Nanovetores Tecnologia S.A. has developed an extremely structured and organized growth and development trajectory. After a competitive evaluation process, the company

began its activities within the Celta incubator, with a business plan aimed at developing innovative encapsulating systems created and patented by its founding partner, Dr. Betina Ramos. In this early phase, Nanovetores Tecnologia S.A. was aided by a BRL 400,000.00 grant obtained through the 2008 PAPPE (Program to Support Research in Businesses) promoted by FAPESC (Foundation for Research and Innovation of the State of Santa Catarina) and by the Stem-

mer innovation award. Shortly thereafter, after a lengthy evaluation of its vision for the future, it received investment from the FMIEE CRIATEC Fund, a seed fund that provided the company with potential for growth, acceleration and the strength to spread its operations throughout the national market. The company's evolution was further boosted by other important innovation awards (best incubated company in Brazil by Anprotec in 2012 and 2014, as well as the German-Brazilian Innovation Award) and three other grants (FINEP 2010, PAPPE 2013, SENAI 2015), developing and demonstrating institutional, business, financial and market maturity throughout its seven-year trajectory, during which it blazed an exemplary path to the best business models imaginable for innovative companies.

Nanovetores is the owner of industrial property patents based on technology that can be applied across several industrial segments, and is best known for developing encapsulation systems made out of water-based, biocompatible and biodegradable materials, with extreme morphological control of: shape, size, dispersion and load – with extended release, which responds to five different release triggers (water, temperature, friction, enzyme and pH).

Developing encapsulation solutions, Nanovetores offers extremely innovative solutions for the cosmetic industry, such as: Nano Cellulitech – an innovative blend featuring highly permeable encapsulated thermogenic active ingredients, with clinically proven efficacy after a single application, and which generated more than BRL 5 million in sales in 2015. Nano Nails – a blend of highly permeable and natural encapsulated essential oils with anti-fungal and anti-microbial properties for application on nails, with proven results in 4 days, generated approximately BRL 2 million in sales in 2015. Nano UP-lift – an innovative system for the treatment of facial wrinkles, with proven clinical results after 10 minutes of use and approximately BRL 1 million in sales in 2015.

Nanovetores Tecnologia S.A. operates in the CTF (Cosmetic, Toiletry & Fragrances) industry – Providing complete and innovative cosmetic ingredients and solutions – segmenting its unique technology for the encapsulation of active cosmetic ingredients (vitamins, anti-oxidants, as well as anti-aging, anti-stain, anti-acne and anti-cellulite elements, etc.) using natural biodegradable and biocompatible ingredients in all its products, in order to protect active ingredients (preservatives), increasing contact surface area, reduced quantity (reduction or extinction and allergenic potential) and release triggers (release accuracy and extended duration).

The company currently relies on a complete infrastructure for developing, prototyping and manufacturing cosmetic products and ingredients. Specializing in the research, development and scaling up of new products, Nanovetores has established itself as a company that generates innovation by developing products and services in future areas – generating innovative products and often import substitutes – enhancing value-adding opportunities for its customers and partners.

Nanovetores' innovative and sustainable DNA is the reason for its growth and consolidation, and helped make it the second-fastest growing company in Brazil in 2015, according to the PME Exame and Deloitte ranking. And it comes through in the analysis of its core products and its market position, based on innovative solutions that are truly unique in the global market, as the results of its natural ingredients in an aqueous solution far exceed those of conventional technologies – all of which allowed it to achieve impressive results within a very short span of time.

1.5. Success Stories of German Startups

Qidenus Technologies - Qidenus Group

Qidenus Technologies was established in 2004 by Sofie Quidenus as a spin-off of the Vienna University of Economics and Business. Soon after its inception, Qidenus was composed of a young team that included in-house experts on production, product development, product design, marketing and sales.

The initial idea was to develop an automatic page changer for musical scores, but it soon became apparent that the market was too small and restrictive. However, the company held the patent for a bionic finger that the goal, and the next idea was to use it to develop a book scanning system. The first prototype was born in 2006, and the first machines went on the market in 2008.

Qidenus currently operates in the b2b (business to business) model, where it's one of the global leaders in book and file scanning – however, the goal is to take things to another level with the new technologies being developed.

There are so many great startups in Berlin that one of the main challenges is probably being able to stand out and attracting the best talents. This is exactly what Qidenus Technologies is trying to do, by adopting a robust company culture.

Since its operation employ very complex technologies, attracting some of the top technology talent in the city and achieving meaningful results are crucial to the company's plans.

Uniplaces

Uniplaces was founded in Lisbon in 2012 by Miguel Amaro, Ben Grech and Mariano Kostelec, shortly after their graduation from the University of Nottingham and King's College London. During this period, the partners began to notice how difficult and outdated the process to find housing for students was, and that's how they got the idea for the initiative.

Originally funded with the founders' own savings, Uniplaces has been growing continuously, and currently has a staff of over 150 employees. The website has seen rapid growth, having expanded to 33 cities across Europe in just six years. With over 40,000 decorated rooms in its inventory, it generated more than USD 35 million in bookings for homeowners since its launch.

With a clearly defined market model and the main target of becoming the worldwide leader in the student housing market, Uniplaces has already booked rooms for students from over 140 different countries, for more than 1,500,000 nights.

The company's main challenges in Germany are: creating and developing a high level of trust among consumers, getting used to navigating the bureaucracy of local institutions, and finding the best talent in a competitive market like Berlin.

Gallereplay

Gallereplay emerged after the entrepreneurs were introduced to cinematography and, after some research, noted the absence of specialized image providers in a new and exciting format. During the construction of a basic prototype for the site, the startup applied for and was accepted in a Berlin-based acceleration program. After that, they were able to dedicate themselves full-time to the project.

Gallereplay can be seen as a marketplace and an agency for film creators who can advertise and sell their works to digital agencies, or work on exclusive campaigns for different brands, outsourcing their production to the respective artists.

One of its main challenges is to recruit the best creative developers, especially during the early stage. In Berlin, the demand for good developers is certainly greater than the supply, and good professionals in the field can be easily placed in large companies.

As a result, a growing number of young startups in Berlin are outsourcing their projects to Eastern European countries, known for their accessible and talented developers.

The main goal of Gallereplay is to evolve continuously and become the leading provider of images in its market niche. In addition, it also seeks to gather quality materials developed by the best artists in the area and to achieve an exponential increase in sales, but always keeping its commitment to provide “quality over quantity.”

1.6. Open Innovation in the context of partnerships between large companies and startups

The importance of innovation

It is not by chance that companies around the world are increasingly investing in strengthening an innovation culture in the workplace. Although this type of incentive is usually justified and encouraged due to its positive results, it should be noted that, for many sectors, especially those that rely heavily on technology, innovating is not a choice, but a necessity in order to stay in business.

In times of economic crisis, such as the one Brazil is currently going through, the advantage goes to those who are able to suggest alternatives, solutions and improvements

to the products and technology currently available in the market, and which do not conform to their position. After all, needs – and therefore the opportunities – will always exist, and there is arguably no better time for consumers to try out new alternatives.

The benefits of innovation for businesses are many: de-bureaucratization of internal processes, greater efficiency to cope with new scenarios, ability to predict new demands and technologies, and a strong and positive image among competitors and consumers, and many more. Still, innova-

tion is not an exact science, and it is up to companies to find ways to make it happen on a frequent basis.

And one such way that has been gaining popularity in recent years is the concept of Open Innovation. Coined by economist Henry Chesbrough, the term is used to define the innovation method characterized not only by internal contribution, but also by external support, in which other businesses, universities and even customers can participate in the innovation chain inside companies.

Reasons for adopting Open Innovation

Until the beginning of the 21st century, most companies associated innovation with investments its own employees and infrastructure, using much of its internal capital to this end, under the premise that the rights to property and to the know-how resulting from these activities should be protected and kept under strict confidentiality. This approach certainly has its advantages, and may be the most appropriate in some cases.

However, when we close our eyes to what is being produced by third parties, to what has not necessarily gone through the entire process of the innovation chain that is usually found in specific manuals, or even to suggestions by customers and consumers, we may miss out on valuable business opportunities.

As is widely, now more than ever, entrepreneurs from different fields of activity develop new technologies and new business models, with disruptive capacity to transform industries at a surprising speed.

So-called startups are the result of initiatives by these entrepreneurs, who innovate in an independent and agile manner, and with a mentality that is increasingly distant that what has been observed in the past. In addition, it has never been easier to listen to consumers and understand their main demands, due to the enormous reach of the social networks.

Innovation from the outside in

It is within this scenario that the concept of Open Innovation emerged, in which the innovation management pillars are very different from the traditional approach. In short, it can be described as when companies open up to receive external contribution and third-party knowledge to complement their internal knowledge, accelerating and expanding the innovation process.

Thus, it is perfectly possible for a large company to entrust a startup with a coming up solution to its technical problems, or even to accept suggestions for improving their products, in relationship that benefits both sides. The company does not divert the focus from its core activities and relies on the speed, creativity and innovation characteristics of a technology startup, which, in turn, has the chance of earning a major contract and recognition of its competence in the market.

Another interesting aspect is the possibility of competitors helping pay for joint research aimed at the application of new technologies, as well as agreeing to share the intellectual property rights resulting from this work. As can be seen, competing firms benefit from a considerable cost reduction and do not lose any competitive advantage, since the research would inevitably be conducted by both parties separately.

This model also includes the search for technical solutions within the academic world, bringing universities and private enterprises closer together. The combination of these worlds results in a much better use of academic knowledge, which, without guidance from companies, could sometimes be wasted or take much longer to reach the market.

Finally, considering the aforementioned ease of contact between consumers and companies, and the increasingly fierce competition in the markets, responding to consumers' complaints or suggestions certainly provides positive results.

Innovation from the inside out

It is worth noting that, in addition to allowing companies to obtain external creations, this innovation model can also result in partnerships for inside-out cooperation.

It is not uncommon for interesting projects to be discontinued, or even for completed projects to be simply abandoned before they even hit the market. As a result, some companies are left with valuable underutilized technology, which is sometimes obsolete, because they are not directly related to the end activity or to the immediate efforts of the company in question. It is precisely in these cases that the company has the option of allowing its technology to be shared with third parties.

This can be done in a variety of arrangements, ranging from the licensing of intellectual property rights to third parties to the creation of spin-offs, which would be startups aimed at a different line of business than the company, lean and with great growth potential.

In light of the above, it is clear that the success of implementing an Open Innovation process depends directly on a careful definition of the expertise that the company needs, and on an understanding of what technologies the company can allow to leave its internal environment.

Formalization of partnerships under Open Innovation

Due to the difficulty in predicting the time needed for an innovative process to start generating the expected result and the high expectations of both parties in this market, it is important for all collaborative efforts to have their terms and conditions clearly defined and formalized by a legal instrument.

It is therefore imperative that the main terms and conditions of a partnership, including the roles, rights, obligations, responsibilities, risks, payment, incentives and decision-making power of each entity involved in the partnership be formally defined and clearly communicated to all stakeholders. That avoids frustrated expectations and disagreements about the destination and possibility of return of investments.

When it comes to the search for inventions, it is essential that both parties pay special attention to the intellectual property aspects involved in the partnership. It is not uncommon for a project to rely simultaneously on patents, business secrets, and other information originally belonging to each of the companies involved. Therefore, the aspects of ownership, exclusivity, terms of use and possibility of third-party licensing must be regulated from the very beginning.

Conclusion

There are no rules about the best ways to pursue innovation in companies, but the consensus is that it must be done.

The adoption of an Open Innovation process does not mean that the company must close or devalue its internal R&D department (which remains essential for many companies), or that the pursuit of exclusive rights does not deserve the same attention. Quite the contrary, the concept of Open Innovation may even make this department's creations more valuable, by allowing for the possibility of employing them in other markets. The idea of the Open Innovation model is precisely the consideration of when a different alternative should be adopted, taking into account the potential gains for all stakeholders.

The assumptions that (i) what was created outside the company cannot be used, or (ii) what was created internally cannot

be divided, are the main reasons companies do not pursue innovative initiatives. Therefore, we must emphasize that the greatest challenge of large and small companies when adopting an Open Innovation policy is engaging their staff, who must constantly be reminded of this direction and encouraged to promote it, without being afraid of changes to the work method and of disruption with procedures that are sometimes treated as absolute and rarely questioned rules.

In short, there must be broad acceptance and adaptation to the new processes and to the mindset of a company that wants to take advantage of all the benefits provided by the culture of innovation.



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2

Incentives

2.1. Overview of incentives to innovation in Brazil

Investing in new products and processes is proven to making companies more competitive. Nowadays, this is decisive for success, considering that products have a shorter life cycle, consumers are much more demanding, as are governments and society in general, including ecological aspects. If your competitors are constantly launching new products, features, and adding new services and reinventing processes, your company must be ready to compete with them. Investment in Research, Development and Innovation (RD&I) is an essential factor in this preparation.

Expenditures with RD&I by companies and by all three levels of Government in Brazil is of approximately 1.5% of GDP – well below the level of developed countries. Finland, Sweden, Japan, South Korea, Israel, Switzerland and the United States top the list of countries that invest the most, at between 3% and 4% of GDP. And most of the investment in RD&I in these countries is carried out by private companies, not by the public sector. In Brazil, the public sector's investment in Research and Development (R&D) accounts for 80% of all investments and equals 0.5% of GDP, similar to what Italy and Spain invest. However, in South Korea only 17% of investment is made by the public sector, while in the US that figure is just over 20%. The European Union recently signed an agreement to use 3% of GDP in 2020. In 2014, China employed 2.05% of its GDP in science and technology. It now has a five-year program to increase that amount to 2.5% of GDP.

“Soon after the approval of the 2030 Sustainable Development Goals by the United Nations General Assembly, UNESCO's Science Report clearly shows that research is both an economic development driver and a determining factor in building societies that are more sustainable and have more respect for the planet,” said UNESCO Director-General Irina Bokova. The first lesson from the report is that, despite the economic crisis that affected industrial countries in 2008, gross domestic investment in R&D increased by 31% world-



wide between 2007 and 2013 – from USD 1.132 billion in 2007 to USD 1.478 billion in 2013. This increase was faster than that of world GDP over the same period (20%). The United States still leads, with 28% of global R&D investment; the rest of the world accounts for 67% of the world's population, but only 23% of R&D investment¹.

G20 countries account for 92% of global spending on research. These countries are home to two-thirds (64%) of the world's population, but are also responsible for 80% and 92% of GDP spent on Research and Development, according to the UNESCO Science Report. When it comes to the creation of private knowledge, the domination is even greater: 94% of the patents granted by the United States Patent and Trademark Office come from G20 countries².

Brazil ranks 70th among the world's most innovative countries. The report from the 8th edition of the Global Innovation Index 2015 analyzed the innovation environment in 141 nations, and showed that Europe is still the best region for the emergence of new technologies and services. The first five countries on the Index in 2015 were, in this order: Switzerland (1st in 2014); United Kingdom (2nd in 2014); Sweden (3rd in 2014); Netherlands (5th in 2014); and the United States (6th in 2014). Brazil reached the score of 34.95 and was 70th place in the global ranking, representing a drop of nine positions from the 2014 ranking. In Latin America and the Caribbean, the country is in the 8th position. Finally, the survey had Brazil 99th in the Efficiency Index³.

Brazil lost some of its share in worldwide R&D investment, and only a few Brazilian companies are among the 1,000 companies that invest the most in R&D around the world (in 2009, these were Vale, Petrobras, Embraer, CPFL and TOTVS). We need to far exceed the current amount of investment in R&D and, at the same time, change its composition and its quality. The recipe is not simple, and much less its execution, especially since the country still needs to provide access to quality basic education. Although we cannot invest as much as the world's major powers, investments in R&D should be at least around 2% of GDP, and made through a very clear development policy that would allow us to glimpse a horizon beyond our condition of emergent country.

Investments in research and development centers made by domestic and foreign companies could allow Brazil to create more products and improve its offer to the local market. In addition to the products created by these centers, the country could change its export profile, in addition to transferring technology to local partners, thus generating a cycle of new products and services for the Brazilian market. It all depends on favorable macroeconomic factors, such as educational level and the profile of the companies operating in the country. Some of the benefits that these centers can bring to Brazil include an increase in qualified jobs, joint development and transfer of cutting-edge technology to suppliers, customers and partner companies, agreements with universities, investment attraction – in short, making the country more competitive in comparison to others that do not have the same conditions.

Legal Framework

Brazil has created some important legal framework for innovation, such as Law No. 10,973 (known as the Innovation Law, 2004), Law No. 11,196 (known as the "Good Law", 2005) and, since January 2016, Law No. 13,243, which contains the new legal framework for Science, Technology and Innovation, and regulates the integration between the public and private agents that comprise the Brazilian science, technology and innovation system. Among other impacts, these frameworks effectively reduced the "Brazil PD&I cost," turning the country into a plausible alternative for multinationals to make PD&I investments through their Brazilian subsidiaries.

And what must a company do to start investing in R&D? The first step is to have a clear strategy for innovation, which is based primarily on five dimensions: strategy, people, processes, environment and technology. The next steps should include: capacity building of leaders on the subject, selection of a cross-functional committee to deal with innovation, mapping of ongoing innovative initiatives, effective management of respective projects, training of innovation agents at the base of the pyramid, partnerships with science

and technology and universities. And, not least, the identification of sources of financing/ loans/ funding/ tax incentives for these initiatives, such as:

- Tax Incentives – “Good Law”, Inovar-Auto, Information Technology Law and regional laws (North, Northeast and Center-West, with the exception of the Federal District);
- Refundable Financing - Finep (continuous flow submission), Inova Empresa RFPs (Finep/BNDES), BNDES Innovation (BNDES);
- Non-refundable financing - EMBRAPII (CNI), FUNTEC (BNDES) and SESI SENAIS Innovation Funds;
- Grants for researchers - *Inova Talentos*/ IEL.

This German-Brazilian Innovation Guide contributes to these initiatives by listing the main sources of incentives currently available in Brazil; however, it does not exhaust such list.

Law No. 11,196/ 05: tax exemption for innovators

The incentive mechanisms provided by the national innovation system, especially Law 11,196/05 (“Good Law”), contribute to increasing the ability of Brazilian companies (from both the private and public sectors) to compete.

1. Is it a good idea to take advantage of the “Good Law” (Law No. 11.196/05)?

Yes. Besides being an important source of motivation for employees, since it rewards people involved in Research, Development and Innovation, the law can also be used to leverage these activities, which themselves become much more strategic in times of crisis. By enabling a return of up to 27.2% of the amounts invested in RD&I, the rate of return on innovation projects becomes much more attractive, and companies become increasingly competitive. It must be noted that this is a government strategy created under Law No. 8661 (1993), and reinforced in 2004 with the Innovation Law, and again in 2005 with the so-called “Good Law.” Today, approximately 1,000 companies have innovation programs that receive support under this legislation.

2. Is the Good Law valid for the 2016 tax year?

Yes, for 2016 and subsequent years. In March, Congress vetoed Provisional Measure No. 694, which sought to suspend

the law. Trying to suspend the law was a very serious error by the Brazilian government. Studies conducted by Pieracciani Desenvolvimento de Empresas, based on its own client portfolio, show that the additional tax revenues derived from innovation (with new products and services) is seven times higher than the government’s tax exemption. In other words, the economic benefits brought by innovation far outweigh tax incentives.

3. Does the economic recession in 2016 justify the overall reduction of innovation efforts by companies?

RD&I activities must be maintained, especially in a hostile setting, which combines recession with increasingly fierce international competition. Businesses must be aware of other sources of funding for innovation in Brazil besides the Good Law, such as refundable and non-refundable financing or research grants, offered by EMBRAPII, Finep, BNDES, SENAI and state-funded research support foundations, among others. We will address these sources below.

4. Does the Ministry of Science, Technology, Innovation and Communications (MCTIC) continue to apply the same rigorous analysis towards corporate innovation programs?

The MCTIC has applied profound changes on its last evaluation cycles, which are very welcome, since they help separate the companies with real innovation capacity from opportunists who only seek occasional fiscal incentives. Another topic that deserves to be discussed is the introduction of Technical Support Committees. These are groups of university professors who analyze the contents of the documents (FormP&D) that companies submit every year to the MCTIC, and issue detailed opinions. The changes in the evaluation process and the academic approach (something that needs to be improved by the MCTIC) have significantly raised the “evaluation gauge.” The result is that, for the 2014 tax year, approximately 80% of companies had their FormP&D returned to them with requests for clarification by the MCTIC.

5. How does the newly enacted National Code Science, Technology, and Innovation affect the Good Law and businesses?

This code was enacted at a perfect time. Law No. 13,243 (January 2016) established the National Code of Science, Technology and Innovation, regulating incentives for scientific development, research, scientific and technological

training and innovation, and modified several laws. One of these changes was on the definition of a Scientific, Technological and Innovation (STI) Institution, which had been set by the Innovation Law (Law No. 10.973/04). These institutions are now defined as a "body or entity of direct or indirect public administration, or a legal entity of private non-profit law legally established under Brazilian laws, headquartered within Brazil, which includes product development or basic or applied research of scientific or technological nature, services or processes in its institutional mission or its corporate purpose." In other words, a project that was previously covered by the Good Law can now be carried out by the company with a public or private STI institution.

6. How can companies take advantage of the Good Law and other funding mechanisms available for innovation in a broad and secure manner?

In order to make good use of these mechanisms, companies must continuously monitor the legal and tax frameworks, and of the technical developments and interpretations by the MCTIC and tax authorities. But this is far from enough: the perspective from those who lived R&D on their daily lives, the ability to integrate with company management systems, mobilization of employees at all levels and the development of traceability procedures are all crucial. Businesses can also choose to work in partnership with the German-Brazilian Chamber of Commerce and Industry of São Paulo (AHK São Paulo) and its accredited specialists, as it allows them to shorten their learning curve and reduce risks.

EMBRAPII: an industry ally for innovation⁴

EMBRAPII (Brazilian Agency for Industrial Research and Innovation) has been classified as a Social Organization by the Federal Government since September 2013. The Management Agreement was signed with the Ministry of Science, Technology, Innovation and Communications (MCTIC) on December 2, 2013, with the Ministry of Education (MEC) as the intervening institution. Both federal agencies share the responsibility for funding.

EMBRAPII was contracted due to an acknowledgment of opportunities to exploit the synergies between technological research institutions and industrial companies, for the sake of strengthening Brazil's innovation capacity. Its mission

is to support technological research institutions, in selected competence areas, so that they can carry out projects for the development of technological research for innovation, in cooperation with companies in the industrial sector.

EMBRAPII operates through cooperation with public or private scientific and technological research institutions, focusing on business demands and targeting risk sharing in the pre-competitive phase of innovation. By sharing the risks of projects with companies, it seeks to encourage the industrial sector to produce more innovation with greater technological intensity, thus boosting the competitive strength of companies, both in the domestic and in the international market.

How EMBRAPII works

The business owner comes in direct contact with the EMBRAPII unit or EMBRAPII IF business hub, which will meet the business demand for RD&I. Accredited units have a flexible and agile cooperation model and are experts in technological skills, ensuring a high level of satisfaction in these areas.

Funds are already available:

- EMBRAPII advances funds for its accredited units, which contract the projects directly with the companies. Thus, the funds are already available as soon as the contract is signed. These funds are for used towards the project;
- The project is negotiated directly between the company and the accredited unit;
- This system allows for agility, flexibility and speed in using the funds and in changing the scope of the project.

EMBRAPII Units

They are composed, according to specific technological competencies held by scientific and technological research institutions (public or private non-profit), with proven experience in the development of innovation projects, in partnership with companies from the industrial sector.

Industrial companies are expected to be attracted by the strong knowledge base at all twenty-three accredited EMBRAPII Units as of September 2016, and by their capacity to generate technological solutions, leveraged by the cost-sharing mechanism offered by EMBRAPII to generate industrial innovation in Brazil.

1. Center for Electrical and Computer Engineering (CEEI) of the Federal University of Campina Grande (UFCG)

2. Foundation for Centers of Excellence in Innovative Technologies (CERTI)
3. Center for Advanced Studies and Systems of Recife (CESAR)
4. National Center for Research in Energy and Materials (CNPEM)
5. Alberto Luiz Coimbra Institute for Graduate Studies and Research in Engineering (Coppe)
6. Center for Research and Development in Telecommunications (CPqD)
7. Computer Science Department at the Federal University of Minas Gerais (DCC-UFMG)
8. Embrapa Agroenergy
9. Mechanical Engineering College (FEMEC) of the Federal University of Uberlândia (UFU)
10. National Telecommunications Institute (Inatel)
11. Eldorado Research Institute
12. Lactec Institutes
13. National Technology Institute (INT)
14. Technological Research Institute (IPT)
15. IPT-Bio
16. Technological Aeronautics Institute (ITA)
17. Physical Metallurgy Laboratory of the Federal University of Rio Grande do Sul (LAMEF)
18. Polytechnic School of the University of São Paulo (Poli/USP)
19. Laboratories for Research in Refrigeration and Thermal Physics of the Federal University of Santa Catarina (POLO)
20. Environmental Research Center at Ressacada, Federal University of Santa Catarina (REMA/UFSC)
21. SENAI/Cimatec
22. SENAI Institutes for Innovation in Polymer Engineering (Senai/ Polímeros)
23. Tecgraf Institute of Scientific and Technical Software Development of PUC-Rio (Tecgraf/PUC-Rio)

Technological competence

- Biochemistry of Renewable Resources
- Environmental Biotechnologies Applied to the Recovery of Contaminated Areas and to the Appreciation of Industrial Waste
- Optical Communications
- Development and Scaling of Biotechnological Processes
- Internet and Mobile Computing Devices
- Embedded electronics
- Underwater engineering
- Aircraft manufacturing

- Integrated manufacturing
- Materials – high performance
- Materials for Eco-efficient Construction
- Metallurgy and materials
- Environmental monitoring and instrumentation
- Polymers
- Biomass processing
- Connected Products (IoT)
- Smart Automotive Systems
- Cyber-Physical Systems
- Digital and Radio Communication Systems
- Embedded systems and digital mobility
- Smart systems
- Software and automation
- Computational Solutions in Engineering
- Pipeline technology
- Industrial Chemical Technology
- Refrigeration Technologies
- Health technologies
- Metal-Mechanical Technologies

Compulsory investments in R&D: the Research and Technological Development Program of the Electric Energy Sector⁵

Compulsory investments in RD&I provide opportunities for companies to do business with the Brazilian public sector, as long as they have products and services to offer. In this sense, these compulsory investments would ideally be an important element to help boost RD&I development in Brazil.

Given its relevance and impact on several production chains, the Research and Technological Development Program of the Electric Energy Sector deserves special attention. Regulated by the National Electric Energy Agency (ANEEL), the purpose of this program is to adequately allocate human and financial resources in projects that demonstrate the originality, applicability, relevance and economic viability of products and services for energy processes and its end uses. It seeks to promote a culture of innovation, stimulating research and development in the Brazilian electric sector, creating new equipment and improving the provision of services that contribute to the safety of the electric power

supply, power factor tariffs, reducing the industry's environmental impact and the country's technological dependence.

In accordance with Law No. 9.991, dated July 24, 2000, amended by Laws No. 10.438, dated April 26, 2002, No. 10.848, dated March 15, 2004, No. 11.465, dated March 28, 2007, No. 12.111, dated December 9, 2009, and No. 12.212, dated January 20, 2010, Public utility companies for the distribution, transmission or generation of electric energy, the permit holders for public electricity distribution services and authorized independent electric energy producers, excluding those that generate energy exclusively from wind, solar and biomass facilities, or from qualified co-generation and small hydroelectric plants, must apply a minimum percentage of their annual net operating revenue in Research and Technological Development projects of the Electric Energy industry, according to regulations established by ANEEL.

The "Manual for the Research and Technological Development Program of the Electric Energy Sector," the last version of which was published in August 2012, establishes the guidelines for the preparation of R&D projects regulated by ANEEL. These projects should be guided by the search for innovation to meet the technological and market challenges of electric energy companies. R&D projects for the electric energy industry must be original and innovative. However, unlike the pure academic research, which is characterized by its freedom, it must have clearly set targets and expected results.

R&D project topics that may receive investments as regulated by ANEEL

- FA - Alternative sources of electric energy generation
- GT - Thermoelectric Generation
- GB - Management of Basins and Reservoirs
- MA - Environment
- SE - Security
- EE - Energy Efficiency
- PL - Electric Energy Systems Planning
- OL - Electric Energy Systems Operation
- SC - Supervision, Control and Protection of Electric Power Systems
- QC - Quality and Reliability of Electric Energy Services
- MF - Measurement, billing and combat against commercial losses

Finep: the largest innovation incentive agency in Brazil⁶

The Studies and Projects Financing Company (Finep) offers non-refundable grants and funding to Brazilian companies and research institutions. Finep's support covers all stages and dimensions of the scientific and technological development cycle: basic research, applied research, and product, service and process innovation and development. Finep also supports the incubation of technology-based companies, the implementation of technology hubs, the structuring and consolidation of research, development and innovation processes in established companies, and market development. In 2012, Finep also began to offer support for the implementation of industrial facilities, as well as for mergers, acquisitions and joint ventures.

Reimbursable loans are provided with the Finep's own resources or with transfers from other sources. Companies and other organizations interested in obtaining financing can submit their Strategic Innovation Plans to Finep at any time. As of September 3, 2013, they must access the Finep 30-day hotspot, where they will find all the necessary information to obtain funding for innovation investment in the form of a loan, as well as access to the Corporate Portal, where they can register the company and its Strategic Innovation Plan to be reviewed by Finep.

Finep selects and supports Science, Technology and Innovation projects presented by national STI institutions, with funds from the National Fund for Scientific and Technological Development (FNDCT), the Fund for the Technological Development of Telecommunications (FUNTTEL), and cooperation agreements with ministries, government agencies and trade institutions.

The non-refundable financing is composed with funds from the FNDCT, currently made up predominantly of ST&I Trade Funds. They are intended for non-profit institutions, in programs and areas chosen by the Fund management committees. Financing proposals must be submitted in response to RFPs or special orders.

Finep also offers financial support for ST&I meetings, seminars and congresses as well as technological fairs, but the CNPq (National Council for Scientific and Technological Development) is currently responsible for the selection, evaluation and contracting of operations.

Finep is also increasingly involved in supporting technology-based companies. Since 2000, it is responsible for the Inovar Project, which involves a broad, structured and transparent set of incentive actions for new companies, through a range of instruments that includes the indirect provision of venture capital, through venture capital funds.

Types of support

Incentive programs may combine different types of support to innovation. The types of support may be offered directly by Finep or in a decentralized manner, through financial agents or state-based partners, namely:

- Refundable financing;
- Non-refundable financing to scientific and technological institutions;
- Economic subsidy;
- Investment operations;
- Decentralized operations: aimed at meeting the demands of innovative companies and other institutions through agents that manage funds granted by Finep;
- Information about my project that must be shared with the incentive agency: confidentiality and intellectual property.

All incentive agencies undertake not to disclose, without authorization, any confidential information of which it may become aware due to the analysis and assessment of the projects, except when legally required to do so. However, companies are advised not to provide details about their industrial secrets, but rather just describe the purpose of the project and/or technological platform, the technology under development, the technological challenge involved, the technological barriers to be overcome, the target market, the methodologies that will be used and the activities that will be carried out.

Finep values the acquisition of intellectual property rights for the results achieved in projects, programs and research and innovation plans that it supports, as it believes that it can encourage the development of innovative technologies and increase the competitiveness of Brazilian companies, as well as a help leverage the country's economic and social development.

Finep will not demand any ownership or co-ownership of industrial and intellectual creations resulting from the projects, programs or research and innovation plans that it

supports. Instead, such rights will belong exclusively to the Brazilian institutions and companies involved in research and innovation initiatives.

The terms of agreement on intellectual property, the confidentiality requirements and licensing conditions should be negotiated and established exclusively by the Brazilian institutions and companies, in compliance with the applicable legislation, without any interference from Finep.

Deposits or any documentation related to intellectual property protection applications must be filed with the National Institute of Industrial Property (INPI) and notified to Finep.

The products or processes developed as part of research and innovation projects, programs and plans supported by Finep should preferably be produced and sold by Brazilian companies, contributing to national production and to the generation of jobs and foreign investments for Brazil.

FAPESP: the most important state agency for research incentive

The Foundation for Research Support of the State of São Paulo (FAPESP) is one of the leading agencies for the promotion of scientific and technological research in the country. With autonomy guaranteed by law, FAPESP is linked to the Department of Economic Development, Science, Technology and Innovation.

With an annual budget of 1% of the state's total tax revenue, FAPESP supports and funds scientific and technological research and information-sharing in São Paulo.

Types of Support

FAPESP supports scientific and technological research through scholarships and grants that promote all disciplines: Life Sciences, Health Sciences, Earth Sciences, Engineering, Agricultural Sciences, Applied Social Sciences, Human Science, Linguistics, Literature and the Arts. Some of the programs associated with these disciplines are listed below.

The scholarships are available to undergraduate and graduate students; and the grants are available to researchers with at least a doctorate level degree, who work with higher education and research institutions in the State of São Paulo. The scholarships and grants are provided through

three lines of funding: Regular Line, Special Programs and Research Programs for Technological Innovation.

The Regular Line meets spontaneous demands, i.e., project proposals submitted by undergraduate and graduate students, as well as researcher-doctors. In 2014, FAPESP allocated BRL 482.5 million to finance Regular Scholarships in Brazil and abroad, and BRL 423.9 million for Regular Research Grants and Thematic Projects.

The purpose of the Special Programs is to induce the development of research that promotes the advancement of the knowledge frontier and respond to the demands of the Science and Technology System of the State of São Paulo and of Brazil. These programs include Support to Young Researchers, Public Education, Infrastructure Support and others that received more than BRL 129 million in funding in 2014.

The Research Programs for Technological Innovation are aimed at helping induce new researchers into the practice, and support research with the potential to develop new technologies and practical application across various disciplines, in line with the state government's Science, Technology and Innovation policy. Total funding provided for these programs in 2014 was 117.6 million BRL.

Programs geared to specific themes:

- Bioenergy Research (BIOEN);
- Biodiversity Research (BIOTA);
- Inter-Institutional Cooperation in Support of Brain Research (CINAPCE);
- Program for eScience Research (ESCIENCE);
- Climate Change (PFPMCG);
- Structural Biology Network on Advanced Life Sciences Topics (SMOLBNET).

Applied research programs

(corporate and government):

- Support to Intellectual Property (PAPI/NUPLITEC);
- Research, Innovation and Dissemination Centers (CEPIDs);
- Trade Consortia for Technological Innovation (CONSITEC);
- Public Education;
- Innovative Research in Small Businesses (PIPE);
- Program to Support Research in Businesses/ FAPESP Program for Innovative Research in Small Businesses (PAPPE-PIPE);
- Joint Research on Technological Innovation (PITE);
- Public Policy Research;
- Research Program for the Unified Health System (SUS).

Research Infrastructure Programs:

- Research Infrastructure Support;
- Technical Training;
- FAPBooks;
- Program for Young Researchers in Emerging Centers;
- Museums and Information, Documentation and Biological Collection Depositories;
- ANSP Network;
- Scientific Electronic Library Online (SCIELO);
- Institutional Technical Reserve.

Scientific dissemination program:

- Scientific journalism.

National Fund For Scientific and Technological Development: an important instrument for the promotion of innovation in Brazil

The National Fund for Scientific and Technological Development (FNDCT) was created in 1969 through Decree-Law No. 719, for the purpose of financing high-priority science and technology projects. After Decree No. 68,748 was enacted in 1971, the Financing Agency for Studies and Projects (FINEP) became responsible for the fund's technical and administrative management, and was given the autonomy to involve all other scientific and technological agencies of the federal government. But the fund's regulations and management model was only defined by Law No. 11,540/07 and Decree No. 6,938/09, which established a board of directors subject to the current Ministry of Science, Technology, Innovation and Communications (MCTIC).

The Fund benefits from several sources of revenue, established by subsequent laws that regulate sectors considered strategic by the government. In addition to tax revenue from the Federal Treasury, in recent years the fund started receiving a portion of the revenue earned by companies benefiting from tax incentives, as well as financial compensation for the right to use infrastructure and natural resources, licenses and authorizations, donations and loan transactions.

The resources of the FNDCT are used to support research and innovation activities in companies and Scientific and Technological Institutions (STIs), as refundable and non-refundable financing. These resources can also be used as di-

rect or decentralized investments by Finep itself in high-priority projects. In direct investments, Finep is directly responsible for the project's budget execution; as for decentralized investments, the funds are transferred to other partners or agencies, such as the CNPq, which are responsible for implementing the action, such as financing for graduate programs and programs to support young researchers at companies, in the form of scholarships for specialized human resources.

Therefore, these resources are guaranteed to finance several projects of strategic interest to Brazil. The demand for resources is centralized through the two main agencies for the promotion, management and administration of Science and Technology (S&T) in Brazil: Finep and CNPq. But at a time when all areas of government should look very carefully at expenditures, investments, financing for private benefit, and other uses of public resources, a fundamental question must be asked: are the resources being adequately used?

This is a difficult issue to discuss, especially at such a delicate moment as 2016. We are well aware of the importance of Science & Technology in a nation's development, and of government's role as the main provider of incentives. However, despite its strategic importance for business activity, recent years have increasingly shown that the State is the only major investor and driving force for innovation.

Very few companies, no more than between 800 and 1,000, have understood the strategic need of running R&D programs, whether internally or with help from partners who can provide funding or expertise. Very seldom do they seek out STIs for collaborative efforts.

Of these, a nearly inexpressive number uses incentives from Finep or CNPq, which, even in these few cases, represents a small part of the company's total R&D budget.

Finally, there are few worthy incubators and startups that would cease to exist if they did not have access to government funds, due to the total lack of vision of private enterprises, which has invested very little in this sector.

Unfortunately, the share of corporate investments in S&T in Brazil remains very low. Through Finep, CNPq and a few state-owned companies such as Petrobras, the Brazilian Government is the main investor in the area, with part of the proceeds from deposits in the FNDCT.

As a general rule, the incentive agencies and the Fund are not able to meet the country's R&D needs and do not receive much help from Brazilian companies, which remain unaware of how important this investment is for their own future.

Incentive legislation for regulated sectors such as Oil and Gas, Electric Energy, Telecommunications, Electronics and Automotive, provide an "easy path": instead of developing their own projects, companies tend to invest in the FNDCT, which reinforces the adage that "the R&D and innovation issue is the government's problem, not mine."

Especially in 2016, when many government agencies are having to revise, cut or contain their expenses, one alternative would be to keep funding for some R&D programs at public universities, which in turn would maintain incubators for new technologies (strategic for the country) developed by startup companies.

Meanwhile, companies that belong to regulated sectors and, therefore, have to make compulsory deposits to the FNDCT, should instead invest in startup companies and projects and/or with the STIs that could provide direct results and benefit their businesses in the medium and long term. The management of these projects alone would already force these companies to develop and maintain an R&D and innovation culture.



José Hernani Arrym Filho
Managing Partner,
Pieracciani Consulting



2.2. Overview of government support in Germany⁷

For a country, growth is the result of a number of economic and social factors that require careful analysis and a keen understanding of opportunities that may provide short-, medium-, or long-term results.

Some indicators allow us to predict the effect that certain actions will have on an economy, as well as its driving elements, leading to the generation of new ideas and innovations.

When thinking about the subject, countries like Germany, the United States, Japan, South Korea, Sweden and others are the first that come to mind, and usually seen as models for incentive programs and for national development.

Although there are several differences between the economies, some parameters are seen as essential for encouraging innovation and keeping these nations at the pinnacle of competitiveness.

In Germany, the government's support for research and development reveals a clear concern about the issue, especially when compared to countries like Brazil. In 2012, Germany invested 2.92% of its GDP on R&D alone, while Brazil invested only 1.15%. Another factor that influences the execution of projects in both countries is the speed in granting patents, which is six times faster in developed countries than in emerging ones.

Germany has several programs and partnerships that stimulate the development of projects, mainly in Applied Research. One of the models that promotes and assists innovation in the country is a consultancy program carried out by the government that aims to map out the main incentives in a particular project's industry or discipline, helping entrepreneurs find the one that is most suitable for their business. *Förderberatung des Bundes* maps out a wide range of opportunities in Research and Development, such as awards, forums and RFPs related to the subject, gathering detailed information in a single database to help candidates to plan their proposals or applications. In addition, some areas receive special support, which allows for specific incentives to innovation in a given state, or towards global cooperation between EU countries. The highest priority topics currently are:

- Health;
- Energy;
- Mobility;
- Communications;
- Social Sciences;
- Security;
- Education;
- Information Technology.

Government ministries are highly involved in Germany, mainly in the funding of various research institutes that are managed by them. The involvement of the institutes is of paramount importance to support the activities of the respective ministries, in order to encourage and contribute towards the execution of projects. Some of the ministries that are highly involved in promoting science and innovation are:

Federal Ministry of Foreign Relations (AA)

This Ministry has garnered a great deal of attention, mainly due to international collaborations to promote research partnerships, establishing strategies to tackle global challenges; its investment in research is one of the main pillars of German foreign policy.

Federal Ministry of Education and Research (BMBF)

In charge of one of the most strategic subjects in the country's policy, this ministry seeks to strengthen Germany's position as a leader in the fields of research and development, as well as to promote exchange programs for young students, researchers and scientists. One of the strategies adopted to this end is "High Tech," which is aimed at finding creative and efficient proposals for short-term challenges in a wide variety of fields, while simultaneously fostering the industrial sector and world trade.

Federal Ministry of Food and Agriculture (BMEL)

Focused on global concerns such as climate change, resource scarcity and food supply, one of the objectives of the Ministry of Food and Agriculture is to protect the environment by promoting sustainable and safe agricultural production. It should be noted that, in 2013, more than 600 million euros were invested in research on these subjects.

Federal Ministry of Economy and Energy (BMWi)

One of the most strategic of German ministries, especially when it comes to providing incentive to innovations and technologies aimed at long-term economic success. One of the leaders in programs to finance the development and application of new technologies and services for German companies. In 2015, the Ministry had a research budget of 7.12 billion euros.

Federal Ministry of Economic Cooperation and Development (BMZ)

Seeking to solve conflicts and find peaceful solutions, this Ministry has a very strong role in preserving both the domestic and foreign environments. Much of its work is geared towards crisis mediation, from global agreements on issues related to resource scarcity, to the sharing of resources aimed at avoid global poverty.

Federal Health Ministry (BMG)

Germany's Health Ministry divides its activities into three pillars: health, prevention and long-term treatment. Collaborating with health-oriented science and technology institutes is key if it aims to work towards these objectives, and to strengthen the health sector.

Programs and Investments

There is a large number of incentives for research and innovation in Germany, through which various startup programs and small and medium businesses obtain funding and even enter into partnerships with other companies and institutes, enabling the execution of several projects.

Startup Programs

Exist – startups out of science

Purpose: to strengthen the entrepreneurship culture within universities and research institutions.

Target: startups and entrepreneurs.

Planned investment: EUR 70 million in 2016, part of which is funded by ESF (Europäischer Sozialfonds für Deutschland).

High-tech start-up fund

Purpose: to fund startups with innovative technologies.

Target: technologically innovative startups.

Planned investment: EUR 70 million in 2016, part of which is funded by ESF (Europäischer Sozialfonds für Deutschland).

Invest – grants for venture capital

Purpose: to facilitate the access of new businesses to venture capital institutions and attract angel investors.

Target: startups.

Planned investment: EUR 30 million in 2016.

Incentives for SMEs

Centres of excellence

Purpose: to support companies with testing of new solutions and information gathering through 11 SME research centers.

Target: Entrepreneurs and SMEs.

Planned investment: EUR 18 million.

Federal “Research and Innovation” Funding Advisory Service

Purpose: to strengthen existing skills and use innovation to make the company more competitive.

Target: SMEs.

Planned investment: EUR 6 million.

Collective Industrial Research

Purpose: to promote research in companies of a single sector and/or complementary sectors in pre-competitive stages.

Target: businesses and research institutes.

Planned investment: EUR 139 million.

ZIM Programm (*Zentrales Innovationsprogramm Mittelstand*)

One of the main incentive programs geared towards Small and Medium Enterprises (SMEs), the ZIM Programm is a financing program for companies looking to develop new products, processes and services, or improve existing ones. Established in 2008, the program operates in several technological sectors and provides different financing options:

- Financing for individual R&D projects;
- Financing for projects executed in collaboration with companies;
- Financing for projects executed through a collaborative network (up to six companies involved).

It should be noted that the Ministry of Development, Industry and Foreign Trade of Brazil (MDIC) and the Ministry of Economic Affairs and Energy of Germany (BMWi) signed an agreement in 2015 for the purpose of encouraging international cooperation between the two countries, which calls for joint R&D projects with the participation of at least one SME from each country. On the Brazilian side, the funds are granted by BNDES and other development institutions; on the German side, ZIM is responsible for providing the resources.

Euro 2020

Long-term planning is a very common European trait, especially when it comes to investing. In March 2010, with a focus on a 10-year horizon, the European Commission agreed on a program that is based on being sustainable, efficient and inclusive, aimed at the growth of participating countries, such as employability index, increasing research investment, cutting gas emissions, reducing school dropout rates and lowering the number of Europeans living in poverty.

The results of this program will be measured and new targets will be established according to the impact achieved over this decade.

KfW: Banco de Desenvolvimento
(Kreditanstalt für Wiederaufbau)

KfW is a federal government bank and one of the leading development banks in the world, focused on the sustainable improvement of living conditions, especially regarding economic, social and environmental aspects. In addition to being one of the main providers of incentives to the opening of new SMEs in Germany, it also led the country in investments and financing for these entrepreneurs in 2012. One example of KfW's strategy is its involvement in the Energy-Efficient Refurbishment Program, in which anyone interested in upgrading the electrical system in their home was able to finance the improved concession directly through the bank, which allocated EUR 1.5 billion for this purpose.

Agreements and legislation

The German constitution is a key element that secures autonomy and freedom for innovation.

The Research and Innovation Pact (*PFI – Pakt für Forschung und Innovation*) contributes directly to the dynamics and efficiency of the scientific community and its long-term planning. This pact, funded jointly by the federal and state governments and relying on partnerships with the Fraunhofer and Max Planck societies, the Leibniz and Helmholtz associations and the German Research Foundation, achieves results that are directly associated with political research. Generated annually, the reports show that the investments made are largely successful. The Science Freedom Act (*Wissenschaftsfreiheitsgesetz*) also provides protection to the institutes, by ensuring them full autonomy to use the funds in projects that they believe are ideal, without the need for government review and approval.



Fernando Paraiso

Coordinator of the Innovation and Technology Department, German-Brazilian Chamber of Commerce and Industry

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3

German-Brazilian Opportunities

Brazil is Germany's leading trading partner in Latin America. In 2015, German exports to Brazil totaled USD 10.4 billion. The relationship works both ways: Germany is also Brazil's largest trading partner in the European Union. Last year, Brazil exported USD 5.2 billion worth of goods to Germany. In addition, the USD 3.5 billion in direct investments make Germany the 5th country with the most foreign investments in Brazil.

These prolific numbers reflect a trade relationship that began to be built a century ago. The first German-Brazilian Chamber of Commerce dates back to 1916, in Rio de Janeiro. Since then, Germany has been an important trade partner. The first wave of industrialization in Brazilian cities was driven by German investments. The 1970s boom period benefited from the arrival of several Germanic manufacturers. Today, the State of São Paulo has the largest German industrial park outside of Germany: in all, approximately



pogonici / Shutterstock

800 companies generate around 250,000 direct jobs, mainly in automotive plants and parts manufactures. German manufacturers in Brazil amount to an impressive 9% of the country's industrial GDP.

Last year, both governments inaugurated a mechanism for High-Level Intergovernmental Consultation, bringing the relationship between the two nations to a new level. This research mechanism could stimulate political dialogue and strengthen economic, technological and commercial cooperation in priority areas for Brazil, as well as further strengthen the relationship between the two countries by creating opportunities in all market sectors. Germany only has this type of agreement with a few countries around the world – and the only one in Latin America is Brazil.

There are many opportunities to expand the bilateral relationship between Brazil and Germany. Brazil is a big country, with one of the largest consumer markets in the world,

a young population, and offers investment opportunities in several industries. Germany, one of the most powerful and innovative economies in Europe and around the world, should also be seen as a strategic partner by Brazil.

The following pages reinforce this idea.

**Geovani Fagunde**

partner, PwC Brasil; leader,
German Desk

3.1. Agribusiness

Facts and Data

Brazil is notorious for its relevant participation in the global agribusiness market. The country is the world's largest producer and exporter of coffee, sugar and orange juice, in addition to being ranked near the top in the production and export of soybeans, corn, pork, beef and chicken. The industry is responsible for approximately 20% of Brazil's Gross Domestic Product (GDP), and the main reason for its trade surplus, accounting for more than 45% of the country's export value.

There is a number of characteristics that benefit agricultural and livestock production, and ensure the prominent position of Brazilian agribusiness in the international market. Among its natural features, we should mention the high amount of sunlight, abundance of fertile farmland and water resources (rivers, lakes, aquifers and rainfall), as well as a broad range of climates, soils and biomes that are ideal for the production of various crops. Another relevant aspect is the fact that Brazil has the technical knowledge acquired over a long history of its agricultural and livestock industries, which is fundamental for achieving efficiency on the field.

Although it is already a world leader in agribusiness, Brazil could be better positioned in international trade if agricultural products managed to reach the international market in the same competitive condition as when they leave the farms. However, poor logistics infrastructure from farm to port, and from there to other countries, insist on holding the country back. Currently, logistics is the main challenge for Brazilian agribusiness.

Brazil still relies heavily on road transport for its agricultural production, and the country has continuously failed to take advantage of its privileged geography to develop rail and waterway transport systems. In addition, the limited infrastructure of most ports results in delays to load the ships, which form long lines waiting for the products. Not to mention the waste along the entire production chain, which is also caused by inefficient logistics.

If the Brazilian agribusiness industry wishes to continue growing in the upcoming years, it must overcome these logistical barriers. Private enterprise has been heavily involved by acquiring concessions to build highways and railways. Even agribusiness companies have ventured into the

investment and planning of public infrastructure. By doing so, they also open up several doors for foreign investment and many foreign companies have started to consider investing in this segment.

The challenges faced by the Brazilian agribusiness industry also represents real opportunities, since Brazilian agricultural production is likely to grow along with internal and external demand for commodities and high-added value products, such as meats, specialty coffees, dairy products, among others. Generally speaking, this scenario tends to favor a gradual improvement of prices and generation of value for the entire value chain, especially in services, logistics and infrastructure.



Ana Malvestio
partner, PwC Brasil and
Agribusiness expert for Brazil



Lara Moraes
Agribusiness expert, PwC
Brasil

A company's vision - BASF

A partnership that yields results

BASF, the leading chemical company when it comes to innovation, celebrated its 150th anniversary in 2015, and operates in many segments in Brazil for over 100 years. Its long-standing relationship with Brazilian agriculture, which has yielded very positive results for both sides. BASF's Crop Protection unit offers solutions for crop protection, seed treatment and biological control, as well as innovations in nutrient management and plant health. The company's portfolio also features products for lawns and ornamental plants, urban pest control and public health.

BASF makes constant investments in innovation aimed at contributing towards agricultural solutions to control weeds and fight pests and diseases, helping to increase the productivity of Brazilian farmers. The innovation is in BASF's DNA – in fact, it is one of the pillars of our strategy. Innovation is related to the continuous improvement and the development of innovative solutions that strengthens the relationship between the company and its customers.

In 2016, the BASF group will invest EUR 1.9 billion in R&D globally, an increase of 6% in the company's average R&D investment for the last five years. In Crop Protection alone, the amount invested in Research and Development this year is EUR 540 million.

With a focus on innovation and on the needs of farmers, BASF has been launching ground-breaking products in the agricultural market, such as its new fungicide to control Asian rust, one of the most harmful diseases to soybean. The company has also invested heavily in relationships and new business opportunities.

One of the main examples of Brazil's relevance to BASF's agricultural business is the Agricultural Experimental Station, located in Santo Antônio de Posse, in the State of São Paulo. The station is one of the company's three global research centers, where creation and selection of new molecules take place. Brazil is a country with unique characteristics for agriculture. Our tropical climate is excellent for the development of several crops, but also contributes to a greater number of pests and diseases. Therefore, the research for new molecules and solutions needs to meet our specific requirements. And that is exactly the role of the Experimental Station, which represents a strategic investment by BASF in Brazilian agriculture.

By offering new technologies and knowledge, BASF helps producers build a better life for themselves, their families and communities.



José Munhoz Felipe
Vice President of Crop Protection, BASF in Brazil

An STI institution's view



Agribusiness and bio-economy in the German-Brazilian industrial and scientific collaborations

Due to the territorial dimension and diversity of climates, soils and terrains, Brazil stands out as one of the world's leading agricultural economies, and maintains important international trade relations in this sector. Currently accounting for 23% of the country's GDP, agribusiness is one of the most solid pillars of Brazil's economy.

Beyond the production and sale of agricultural products, the sector also includes all operations involving the production and logistic distribution of agricultural supplies, the productive stages within rural properties, storage and conservation of raw materials and products, and industrial processing.

Agribusiness not only contribute to the country's economy, but also create demand for technological development and innovation, main keys to strengthen economic, social and environmental sustainability. Applied research contributes directly to increase productivity on the agribusiness sector, improving distribution logistics, reducing losses along the production chains, and making better use of byproducts. On this matter, a range of opportunities have emerged in Brazil for the intensification of technical, scientific and commercial exchanges.

Fields such as Food Safety, Healthy and Sustainable Foods, the use of biomass and agricultural by-products to develop new materials or generate energy are subjects of common interest of both Germany and Brazil. Precision equipments,

laboratory devices, sensors and industrial engineering devices are also some of Germany's important contributions to Brazilian agribusiness.

Facing the growth of the world population and the foreseen shortage of natural resources, the strategic bio-economics platform addresses the world's main demands for food, energy and materials, and has become an important catalyst to reach important approaches and close collaboration between applied research and industry, looking towards innovation and solution of global problems. Discussions on important bio-economy topics between Germany and Brazil have been intensified since 2012, and have led to the establishment of working groups, technical workshops to identify and discuss the most important challenges. Those discussions have become an important key to build up a solid relationship and multidisciplinary projects, fruitful for both countries.



**Alexandre Martins
Moreira**

Head of the Fraunhofer
Project Center for Food and
Bioeconomy

3.2. Biotechnology

Facts and data

According to the United Nations, biotechnology is “any technological application that uses biological systems, living organisms or their derivatives to manufacture or modify products or processes for a specific use.” Several industries use biotechnology to develop products, such as agriculture for the production of herbicide-resistant species, energy for the production of biofuels and pharmaceutical for medicines.

Vaccines are perhaps the best known and oldest use of biotechnology in the pharmaceutical industry. Science has evolved rapidly in recent years, and the pharmaceutical market has been invaded by various biotech products. According to PhRMA (Pharmaceutical Research and Manufacturers of America), the research pipeline of the association’s companies has 300 drugs produced with monoclonal antibodies, currently the most researched drug type, followed closely by vaccines with 298 drugs.

In addition to the health benefits to the population, biotechnology also helps companies’ business strategy. The report published by PwC, *Beyond 2020: Building Strategic Coherence in the New Health Economy*, lists some actions that pharmaceutical companies can take to succeed in the “New Health Economy.” Three of the success stories mentioned are from companies that use biotechnology to develop innovative products: Celgene, Gilead and Shire.

The market also sees value in biotechnology companies, as evidenced by the volume of venture capital investments in such companies. Also published by PwC, the MoneyTree report analyzes these investments made in various industries in the United States. Biotechnology captured 71% of the investments made in the Pharmaceutical and Bioscience industry over the last two months of 2015. Looking at the total for the year, there was an increase of 18.7% in investments when compared to 2014, reaching USD 7.6 billion, a significant amount. The production of biotechnological drugs is

expensive, and governments are working to cope with the high costs. In Brazil, the population has access to biological medication through the Unified Health System (SUS) for the treatment of some chronic diseases, such as rheumatoid arthritis and Crohn’s disease. These drugs represent 4% of the volume and 51% of the value spent on medication by SUS. To mitigate costs, the Brazilian government has developed an initiative known as Productive Development Partnership (PDP), which is aimed at transferring technology to produce these drugs for public laboratories. From 2010 to 2015, the PDPs enabled the government to save BRL 2.5 billion. In addition, two “super pharmaceutical companies” were created, through the joint venture of Brazilian companies, to develop biotechnological drugs. These companies received BRL 401 million from BNDES to install its factories.

The development of biosimilar drugs is a great opportunity for Brazil to stand out in the pharmaceutical market. Until 2020, several biological drugs will have their patents expired, with global sales exceeding USD 65 billion, opening up opportunities for new entrants.



Eliane Kihara

partner, PwC Brasil and expert
on Health

A company's vision - Henkel

Henkel Corporation is a multinational supplier of products for consumer and industrial applications. We have over 47,000 employees globally, with a clear vision to bring value to our customers through innovative solutions. As a core value, Henkel has placed sustainability at the forefront of its development activities.

The utilization of bio-renewable raw material sources has played a key role in the design and development of products at Henkel for many years and we do it through the replacement of existing petroleum based raw materials and use of new materials to achieve superior product performance.

Three classes of bio-renewable raw materials are needed for the industrial and consumer businesses of Henkel:

- Chemical building blocks that enable the design and manufacture of functional raw materials
- Bio-renewable chemical additives to enhance product performance
- Biopolymers & Biomimetics that perform as functional products

As a concrete example of our commitment, we have invested in our plants and innovation facilities in Brazil (especially in a polyurethane plant in Jundiai, SP) and developed a whole line of bio-based adhesives for flexible packaging

with enhanced food safety features. The work for expanding this principle into new products, applications, markets and technologies goes on.

A collaboration between governments (Brazil-Germany), bio-renewable raw material suppliers, chemical industry leaders and academy is needed to promote the bio-based chemistry to the next level, supporting the economy of both countries while decoupling it from the consequent impacts of strongly rising consumer society on the environment. Such an evolution could become a role model on how to improve simultaneously economy, sustainability and corporate social responsibility on other emerging countries.



Gustavo Cenachi
Senior Strategy Manager,
Henkel

An STI institution's view

Paving the Road to the Bioeconomy by Academic and Industrial Partnering

Brazil is the global hub in academic and industrial know-how when it comes to production of bio-resources and –fuel whereas Germany is the champion in bio-refining to bio-based chemicals.

Obviously linking both nations' capacities yields an enormous potential in academic partnering and commercial projects. CLIB2021, the Germany based bioeconomy cluster, therefore promotes very much German-Brazilian academic and industrial cooperation.

Some of the more than 100 CLIB-members and partners cooperate with Brazilian partners since many years: Fraunhofer's Project Center for Innovations in Food and Bioresources has been established at the Institute of Food Technology (ITAL; Campinas-SP). Since 2012, it works on sustainable food production and processing. The Bioeconomy Science Center (BioSC), which is a bioeconomy initiative of North-Rhine Westfalia's leading academic institutions, runs a science program including exchange of German and Brazilian scientists.

An industrial model of translating basic research into commercial practice in Brazil is given by Germany's chemical



giant Evonik Industries. Based on corn this company produces an amino acid for feed applications in Castro (Paraná). Experience has demonstrated that partnering is successful if both sides evenly benefit and the framework conditions including funding are reliable.

CLIB does not only give access to German bioeconomy stakeholders; in Europe the cluster cooperates very much with partners in the Netherlands and Flanders (Belgium). In the frame of this so-called BIG-C initiative CLIB shares the office of BE-Basic (Netherlands) in Campinas (Sao Paulo).

German-Brazilian partnering topics to be prioritized include

- Sustainable production of biomass for nutrition and industrial purposes;
- Extraction of plant ingredients;
- Transformation of sugar, vegetable oil and lignocellulose to platform chemicals;
- Processing to bio-based fine, specialty and bulk chemicals including energy carriers;
- Cascade use of processing material flows;
- Use of CO₂-emission (e.g. from biogas fermentation) and CO (e.g. synthesis gas from steel mill-emission or municipal solid waste).

These are essential scientific and technological bioeconomy elements. Applying them successfully in industrial enterprises needs in addition promoting regional conditions such as recording of public and private material flows, informing about supply chain options, and achieving societal acceptance. CLIB also works on such regional topics and would introduce its experience in related partnering projects.



Dr. Manfred Kircher

CLIB 2021

Cluster Industrial Biotechnology,
Chairman of the advisory board

3.3. Smart cities

Facts and data

Cities today are more than just the place where thousands – or millions – of people live. They are home to the most important transformations and innovations of humanity. Cities gather a good portion of the world's human capital, leading to some people saying that competition in the global economy is now more between cities than countries. By that reasoning, Brazil does not compete with China, Mexico or Japan – it is São Paulo, Rio de Janeiro or Salvador that compete with Beijing, Mexico City or Tokyo. And competition today does not take place through foreign trade only. The challenge is to attract the best talents and the best companies, which requires cities to be attractive.

Attractive cities, for companies and individuals, are developed cities – i.e., those that have solved issues related to public health, mobility, safety, quality of life, urbanization, education, sanitation and the efficiency and modernization of public administration. Topping the list are concepts such as prosperity and quality of life. It's not a new fact that Brazilian cities have been moving towards development. Our challenge is to fight back, while at the same time competing with the more developed urban centers.

The study "Cities of Opportunities," developed by PwC, analyzed 30 global metropolises, looking to identify the policies and approaches that work best for people and economies in a world undergoing rapid urbanization. São Paulo and Rio de Janeiro were included in this study, and were ranked 25th and 27th, respectively. London leads the ranking, and Berlin came in 12th. The study analyzed the following dimensions: intellectual capital and innovation, technological readiness, relevance in leisure tourism and/or business, transportation

and infrastructure, health and safety, sustainability and natural environment, demography and habitability, economic influence, ease of doing business and cost. Rio de Janeiro and São Paulo did well in sustainability and natural setting. Their worst scores came from costs and technological dimension.

Another important issue for managers (including the private sector, it should be said) is the city's identity. It is no longer a question of attracting companies and industries from various sectors. The development strategy goes through a city's identity. It makes no sense for Silicon Valley to try to attract automakers, but it could try to attract programmers and engineers to develop software for cars. Once the strategic goals are set, it is easier for the manager to create and put actions, programs and policies into practice. Cities must first come to terms with their weaknesses, potentials and challenges before seizing the opportunities to promote long-term sustainable growth and competing on equal footing with other urban centers to attract capital and talent. Brazilian cities have a long way to go to get to that point.



André Marinho
partner, PwC Brazil and expert
on Infrastructure and Cities

A company's vision – Siemens

Competitive cities, smart infrastructures

The historical evolution in recent centuries does not leave any doubt: cities are the natural habitat of modern humans, and the future of humanity is closely intertwined with this

fact. Around the world, cities add two new inhabitants per second, which amounts to a new Munich per week – or, to use a Brazilian reference, a new Campinas. Until 2050, more than two-thirds of us will live in cities, while in 1950 this

number amounted to only one-third. Cities already generate about 80% of the global GDP, consume about 75% of the world's energy and emit about 80% of all greenhouse gases.

Currently, all UN-listed megacities already have a total population of approximately 300 million inhabitants, and are increasingly important to their national economies as growth drivers. The reasons are simple: cities have the best opportunities for employment, health, culture and leisure. As these cities and economies grow, the challenges increase: people want a better quality of life and, at the same time, a dynamic business environment that creates jobs and opportunities. They need to breathe good quality air, have safe drinking water, and reliable electricity to make their lives easier and mobile.

Competitiveness in the global economy is another important consideration. Cities have to compete at a global level to attract ever more mobile investments, businesses, workers and, above all, talents. Time wasted in traffic, pollution, the management of water and electrical distribution systems and sanitation are some of the factors that influence the success of cities. And only a city that offers adequate quality of life for its citizens can meet these demands.

Unfortunately, the infrastructure of many cities is far inadequate for its population's needs – which represents a major challenge for local governments, both in industrialized and emerging nations. In many cities today, trains, electrical systems, buildings, buses and roads have not changed much over the past 40 or even 50 years. And that is where digitization can be an important ally in city management.

Siemens has participated in a number of initiatives that introduce technology as a partner for the sustainable growth of cities, such as London, Berlin, New York, Paris. In Brazil, São Paulo, Rio de Janeiro and Curitiba have also provided interesting examples along these lines.

London has been expanding its transport system towards the east side of town: the Crossrail initiative will connect several railway lines in the British capital and, when completed in 2018, will add 120 kilometers to London's transport system. Automation technologies in transportation systems and advanced signaling and communication systems will enable an

additional 1.5 million people to reach the city's central area in less than 45 minutes through public transportation.

The USD 36-billion investment by Paris on a new, 200-kilometer subway line, will be paid back in approximately ten years. The French capital is also introducing a driverless system that will transport an additional 70,000 passengers at peak times on the city's oldest and most widely used line, removing hundreds of cars from the streets.

An even more example is the yellow line in São Paulo, which transports approximately 700,000 passengers a day, removing thousands of vehicles from the city's roads. Also in São Paulo, smart systems have helped Sabesp to overcome recurrent water shortages in recent years through the integration of software and automation systems that have helped bring water to city's from increasingly distant places.

In Curitiba, electric transport systems are already used at the famous Bus Rapid Transit (BRT) lines, and we have already begun to work with the implementation of a new and much more efficient concept of hybrid electric bus. As for electricity, Light, in Rio de Janeiro, and Eletropaulo, in São Paulo, have begun to implement smart technology to manage the electricity grid.

Smart interventions to the infrastructure of cities can also help reduce air pollution, such as the creation of low-emission zones.

In London, low-emission zones have reduced air pollution by approximately 25% three years after their creation. The congestion charging system in the English capital led to an additional reduction of nearly 5% and also reduced traffic by 20% and travel time by 17%, cutting carbon emissions by approximately 150,000 tons per year. The Berlin Traffic Information Center already integrates all transport modes and operators, resulting in an optimized transport network with lower congestion and pollutant emission.

Making our infrastructures smarter will be essential if we aim to meet the current and future sustainability challenges of our cities, and consequently of our planet.

Many mayors have already understood that a city's success depends on building a globally attractive environment for more economic activity, and that a smart infrastructure is

the key to integrating fully electrified and automated structures into something larger than the sum of its parts. As with other challenges faced by human evolution, technology will again be the great ally of humanity in the challenge of making our cities and countries into prosperous places, with quality of life and prospects for human, personal and professional development.



Paulo Stark

President and CEO, Siemens of Brazil

An STI institution's view

German-Brazilian partnerships and their potential in the sector of "smart and sustainable urban development"

The increasing globalization of value chains in the future market of "smart and sustainable urban development" demands more than ever innovations collaborated with international partners from science and the industry. The international collaboration can increase the expertise and therefore increase the innovation potential of research institutions and strengthen the competitive abilities of the industry to promote solutions for global challenges.

Brazil is the biggest growth market in Latin America and with a population of 192 million people and some of the world's biggest urban agglomerations extremely relevant for the internationalisation of urban systems in the southern hemisphere.

Great potential for a "smart" urbanisation exists in the coastal cities of the Northeast with a demand for infrastructure concepts in the sectors of energy, mobility, security or water supply. In the energy sector 80% of the demand is covered by hydro-dynamic power, the rest is covered by gas-fired power plants. In the field of photovoltaics there are numerous intentions for the implementation of decentralized energy supply in the building sector, which currently are hardly based on regional strategies.

Interesting developments can also be seen in so-called "colonization", mostly on the outskirts of urban agglomerations, where ecologically-oriented infrastructures (for example educational infrastructure) are integrated into the settlement pattern. In the south and southeast of the country there are lighthouse projects, revealing good connectivity for German engineering solutions and technologies.

With contacts to the chamber of foreign trade, the Fraunhofer Office in Brazil, the BDI and the GIZ, there are already promising dialogues towards projects for urban infrastructure concepts and urban development. Besides that, the Fraunhofer IAO and FGV Projetos are establishing a bilateral strategic partnership with the aim of adapting the systematic "Morgenstadt – city of the future" research approach to the challenges of Brazilian cities and implement a first joint City Lab in Brazil.

Academic studies show a worldwide economical „Smart-City“ potential of 1.5 trillion euros until 2020 and an even bigger volume until 2030. If you break down these numbers to a single country like Brazil and its cities, you get an economical potential until 2020 of 750 million euros for a city with 1 million inhabitants, 75 million euros for a city with 100,000 inhabitants and 7.5 million euros for a small city of 10,000 inhabitants. Tapping this potential for an environmentally sustainable and future-oriented development of Brazil should be the common task for German-Brazilian cooperation's and strategic partnerships.



Dipl.-Ing. Mike Letzgus

Urban Systems Engineering -
Fraunhofer Institute for Industrial Engineering IAO

INNOVATION AND TECHNOLOGY DEPARTMENT

The Innovation and Technology Department of the German-Brazilian Chamber of Industry and Commerce aims to foster technological cooperation and entrepreneurial business between Brazil and Germany. To this end, it promotes, among other subjects, the professional training, the main tendencies and the governmental cooperation between the two countries.



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Realization



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Brasil-Alemanha

3.4. Energy

Facts and data

Over the next 20 years, the world will see more innovations in the Electric Power sector than in the entire period since Thomas Edison created the electric light bulb. Global megatrends such as technological advancements, climate change and accelerated urbanization have been creating opportunities and challenges, leading to the emergence of a new cycle led by the increased use of new energy sources, smart grids and more efficient distribution and generation, in addition to the obvious growth in the number of customers. To take advantage of this potential, companies will either need to completely change their approach to adopting new technologies or they will be left out of a broad transformation process that should sweep across the entire industry.

PwC's 19th global CEO survey shows that industry executives are concerned about over-regulation, improving the business environment and the future of the sector, in addition to changes in consumer behavior and the impact of technology on the industry. Another concern is to improve communication with society about the environmental impacts of different activities. Despite the fears, there is some optimism: while 68% of CEOs say that businesses face more threats today than three years ago, 62% see more opportunities now than before. The survey is global, but Brazilian executives seem to hold a similar outlook.

The energy consumed from electricity generation will grow 58% worldwide by 2035, according to BP Energy Outlook 2016 report. Hydroelectric plants will remain the leading source of energy, despite losing some of its share (65%

to 59%), which should occur because alternative sources of energy are likely to grow. Brazil should benefit from this new scenario, given its great potential for the most varied sources of energy, especially alternative ones. According to the report, the country could be a net exporter of energy by 2020.

The energy sector in Brazil has an immense challenge: to expand with security and balance, focusing mainly on market competitiveness, providing quality services, simplifying and reducing bureaucracy in the sector.

The Ministry of Mines and Energy (MME) has stated that the major investment opportunities in electricity over the coming years will be in solar, wind, natural gas and biomass generation. Solar power will grow about sevenfold by 2024, and installed capacity in wind power will triple, as part of Brazil's commitment to deliver 20% of its generation from non-hydraulic renewable sources by 2030.

We could say that, since there are so many alternative sources, those that prove to be more competitive are likely to stand out.



Arthur Ramos

partner, Strategy&, PwC's strategic consultancy, and expert on Energy

A company's vision – Voith Hydro

Experience and innovation in energy storage

As one of the planet's most innovative economies, Germany is a world leader in energy policy. With its bold and ambitious energy transition policy towards a low-carbon, green, reliable and affordable economy (Energiewende), Germany has already set the goal of, by 2050, (1) having 60% of its en-

ergy matrix made up of renewable energy sources; and (2) reduce its greenhouse gas emissions by 80%. The program also calls for the retirement of Germany's entire nuclear fleet by 2022. No other country has been so ambitious. For comparison purposes, a few years ago only 26% of Germany's energy came from renewable sources.

Due to the increasing presence of intermittent renewable sources, such as wind and photovoltaic, the country has been investigating how to avoid the intermittent nature of these sources. How to store the large volumes of surplus energy generated during sunny and windy periods? This is where the concept of reversible plants comes in.

Known and applied since the end of the 19th century, reversible hydroelectric plants are nothing more than giant industrial-scale batteries. The fundamental difference between these and the common batteries we all know is that they do not store electrons, but water. By shifting massive volumes of water between two reservoirs installed at different elevations, reversible plants allow you to store gravitational potential energy by pumping water into the upper reservoir, or to generate energy by whirling and returning massive flows of water to the lower reservoir. The process would be analogous to that of a hydraulic hourglass: the hourglass is flipped over according to a surplus or lack of energy in the system.

With *Energiewende*, it is no coincidence that reversible power plants have gained renewed importance in the new German energy matrix, and with the growing trend towards wind farms around the world, Brazil can benefit from both this expansive technological expertise, as from the regulatory know-how that Germany has acquired over decades of operating these plants. Without having to tread the difficult road of trial and error, Brazil can readily absorb the best practices already established in the German market, adapting them to the specific local nature of the Brazilian Electric sector.

Initially built to provide cutting-edge loads for Europe's incipient 19th-century power grids, reversible power plants have proven their versatility over time, and are currently seen by operators, regulators and manufacturers as true multipurpose facilities.

The first turbine-pump in history was manufactured by Voith – interestingly, it was developed for the Pedreira hydro plant (1939), located in São Paulo. Together with the Traição plant, located on the Pinheiros River, both of these hydro power plants were built in an attempt to increase the capacity of the Henry Borden plant, located at the foot of Serra do Mar, in Cubatão. Nowadays, these plants help reduce flooding in the city of São Paulo by pumping excess water from the Pinheiros and Tietê rivers into the Billings reservoir on rainy days. In Germany, reversible hydroelectric plants have been successfully combined with wind farms to fulfill two main purposes: absorbing surplus loads and regulating the grid's frequency.

With the growing worldwide trend towards adopting wind power, in particular, reversible hydro plants have aroused renewed interest from the Electric sector in general. However, the challenges to adopting this type of power plant require the courage inherent to any innovation process.

With the increasing use of intermittent renewable sources in the Brazilian Electrical sector, the ONS (National Operator of the Electric System) has already realized the need to prepare our electrical system to deal with this new reality. That is why Voith has been working closely with Abaque (Brazilian Association of Energy Storage and Quality) to inform and promote awareness of the need for energy storage as a way to guarantee greater security and reliability for the national electrical system. In addition, the company has been conducting lectures and technical seminars with industry experts in order to present the multiple advantages that these plants can offer to the Brazilian Electric sector.

With the arrival of Industry 4.0 (or Internet of Things), dozens of new possibilities for storing energy will emerge (such as electric car batteries, photovoltaic systems and many others) and be able to perform the same role that only reversible hydro plants have been able to do on an industrial scale. For this, it will be necessary to create compensation mechanisms for those who make their electrical storage capacity available for subsequently supplying the network.

Indeed, there is still a lot to be achieved and to develop in the field of energy storage in Brazil, and luckily we are on the right path. To meet this challenge, we can rely on the German experience, and we are ready to reap what we sow: *Wer ernten will, muss säen*, as they would say in Germany.



Marcos Blumer

President and CEO, Voith
Hydro Latin America

An STI institution's view

Brazil and Germany have a long tradition in cooperation on energy issues. The further deployment of renewable energies is in the focus of both countries. Brazil already plays a leading role in renewable power generation as two-thirds of its electricity production rely on large hydropower plants. In contrast, sun, wind, biomass and hydropower contribute only to one third in Germany.

Feed in tariffs have driven a rapid development of renewable energies in Germany in the recent past. In absolute numbers wind and PV contribute most to the capacity increase. Challenges arise due to the intermittent nature of these technologies. Researchers from universities and companies developed methods to integrate the new technologies into the power system without compromising the high reliability. Still costs are an issue even if unit costs have seen dramatic decreases in recent years. Options are storage technologies or the coupling of the electricity system with the heating system. To store heat is simpler and less costly than storing electricity. The power system needs major changes. New high voltage lines need to transport electricity from the wind rich regions in the northern part of Germany to the strong demand centers in the south. The situation in Brazil is different. The full exploitation of the hydro potential seems unrealistic and is challenged by many opponents. Also here wind and PV need to contribute more in future. Especially solar seems promising due to the other climatic conditions.

Brazil offers huge potentials for renewables like solar and wind energy. Those technologies can be applied in a larger extend in the future to satisfy Brazil's growing electricity demand in a cost effective and sustainable way. Today, solar power in Brazil contributes less than one percent to the power production, although solar radiation is in large parts of the country twice as high as in Germany and its area is 23 times larger. Especially for the increasing number of homes with air conditioning, photovoltaics would be an ideal right on time

supplier. Furthermore, power from the sun could prevent bottlenecks, when hydropower in hot and dry seasons is not sufficient to cover the demand.

German-Brazil investigations in this field already deal with these challenges to transform them into opportunities. Besides exchange programs for students and researchers, a number of projects in the field of energy research is carried out between Germany and Brazil. Organizations like Novas Parcerias (NoPa), GIZ and the German Ministry for Economic Affairs with its initiative "renewables - Made in Germany" help universities and entrepreneurs to conduct bilateral projects. A deeper cooperation would open Brazilian markets for German experiences of the last decades of energy transition. From the integration of decentralized sources as a competitive electricity supply, Brazil would benefit from stabilizing its electricity prices. Closer exchange of knowledge will foster Brazil to use own potentials while creating jobs on the whole value chain.



Thomas Hamacher

Technical University of Munich
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3.5. Industry 4.0

Facts and data

It's no exaggeration to say: the world is currently experiencing the Fourth Industrial Revolution. Companies from all sectors are adopting emerging technologies to improve processes, integrate value chains, store and handle data, and know their consumers better. This movement is also known as digitization, a term that has received much attention from business leaders, and which reflects the impacts generated by a rapid adoption of new technologies.

According to the 19th CEO Survey, a global study by PwC with CEOs of large global companies, 77% of 1,409 respondents said that technological advancement is the trend that will most impact business over the next five years. Brazilian CEOs are definitely quite concerned about this topic. But that doesn't mean they are adapted to the upcoming changes, especially to manufacturing, a sector that is still very much analogue in our country.

A PwC study held this year in Brazil, called Industry 4.0, showed that national companies are little digitized in comparison with the global average. About 9% of Brazilian respondents rated the level of "digitization" of their companies as high – compared to 33% in the global average. The fact that the worldwide number is also low is an unmistakable indication that we are in the midst of the digital revolution.

Also noteworthy in this study is that the adoption and processing of data (big data), the impacts of cloud solutions, drones and the Internet of Things (IoT) are essential tools for

companies that seek groundbreaking developments in their business processes, whether to cross-reference information from data based on consumer behavior and that can be used to send customized offers (as just one example), or to better connect humans and machines for greater operational efficiency.

Finally, increased digitization depends on a number of factors and, according to CEOs, investments in cyber-security (made to increase leaders' trust in the digital environment) and the lack of a digital culture are challenges that need to be overcome. The fact is that the revolution brought about by Industry 4.0 affects the goods and service industries – as well as consumers. And adapting to it is a must for anyone wishing to thrive in the coming years.



Sérgio Alexandre
partner, PwC Brasil and expert
on Digital

A company's vision – Siemens

Digitization is at the core of the Fourth Industrial Revolution

What do the development of Formula 1 cars, Disney theme parks, rocket manufacturing and a new production line project all have in common? The answer is simple: the integration between virtual and real, in a process we call digitization. Based on the integration of digital, mechanical and automa-

tion systems, the so-called Fourth Industrial Revolution is already changing the rules of the game, creating new business models and establishing new paradigms in the means of production. It also incorporates new terms into industrial jargon, such as additive manufacturing, big data and mass customization, to mention just a few.

Behind these concepts is the survival of industry as a relevant and competitive factor in national economies. Only a high-quality, flexible and efficient production can ensure that industry meets the needs of an increasingly demanding and exclusive consumer.

Digitizing the industrial environment means incorporating the hardware and software into the solution presented to the customer, which means that the entire manufacturing process, from product design, product simulation, production engineering and production simulation are all done virtually but with incredibly realistic detail, requiring less financial and time investments.

A new industry is emerging, increasingly based on flexible and efficient production with a high degree of quality, ready to meet the needs of an increasingly demanding and exclusive consumer. Mass customization is one of the demands for this new industry. And digitization is a great ally of the new industry, helping lower costs and increase quality levels. A global PwC survey of 235 companies showed that investing in digital technologies resulted in an average efficiency improvement of 20%.

In Germany, where the term Industry 4.0 was coined, the country's government, businesses, universities and trade associations have formed a coalition to try to further increase local competitiveness. And digitization is one of the paths to achieving that goal. A study by the Booz & Company consultancy firm for the 2013 World Economic Forum shows that a 10% increase in countries' investments in digitization results in a 0.75% growth in GDP and a 1% decrease in the unemployment rate. According to the report, these technologies have recently resulted in the creation of 400,000 highly skilled jobs in Europe and the United States, and 3.5 million jobs in the Asia-Pacific region.

Along with electrification and automation, digitization is currently part of Siemens' strategic pillar, and the company has invested in the acquisition of software companies focused on digitization as part of its investments in Research and Development. Digitization has become the company's flagship, and for good reason.

Considered to be the best factory in Europe, with the highest efficiency and productivity ratios in Germany, the Siemens Electronics Manufacturing Plant in Amberg is a practical example of this new manufacture. With end-to-end digitization, the unit has most of its processes interconnected and managed digitally, with a minimum failure rate. Since its foundation in 1989, production has increased eightfold without the need to expand the physical space, causing the

plant to be seen as a symbol of the future German industry and to collect several awards.

In Amberg, production is largely automated. Machines and computers handle 75% of the value chain autonomously. Products control their own manufacturing process, through an identification code, which tells the machines about their needs and which production steps they will need to perform. This is a sample of what should prevail in the global industry in the near future.

In Brazil, we are also faced with the challenge of significantly increasing our productivity in order to be more competitive in the global chain. Data published by Eurostat (*European Union Institute of Statistics*) in 2013 on GDP generated per hour worked has Germany's productivity at USD 57/hour. In the United States, this index is USD 67/hour, while in Brazil it is only USD 10/hour.

For Brazil and its industrial sector, this may be a valuable opportunity to take a great leap and fast forward right to this new model, avoiding the very costly and recursive investments that the pioneers had to make during the automation era, and investing directly in a light, flexible, efficient and digital automation. Otherwise, the country is likely to increasingly distance itself from developed nations and devolve economically, which implies in high social costs, unemployment and new "lost decades."

It is therefore important that the private and the public sectors work together to create an agenda for the digitization of industry in Brazil, and to support initiatives that will increase competitiveness and add Brazil to the group of countries that are currently on a path to integrated manufacturing, with high added value and productivity.

The disruptive power of the Fourth Industrial Revolution is quite evident. It is up to us to glimpse the opportunities and make a move to shape the future according to the lessons from the present and the past, ensuring a sustainable development environment. The other alternative, which is staying put, can cost us dearly.



Paulo Stark

President and CEO, Siemens
of Brazil

An STI institution's view

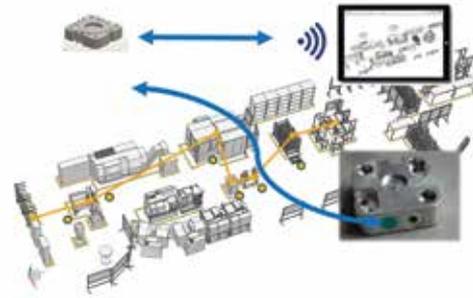
Smart Products and Smart Manufacturing

Both the Brazilian and German industrial sectors face challenges posed by the global economy, which demands that manufacturing companies to reduce costs and time-to-market of new products, as well as meet various customer needs with a broad range of product configurations. Adaptability and potential for innovation become crucial factors to improve competitiveness in an ever-changing marketplace.

The proposals and opportunities brought about by Germany's Industrie 4.0 Program offer a platform to both respond to these challenges and meet the market's need for individualized products at competitive prices. On the other hand, the robust research partnerships established between renowned German and Brazilian research centers are vital for the development and appropriation of this new knowledge – at the same time, the support of funding agencies from both countries and integration with industry players as determinants for funding the development of this technology.

The challenge is to enable a product's real components to store all the information that defines them, as well as the information of the productive process through which they have passed. By integrating these components into a digital network (such as the internet), we create the possibility of interacting with the manufacturing environment through these Smart Components. These Smart Components can control the manufacturing processes and their movement within a factory. Together with other smart or conventional components, they comprise Smart Assemblies and Products. Examples of this application include the identification of failures in the manufacturing processes of individual components, or the use of data from individual components to form optimized pairs of components in complex assembly processes.

The new concept of components as information carriers will have to be examined from two different perspectives. One is focused on capturing and structuring the broad range of data that must be addressed in an integrated component data model. The other, on examining what new processes are needed and how Smart Components interact with the production environments and with the people in these environments.



Source: Anderl; Schützer - Project SCoPE

In this area, there are significant binational initiatives, such as Project SCoPE (Smart Components within Smart Production Processes and Environments), funded by the BRAGE-CRIM Program (Brazilian German Collaborative Research Initiative on Manufacturing Technology). However, there is still the need to consolidate these objectives with a research incentive agenda based on these topics and with the effective support from incentive agencies through a priority program for Engineering.



Prof. Dr.-Ing. Klaus Schützer

Director of the Laboratory for Computer Integrated Design and Manufacturing (SCPM) of the Methodist University of Piracicaba (UNIMEP)



Prof. Dr.-Ing. Reiner Anderl

Director of the Department for Computer Integrated Design (DiK) of the Technical University of Darmstadt (TUD).

3.6. Infrastructure

Facts and data

It is safe to say that one of the great obstacles of Brazil is its inadequate infrastructure, which contributes to the high level of the so-called “Brazil cost.” While it is true that this makes our economy less competitive, it is also a fact that these shortcomings provide great business opportunities for entrepreneurs who operate in several of the industry’s segments, such as transportation, sanitation, energy, and others. Investments in infrastructure also have the double benefit of leveraging growth, both in the short term (through construction, new hires, and so on) and the long term (through the legacy of the works). A study by PwC revealed that governments and companies should invest USD 300 billion in Brazilian infrastructure by 2025 – and most of that will be in Logistics and Urban Mobility.

One of the challenges faced by Brazil is to find out where these resources will come from. In a scenario of short budgets on one hand, and a great need for investments on the other, public agents are forced to adopt sound project management practices. Public authorities are pressed to make smarter spending decisions, which requires improving their project structuring capacities.

In this context, Public-Private Partnerships (PPPs) have already proven to be an adequate alternative to pursue national interests. Governments need to create infrastructure projects to attract the best players in the market. Using in-

stitutions to build a favorable business environment is also essential. In practice, this requires transparency in public budgets and in decision-making, compliance with regulatory framework and judicial decisions, as well as the openness to independent verification of contract compliance.

Another important point is that projects need to be developed so as to attract not only large corporations, but also smaller and foreign companies. The scenario has changed, and they are now vital to getting projects off the ground.

If all these requirements are met, projects will attract the interest of private capital and, more importantly, the country will ensure its development in the upcoming decades.



Marcio Lutterbach
partner, PwC Brazil and expert
on Infrastructure and Transportation

A company’s vision – thyssenkrupp

Infrastructure: how innovation can boost collaboration between Brazil and Germany

Infrastructure is extremely important to Brazil due to the makeup of the country’s economy, based heavily on agriculture, oil and mineral production and the automobile industry.

In order for these areas to enjoy good growth and international competitiveness, the country needs a highly effective transportation system and high-performing steel and energy industries.

Germany has been a long-standing partner of Brazil, with large and medium-sized German conglomerates being very present in the Brazilian automobile and local infrastructure industries.

Within Brazil, São Paulo is home to highest number of German companies, and a perfect example of the synergy and harmony between the two countries.

To Thyssenkrupp, the country's current scenario opens up several infrastructure opportunities, such as increasing the share of wind energy in the national energy grid; upgrading airports and sea ports; the diversified use of biomass for energy and fuel generation; mining and prospecting of high value-added chemicals; as well as the use of special steels in the automotive chain and other materials for the aeronautical chain (aluminum alloys, titanium, nickel and carbon fiber).

There is also space available for civil construction, which should foster industrial segments such as cement production, and the automotive industry's demand for low-carbon solutions.

Thyssenkrupp has been supporting local infrastructure projects and activities through the development of products, processes and sustainable solutions.

Some examples include a large bearing factory for wind farms – of all towers installed in Brazil, half are equipped with bearings produced by thyssenkrupp; the development and provision of transport systems for ports and airports, allowing them to achieve greater efficiency; loading and unloading machinery and systems for the mining industry; ramming and vibration systems for water and soil containment and the local supply of bonded steel.

As an example of the efforts to meet the growing demand for low-CO2 technologies in the automotive industry, we can mention the camshaft factory that Thyssenkrupp opened about a year ago in Minas Gerais. Thanks to its unique technology, it was able to reduce the weight of this set of components by up to 40%, which results in lower fuel consumption, better performance and, consequently, lower emissions.

The company's strategy is to continuously offer products, services and technologies to Brazil's main industries, especially Energy, Biomass, Mining and Automobile, as well as Strategic Areas Such as Chemicals, Oil & Gas, Civil Construction, Transportation and Aeronautics.



Ricardo S. Cardoso
Technology and Innovation
Manager, Thyssenkrupp

An STI institution's view

Investments in Brazil's infrastructure: Opportunities and challenges

The infrastructure challenges currently faced by Brazil are well publicized. The improvements made so far have not been sufficiently broad or fast. Looking at the country's road infrastructure, statistics show that the number of vehicles increased 184% over the last 15 years, while the paved road system rose by only 23%. Due to the lack of adequate infrastructure in all areas, the logistics costs in Brazil are very high.

The last few governments have already understood the essential role that infrastructure has in the country's growth and development. Current President Michel Temer recently launched "Partnership and Investment Programs" aimed at improving infrastructure through private investment. Part of this initiative is the "Grow Program," which encompasses 25 projects in Transportation and Logistics, Energy, Water and Sewage Systems. In order to attract foreign investors, the new notice for bids will also be published in English, and the



period between publication and selection will be extended to 100 days. Projects and new procedures can be attractive to private investors, including German construction companies, port and airport operators, and even river and ocean transport companies.

Due to Brazil's business environment (legal and administrative system, language, economic and cultural differences, and so on), foreign companies must plan their entry into the market very carefully. Doing business in Brazil requires a permanent management team on both sides of the Atlantic. Especially in infrastructure, it is very important to monitor the changing political and legal environment and establish strong relationships, without getting too involved.

Since the middle of the last century, German universities and specialized research institutes (some of them closely associated with universities) have focused on the scientific economics of transport and traffic policies, as well as on shipping, transportation and logistics. Based on their goal of developing guidelines for practical applications, many researchers are strongly involved in supporting technical, economic, environmental, administrative, legal and social policy and business initiatives. In addition, some of them are repre-

sented on the Consultative Council of the Federal Ministry of Transport and Digital Infrastructure, or were involved in the elaboration of the Federal Plan for Transport Infrastructure (*Bundesverkehrswegeplan*). Others provide commercial consultancy services to logistics and infrastructure companies.

The DHBW Department of Shipping, Transportation and Logistics in Lörrach conducted a considerable amount of applied research in the Brazilian transportation sector and established agreements with several Brazilian research institutions.



Prof. Armin F. Schwolgin

State University of Baden-Württemberg (DHBW Lörrach) and Head of the Department of Shipping, Transportation and Logistics

3.7. Mobility

Facts and data

When a country's transportation and logistics infrastructure is inadequate, the cost of goods and services increases. This situation is bad for domestic consumption, as companies and citizens pay more for goods, but it is also negative for foreign trade, because the additional cost of logistics makes the exported product less competitive. Investments in this area tend to be very large, complex and take a long time to be executed.

Therefore, if public authorities want to ensure the participation of private agents in this market, they need to work to lower regulatory complexity, establish clear definitions of the responsibilities of private economic agents, ensure asset protection, legal security, and other issues. In order to be successfully executed, projects also require proper planning, structuring, and funding. In the case of Brazil, which competes globally to attract international funds with Asian countries (which currently attract more investments), settling these issues is a critical step.

Apart from these issues, companies in the Transportation and Logistics sector have to deal with challenges and opportunities that emerge due to the technological development that changes these organizations' strategies. These new technologies include geolocation, advanced man-machine interaction interfaces, authentication and fraud detection, 3D printing, the use of smart sensors, big data analysis, customization in multilevel interactions with customers and suppliers, cloud computing, the widespread use of mobile devices, virtual reality and the interconnectivity provided by the internet.

In a survey conducted by PwC with global industry CEOs, 37% of respondents said they have already reached an advanced level in the use of technologies to gain competitiveness for their business. Approximately 71% believe that they will achieve a high level of adoption of technologies. While CEOs see digital technologies as one of the tools for solving their problems, the training required to adapt the workforce to these technologies represents a major challenge. Until physical infrastructure issues are not solved, the tools enabled by the digital and technological transformation provide transportation and logistics companies the means with which to create competitive advantages and improve their position in the market, by taking advantage of new opportunities that arise with the country's logistical deficit.



Marcio Lutterbach
partner, PwC Brazil and expert
on Infrastructure and Transportation

A company's vision – Robert Bosch

Self-driving and future mobility

In the future, mobility will be automated, connected and electrified. With that in mind, the Bosch Group has been making great efforts to offer multi-modal solutions that follow these three conditions. These are technologies aimed

at a more economical, comfortable and environmentally friendly commute – factors that drive one of the most innovative companies in the world to develop cutting-edge technologies and to be an agent in the quest for smarter and more sustainable mobility.

With the development of driver assistance systems and self-driving technologies, for example, Bosch is pursuing an important goal, which is to contribute towards accident- and injury-free roads. Electric and self-driving vehicles, big data and different models of mobility services, which will improve user safety and experience, are some of the trends that will provide major contributions towards resource conservation, environmental protection, energy efficiency, safety and comfort.

Another important innovation driver at Bosch, which also guides the company's current developments, is the increasing interconnectivity of people and products on the internet, as well as new services and business models resulting from this connection – the Internet of Things and Services –, and which will make the lives of future generations safer, simpler and more efficient.

Some of these innovations are already available in the Brazilian market, in hybrid and electric cars, for example. However, 100% self-driving vehicles are not expected on Brazilian roads anytime soon, due to several factors that include the country's infrastructure and legal framework. However, driver assistance systems are becoming increasingly closer to being a reality, since the electronic stability program (ESP), which is the technological basis for many of these devices, will be mandatory in all new vehicles manufactured in Brazil or imported as of 2020.

In addition, some vehicle models sold in the Brazilian market – including imports – already have technologies such as

park assist, overtaking sensor, automatic headlights, and an advanced telematics system that offers the driver emergency, safety, navigation, concierge and connectivity services in a single device.

Despite the trend towards an increasingly automated, connected and electrified mobility, Bosch continues to invest in systems and technologies that aim to make combustion engines cleaner and more efficient, since vehicles with this type of engine will still be on the world's roads and highways for a long time.

Developing innovative products and services that bring excitement to its customers is one of Bosch's main goals. In short, that means exceeding expectations and offering something that can improve the quality of life – that is "Technology for Life."



Carlos Abdalla
Marketing, Communication
and Institutional Relations
Manager, Bosch Latin America

An STI institution's view

Ecological urban mobility is necessary and feasible

The urban mobility in Brazil and Germany develops according to similar trends, even though the conditions are different. In both countries it is necessary to reduce the motorized individual transport with fuel engines in favor of public and bicycle transport. In Germany as well as in Brazil (especially in Rio de Janeiro and São Paulo) good operating experiences have been made regarding the expansion of the bike lanes and the development of bike-sharing systems. However, the public transport must change, too. The era of high-emission, noisy, diesel-engine buses is over, and the subway construction in the metropolises is not feasible anymore. Instead, environmentally-friendly, powerful trams must become the

backbone of public transport in big and middle-sized cities, as is the case of the successful implementation of the VLT (Light Vehicle on Rails) in Rio de Janeiro (RJ) and in Santos (SP). Furthermore, buses must be changed to electric traction, too. German companies can offer a great deal of know-how for these changes towards public electric mobility in Brazil.

Besides that, it remains important to question the dominant role of motorized individual transport and offer alternatives. Here, the world-wide successfully introduced car-sharing systems by Mercedes-Benz (car2go) and BMW (drive now) could play an innovative role. With these systems, registered users book, via an app, a vehicle out of a fleet of cars distributed all over the city. They drive the car as long as they want and pay



for the time spent. In Germany, over one million people are using this innovation. In Berlin, 1500 vehicles are available for users of car2go. Regarding the great dissemination of gated communities in Brazil, it would also be economically feasible to develop "fixed station car-sharing". Here the client books a car at a fixed station, e.g. in his living area, and can only park the car at another station, e.g. his workplace in the center of the city. Advance booking guarantees availability. If the car-sharing system is planned in the inner-city, the combination with electric automobiles is desirable.

In almost all of Germany's big cities nowadays, there are already bike- and car-sharing systems, some of them in connection with electric mobility. The ecological benefit and the economic viability are scientifically proven. As an example, the Berlin Innovation Center for Mobility and Societal Change (INNOZ) has conducted many international studies. The praxis-oriented products of the INNOZ, such as mobility-apps, smart

grids, and feasibility studies can – in an adapted manner – also be applied in Brazil. Furthermore, joint projects in line with the initiative "Future City" of the German Ministry of Science and Research (BMBF) can be developed. The possibilities for cooperation in the area of urban mobility between Germany and Brazil are manifold. The prerequisite for a sustainable urban mobility is the overcoming of mental barriers and outdated mobility concepts.



Dr. Martin Gegner

Researcher at Innovation Centre for Mobility and Societal Change Germany
- InnoZ GmbH

3.8. Health

Facts and data

Due to its specific characteristics, the Brazilian health system is one of the largest in the world. After all, the country has a population of 200 million people and a universal coverage system guaranteed by the legislation, known as the Unified Health System (SUS). The private hospital network is also large: there are more than 4,000 hospitals, 270,000 beds and 1,000 health plan operators with beneficiaries.

The numbers are massive, and indicative of the investment opportunities that the country represents. In addition, the population is aging, which increases the demand for more healthcare; hospital services are spread throughout a vast geography; there is a low level of market concentration, either geographically or by specialization; and there is great potential for efficiency and productivity gains.

With the economic crisis that the country is facing, however, the sector has suffered some consequences. According to the Institute for the Study of Supplementary Health (IESSE), there was a 6.4% drop in the number of insured individuals in June if compared to the same period in 2015, and the number of operators fell 23% – bringing the number of active operators down to 237. The market has been working to overcome this difficult moment. One of the examples is the discussion about the creation of a “popular” health plan, which should be cheaper and feature less requirements than those currently imposed by the National Supplementary Health Agency (ANS).

The pharmaceutical industry, in turn, felt less the impact of the crisis. Medicine sales rose 7.5% in 2015, while GDP fell by nearly 4%. However, the segment does seem to be slowing down when compared to previous years – between 2010 and 2014, sales grew at an annual average of nearly 13%.

Given the current Brazilian scenario, the numbers are quite positive, and industry executives are optimistic.

A global survey of CEOs conducted by PwC shows that 48% of pharmaceutical executives are very confident about their business growth over the next 12 months – which is higher than the overall average for all industries (35%). If we extend the horizon for the next three years, this optimism is even greater. The survey is worldwide, but there are several reasons to believe that Brazilian executives are equally optimistic. Among them, the sale of generics, which still represents only 26% of the total, and several government initiatives to stimulate the pharmaceutical industry, such as the decision by BNDES to invest BRL 400 million in the construction of two factories and the support to technology transfer programs.

Therefore, even though executives are currently dealing with the results of an economic crisis, the characteristics of the country’s population and of its healthcare market allow us to expect a sharp recovery in the coming years, both in pharmaceuticals and other related industries.



Eliane Kihara
partner, PwC Brasil and expert
on Health

A company's vision - Bayer

Innovation is in our DNA

Many people believe that a corporation exists primarily to make a profit. And profits are certainly very important, but for some time now it is not the sole and primary purpose of entrepreneurs, regardless of the company size. A very positive example of this shifting of change in mindset is the growth of the open innovation model, which brings large companies and startups together. Companies are becoming increasingly aware of the transforming potential of this type of relationship.

Since its inception, Bayer has always invested in cutting-edge technology to deliver more and better in a joint effort with its employees around the mission of "Science for a Better Life." Today, the company also strives to exploit the digital revolution in order to strengthen its business leadership. No wonder our global motto is "passion for innovation." Promoting innovation is in Bayer's DNA, and, in an increasingly connected world, the possibilities are endless.

And how do we do that? With a focus on producing knowledge and promoting education. In the last 153 years, we have worked on a daily basis to be a transforming force in healthcare around the world, and we have been doing the same in Brazil for 120 years. We want to demonstrate our innovative capacity, but also open doors by combining our experience with the ideas of other experts. Good partnerships are the key to innovation and success. The newest challenge is the Grants4Apps program of our Open Innovation portfolio, which seeks to impact the life of sciences industry with cutting-edge ideas. We employ Design Thinking methodology to look for high added value solutions for the company. The team consists of people with different experiences, cultures, and hobbies. The current team, for example, features two employees from Brazil, one from Germany, one from Singapore and another from the United States.

Grants4Apps is one of the initiatives that aims to create an environment conducive to the advancement of digital innovation in healthcare. Founded in 2014, it provides office space at the Bayer HealthCare facility in Berlin to five Digital HealthCare startups. Its mission? To discover digital projects that reinforce our culture of innovation and foster more qual-

ity of life for people. This year's edition is focused on projects in Women's Health, Cardiology, Ophthalmology, Hematology, Oncology and Radiology. The company seeks tools aimed at issues such as disease prevention, increased adherence to treatment by patients, clinical trials, awareness or management of clinical conditions.

Another project that combines innovation and education is Startups Connected, in partnership with the German-Brazilian Chamber of Commerce and Industry. The initiative is part of the AHK Startups Accelerator program. As one of the sponsors, Bayer supported the Life Sciences category, aimed at startups with innovative solutions for Agriculture or Human and Animal Health. Also, the result of partnerships between the company, startups and academic institutions, Grants4Tech is aimed at experts in the field of robotics. Potential candidates may submit their projects to the production area, and the six finalists will have the opportunity to present their solutions in Berlin, in May 2017. Three winners will receive prizes of up to EUR 40,000.

We believe firmly in the transforming capacity of working together with great minds. These programs are some of the platforms we use in search of digital projects to strengthen our innovation culture and our mission to use science to improve lives. Great ideas often show up in unexpected places. That is why, above anything else, we base our choice on the potential impact that the solution can bring to society and/or its target audience.



Paulo Pereira

Director of Corporate Communications in Brazil, Bayer Group

An STI institution's view



Work together to seek new solutions for healthcare

The continuous growth of Brazil's middle class has enabled more people to access more complete and adequate healthcare services. In addition, both in Germany and Brazil there is also a major ongoing demographic change when it comes to the population's age, due to low birth rates and a longer life expectancy. This has led to a strong demand in both countries for modern and efficient diagnostic technologies and treatments, which has become one of the most discussed topics by the economic, scientific and health institutions of the public and private sectors.

More than ever, great funding opportunities have been created for research and development projects in the field of medical technology. Collaborations with Brazil will continue to receive funding from government agencies due to the need for new technical solutions for the sector, even if the country's outlook is not the most optimistic right now.

For both countries, relevant topics include solutions in the optimization of processes in hospitals and medical offices, such as length of stay, treatment and recovery. These include automated support systems to determine results, telemedicine solutions, new technologies for surgery to mi-

nimize trauma, new biotechnologies for use of modern implants and prostheses and the development of new drugs for the treatment of viruses and diseases.

This extensive and interdisciplinary research area leads to a growing number of research groups and programs that deal with the fields of medical technology and health. The exchange of students between the two countries has continued, despite the "Science without Borders" program, which was funded by the Brazilian government. Both sides hope that the collaborative efforts can continue to be expanded over the next few years.



Dipl.-Ing. Tobias Zobel

Director of the Central Institute of Medical Engineering (ZiMT) at the Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU)

3.9. Information Technology

Facts and data

It is no exaggeration to say that, in a medium- to large-sized company, all procedures must go through computer networks – from sales force automation to storing customer data, or from process control to supply chain management. And digital technology is behind all of these processes. The solutions are increasingly comprehensive and innovative. The productivity gains from the use of technology are unquestionable – and as it advances, new possibilities arise to create digital business models or to gain additional efficiency gains. A key issue in the digital age is information security in association with cyber risk.

One of the biggest concerns of business leaders is the efficient management of cyber security risks. An intrusion into the company systems may cause irreparable operational impacts or generate significant financial and reputation damage. Cyber criminals around the world seek anything that might somehow be monetized, ranging from the traditional theft of passwords and credit card numbers to intellectual property information, secret formulas, customer bases, commercial strategies and even personal data of CEOs that could be used for blackmail.

Here is some bad news: Cyber attacks have been increasing in frequency, severity and impact. Criminals have been acquiring skills that allows them to operate increasingly sophisticated processes and technologies. Many organizations do not know what to do or do not have the tools to combat computer crime.

PwC's Global Information Security Survey showed that the average number of cyber security incidents in enterprises increased by 38% worldwide between 2014 and 2015. In Brazil, that increase was even bigger: 274% over the same period. In absolute numbers, the global survey showed that organizations suffered an average of 6,853 incidents over the course of one year. That average is also higher in Brazil: 8,695 incidents in 12 months. The data is surprising and reveal an increase in cyber crime activity and, at the same time, efficiency by companies in detecting such incidents.

Another interesting number from the survey is the average loss incurred by Brazilian companies as a result of cyber incidents: USD 2.5 million. On average, Brazilian companies invest USD 6 million in cyber security.

The digital era has brought profound changes to society, governments and organizations. In order to fully enjoy the benefits of technological advances, companies must be able to keep their technological environments safe and reliable.



Edgar D'Andrea

partner, PwC Brasil and expert
in Information Security

A company's vision – SAP

Innovation Made in Brazil

The Brazilian subsidiary of SAP is always at the forefront of innovation, bringing the main technologies developed and launched by the company in Germany and other parts of the world to Brazil.

Brazil is an important development hub for the company due to its research and development center known as SAP Labs Latin America, which serves all of Latin America. Located in the city of São Leopoldo, in Rio Grande do Sul, it promotes the most advanced technological innovations.

The prototypes developed represent an opportunity to spread local creation to any organization around the world. An example is Stara, a Brazilian agricultural machinery manufacturer that has developed a prototype, in partnership with SAP Labs, which connects tractors, seeders, distributors and sprayers to the Internet of Things in order to collect data. The information can be used by farmers in real time and integrated with management systems to make better decisions about planting, soil preparation, spraying and harvesting processes.

By combining the information from the sensors with those from the GPS systems, workers can determine the best place to plant each seed, with millimetric precision. This avoids wasted supplies (farmers no longer just plant the seeds and pray for something to happen) and reduces the use of fertilizers, because the seed is planted in areas with better nutrients.

In order to take advantage of this wealth of data, including historical weather reports or market transactions, farmers must adopt a big data solution that is capable of processing information in real time. It can be used to create short- and long-term simulations, and thus respond to unexpected situations such as droughts and floods caused by climate change or the emergence of new market demands. It can also be used to track products with great detail across the entire chain of production and supply, from soil preparation to harvesting and packaging of foods.

There are dozens of other examples of how innovation can help companies down the path of digital transformation to become more efficient by adopting technologies like big data, the internet of things, cloud and analytical applications.

SAP's constant exchange of knowledge at a global level enables local organizations to access state-of-the-art technology. This is the SAP advantage.



Afonso Lamounier
Vice President of Government
Affairs, SAP Brazil

An STI institution's view

Artificial-Intelligence: a must-have topic in the Brazil-Germany Scientific and Technologic Agenda

The World Economic Forum of Davos, famous for global conjuncture analyses, in 2016, delved on "Mastering the Fourth Industrial Revolution". Not surprisingly, the main takeaway was the agreed seminal importance of Artificial Intelligence (AI) for the future of the already starting next revolution for humankind, also advocated by Davos founder and organizer,

Klaus Schwab. Participants concurred that the current technological moment, especially because of current disruptive technologies (e.g. 'internet of things', 'big data', 'cloud computing', 'deep learning' among others), is not only the beginning of the new revolution but that AI developments will be driving the process.

On both sides of the Atlantic, Brazilians and Germans have already understood the need to encourage/support not only



the soft landing of the just apparent insurmountable change of the new paradigm of Industry (into 4.0), but all its “aftermath”. Of course, there will be no catastrophe, no dramatic changes, no shock, especially because we are already taking some preparatory and thoughtful measures. Additionally, as a society, we are somehow ready for welcoming big changes since we experienced, not so long ago, the inception of the information society. And the extensive discussions held are getting us prepared to shape up this new era, in which massive interconnection of machines will be spiced with powerful adaptation new abilities.

In the Governmental scope, Brazil and Germany are also in sync, as in many occasions and for a long time they work side-by-side to identify opportunities and target problems. A nice example of that is what Capes (Brazil) and Alexander von Humboldt (Germany) Foundations have been doing together by organizing every year, since 2010, BRAGFOST (Brazil-Germany Frontiers of Science and Technology Seminar).

Academies of Brazil and Germany are also pairing up to great extents, especially on topics such as Smart ICT. And just for providing a practical example of how prone collaborations across the pond are, in my sabbatical leave in 2015 at WWU Münster, what was supposed to be one single visit to a German colleague of ERCIS (European Research Center for Information Systems at WWU) quickly gave rise to research collaboration with many others chairs there, six PhD research

grants were granted because of that, and network formation discussions took place with RWTH Aachen, University of Bremen and European Academy of Technology and Innovation Assessment. This was made possible also because conversations were permeated by computational intelligence, this topic of so high interest to industry with direct applications to supply chain management, parallel computation, e-commerce and decision support systems.

Will somebody be left out? Yes, as always, but not so much if Artificial Intelligence is kept central in our research agendas. In such revolutionary scenarios, wide and quick dissemination of information as well as narrowing gaps among players of the innovation helix (academia, industry and government) are deemed seminal. Meanwhile let us toil collaboratively for the accounts be favorable to the betterment of our societies.



Fernando Buarque

Associate Professor at School of Engineering, University of Pernambuco, Visiting Professor to ERCIS, WWU Münster

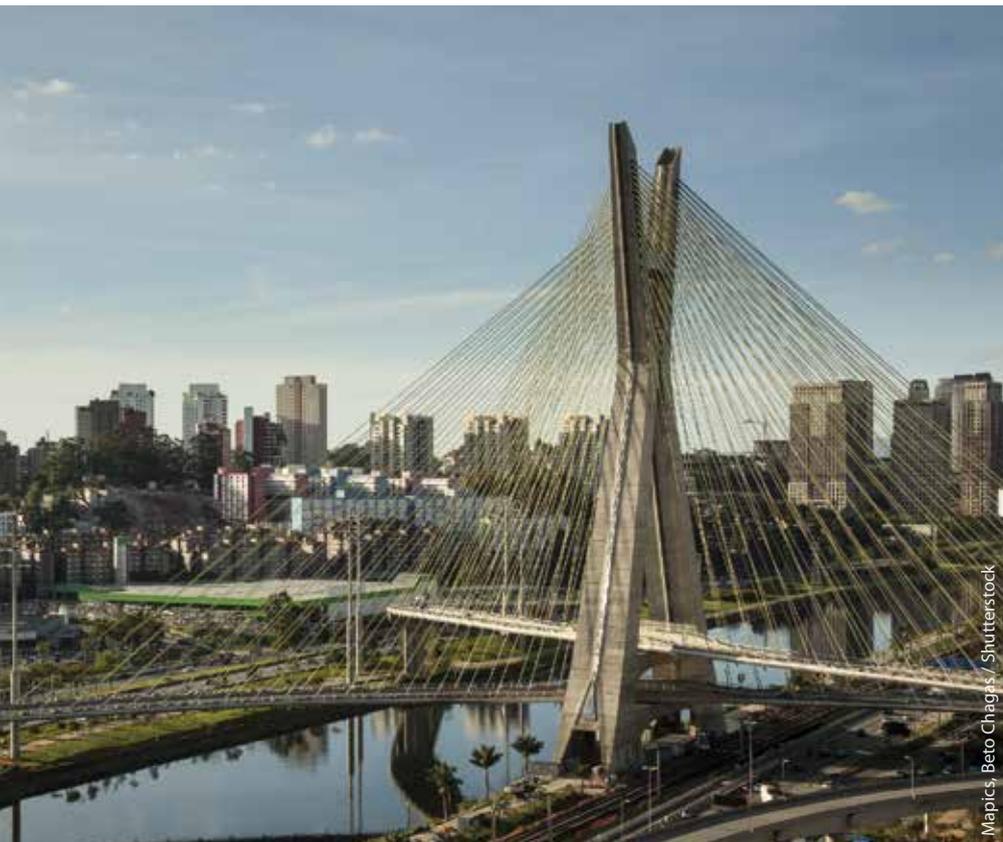


4

Bilateral Projects

To Brazil, Germany has been an important strategic partner in innovation for almost half a century - more specifically since 1969, when the countries signed the Basic Agreement for Scientific Research and Technological Development. Collaborative efforts between both countries hold great potential, as their resources and needs complement each other, which creates a capacity for projects that are highly beneficial to both economies today.

The German-Brazilian High-Level Consultations, which were established in August 2015 following German Chancellor Angela Merkel's visit to Brasília, was a demonstration of the importance and the strengthening of dialogue, since global issues have been consolidated and expanded, such as the increased cooperation in science, technology and innovation. During the event, the MDIC (Ministry of Development, Industry and Foreign Trade) and the BMWi (Federal Ministry of Economy and Energy of the Federal Republic of Germany) signed a "Joint Declaration of Intent for Bilateral Cooperation on Research, Development and Innovation", and launched a request for proposal for "Joint RD&I Projects" between Brazilian and German companies. It should be noted that Brazil is now part of a limited group of countries with which Germany has entered in such partnerships (currently ten countries), and the only one in the Americas.



In the same year, representatives also signed a “Memorandum of Understanding” aimed at promoting co-operation between the Fraunhofer Society and the Brazilian Corporation of Industrial Research and Innovation (EMBRAPII) for the training of researchers and RD&I management professionals. The partnership allows Brazilian companies with projects in the same fields supported by EMBRAPII to access the expertise and excellence of the Fraunhofer Institutes.

In addition to the agreement with EMBRAPII, the Fraunhofer Society and National Service for Industrial Education (SENAI) signed a cooperation agreement in 2015 that allows all 15 of SENAI’s Operational Innovation Institutes to enter into partnerships and access the innovations produced by all 67 Fraunhofer Institutes, especially those technologies that are not currently available in Brazil. One project, developed together with the Fraunhofer Institute of Production Systems and Design Technology aims to establish a collaboration between the Brazilian and German industrial sectors, within the scope of Industry 4.0, an essential theme to ensure the competitiveness of tomorrow’s industry in both countries.

It was due to initiatives such as these, especially with the incentive to joint efforts between Science and Technology Institutes and companies, that 2015 became known as a crucial year for technological cooperation with Germany. The tools and instruments created generates opportunities for innovation and allowed the productive sector of both countries to access new markets. The aligned and coordinated efforts of government institutions, together with the excellent work of the German-Brazilian Chamber of Commerce and Industry (AHK São Paulo), holds potential to continue leveraging bilateral projects in strategic areas of both economies.



Marcos Vinícius de Souza

Secretary of Innovation and New Business of the MDIC (Ministry of Development, Industry and Foreign Trade)

Smart Components within Smart Production Processes and Environments - SCoPE

Description and purpose

The manufacturing sectors have been continually faced with challenges imposed by a globalized economy that requires manufacturing companies to shorten the time to market for new products, respond to customer demands by offering a wide variety of product customizations and at the same time to reduce manufacturing costs, challenging countries such as Brazil and Germany to develop flexible and adaptable production units. The strategic initiative proposed by the German Government as a Fourth Industrial Revolution, *Industrie 4.0*, aims to respond to these challenges and improve the competitiveness of the manufacturing industry by creating highly adaptable factories that use cyber-physical systems embedded in products and production environments. As part of this vision, this research project seeks the digital and intelligent integration of the entire production environment, offering support for both the simulation and optimization of processes through the development of digital models of the production environment, as well as to promote individual physical components to becoming information carriers, with data of their physical properties, customizations, manufacturing history and application. Such information-carrying components can communicate with production databases containing manufacturing processes, or assembly plans, becoming "Smart Components". These "Smart Components" are then able to control the manufacturing and assembly processes applied to them and to navigate autonomously in a factory equipped with cyber-physical production systems. They can be used to determine the traceability of the individual components' manufacturing history, for investigations in the case of failures, or the use of component data to obtain optimal pairs of components within complex assembly processes. To support this new approach, a new concept is required for the structured specification of component data, i.e., an integrated component data model, or "Component Model." In addition, the processes must be developed in order to allow for the introduction and support of Smart Components within manufacturing.

Model of partnership/cooperation used

This project is linked to the BRAGECRIM Program (Brazilian-German Collaborative Research Initiative on Manufacturing Technology) which obtains funding for research projects from CAPES (Coordination Agency for the Improvement of Higher Education Personnel) and DFG (German Society for Research Support). The projects are developed collaboratively with research activities distributed among the partners and an intense exchange of researchers and knowledge in both directions.

Main impacts of this project for Brazil and Germany

Among the goals to be achieved by the project, stand out:

- Implementation of the component integrated data model, which will allow each instance of a component to have all of its data represented, thus enabling the creation of Smart Components;
- Implementation of supporting systems for the so-called Cyber-Physical Production Systems, which will interact with the Smart Components;
- Implementation of production systems that support the construction of Smart Prototypes that will be comprised by the Smart Components;
- Training of researchers in Brazil and Germany on this discipline.

These goals must be achieved with the participation of industries from Brazil and Germany, with the knowledge developed throughout the project being transferred to the industry, allowing the project to obtain new knowledge and learn of new challenges following its application in a real production environment.

This project featured the participation of **Prof. Dr.-Ing. Klaus Schützer**, Director of the Laboratory for Computer Integrated Design and Manufacturing (SCPM) of the Methodist University of Piracicaba (UNIMEP), as the project coordinator in Brazil and **Prof. Dr.-Ing. Reiner Anderl**, Director of the Department for Computer Integrated Design (DiK) of the Technical University of Darmstadt (TUD), as the project coordinator in Germany. The project includes the researchers: **Prof. Dr. Eduardo de Senzi Zancul**, head of the Laboratory for Innovation Management of the Polytechnic School of the University of São Paulo and **Prof. Dr. Alexandre Simon**, of the Graduate Program in Product Engineering at the Methodist University of Piracicaba (UNIMEP).

Fraunhofer Project Centers

The Fraunhofer Projects Centers (FPCs) in Brazil are the result of a partnership between the Fraunhofer Institutes and leading Brazilian R&D institutions which, together, promote applied research geared towards the local industry sector and seek to meet the most varied technological demands, within the scope of public programs and agreements.

The FPCs work to develop new solutions: they improve and enhance not only products, but also existing processes and organizational structures; help accelerate projects and move from development to production in a short span of time; conduct market analysis and feasibility studies; incorporate new technologies and obtain licensing. In addition, they also work with testing and certifications.

There are currently two project centers in the country: the Fraunhofer Project Center for Software and Systems Engineering UFBA (FPC-UFBA) and the Fraunhofer Project Center for Innovations in Food and Bioresources at ITAL (FPC-ITAL).

FPC-UFBA is a partnership between the Federal University of Bahia (UFBA), the Bahia State Government and the Fraunhofer Institute for Experimental Software Engineering (IESE). It gathers the research competence of UFBA's Software Engineering Laboratory (SLE) and the expertise and know-how of the IESE to boost the development of innovative software solutions for the market. Located in Bahia's Technology Park, in Salvador, FPC-UFBA has a team of 30 scientists. The main disciplines studied at this center are: Critical Systems; Data



Analysis and Information Visualization; Energy, Oil and Gas; eGovernment; Software-Based Systems for Health Care and Quality of Life; Mobile Applications for Business; and Emergency Crises.

Located at the headquarters of ITAL, in Campinas, FPC-ITAL is a partnership between the Institute of Food Technology (ITAL) and the Fraunhofer Institute for Process Engineering and Packaging (IVV). This Project Center was created to service the industrial sector and help boost competitiveness in all stages of the food and packaging production chain, seeking innovations in process technologies and the development of new products in order to add value along the supply chain. The infrastructure of FPC-ITAL allows it to carry out tests at near-industrial scales, as well as to assess the

economic viability of processes. The main disciplines studied at this center are: Energy and Materials from Renewable Resources; Innovations in Packaging; Functionality, Health and Nutritional Aspects of Food; Quality and Sensory Aspects of Food.



Andrea Mandalka
Head of Fraunhofer Liaison
Office Brazil

Economic and scientific regional collaborative efforts of Medical Valley lead to internationalization

As the only leading medical technology group in Germany, Medical Valley, located in the metropolitan area of Nuremberg (EMN), is currently known for its close cooperation with member companies, universities, research institutes and hospitals.

Its unmatched infrastructure and support for cooperation offer the ideal conditions for research and development, resulting in market-ready products or services. Medical Valley recognizes that the growing importance of the globalization of value chains also create the need to advance in innovation, in ever closer cooperation with international scientific and industrial partners. Medical Valley faces this challenge in close cooperation with the Friedrich-Alexander University of Erlangen-Nuremberg (FAU) as part of an internationalization strategy promoted by the German Federal Ministry for Education and Research (BMBF). New impulses are provided to build strategy-oriented international collaborative efforts, creating and providing new knowledge through complementary skills.

In addition to partnerships with countries known by their technologies such as the United States and China, new possibilities emerge, especially also in Brazil, to take advantage of resources and knowledge that are somewhat

underestimated, and so far underexplored. The selected geographical region, the state of Rio Grande do Sul, stands out for a dynamic entrepreneurship culture, well-equipped hospitals and excellent universities, which are increasingly committed to industrial cooperation. Extensive research projects are currently being planned or executed with universities such as Unisinos, PUCRS and UFRGS, which will require the creation of long-term partnerships. In this context, the integration of companies such as Siemens Healthineers, SAP and medium-sized enterprises is particularly important. The projects are promoted by both the German and the Brazilian stakeholders.



Dipl.-Ing. Tobias Zobel
Director of the Central Institute
of Medical Engineering (ZiMT)
at the Friedrich-Alexander-Universität
Erlangen-Nürnberg (FAU)

Implementation of Dual Mechatronic Education

The project features a Public-Private Partnership (PPP) between Volkswagen of Brazil and the Ministry for Economic Cooperation and Development of Germany (BMZ) through the German Bank for Investment and Development (DEG).

The German-Brazilian Chamber of Commerce and Industry (AHK São Paulo) is responsible for implementing Dual Mechatronics Professional Training in Brazil through its Vocational Training Skill Center. The project is divided into three phases: support, when the main training elements are identified and implemented according to the German model; monitoring, in order to assess whether the methodologies are being applied, and, finally, certification, which occurs through the application of final tests.

Format

The project consists of a two-year training program, mixing theoretical and practical classes in the laboratory, according to the Brazilian educational model (affirmative action), and the addition of a third year of training, when students are hired as employees. In this last year, students will apply the acquired knowledge directly in the company's production environment.

After passing in the dual course, the student will receive the certificate recognized in Brazil issued by SENAI, and the certificate issued by the German-Brazilian Chamber of Commerce and Industry, validated by the German Confederation of Chambers of Commerce (DIHK).

Participants

Volkswagen Brazil implemented this pioneering project, and receives help from partner companies, including B. Grob do Brasil SA, ZF do Brasil Ltda., Mahle Metal Leve SA, Kostal Eletromecânica Ltda. and thyssenkrupp.



Patrícia Caires
Director of the Vocational
Training Skill Center

No-Waste

IFG, Brazil and Germany: new partnerships in Biotechnology

The Federal Institute of Goiás (IFG) has developed RD&I international cooperation projects with Germany for over 16 years. IFG's partnership with German institutions in Bioeconomics was started in 2003, at the German-Brazilian Economic Meeting in Goiânia, resulting in the cooperation agreement with the University of Applied Sciences Hochschule Trier (HS Trier). Between 2005 and 2009, the German Academic Exchange Service (DAAD) funded activities for the exchange of about 35 students and researchers from IFG and HS Trier, resulting in several other projects that include the current Master's Program in Sustainable Process Technology IFG.

The "No-Waste" project, funded by the European Commission (Marie Curie People FP7, 2012), enables collaboration efforts with research entities and companies in Germany,

France, Finland, China and Morocco, aimed at developing sustainable solutions for the use of industrial waste.

The possibilities have expanded since 2011, after the first contacts with the Düsseldorf-based Cluster of Industrial Biotechnology, CLIB2021, at the annual meeting of the Brazilian Society for the Advancement of Science (SBPC) in Goiânia, and the support of the German Embassy in Brazil. The use of waste from the sugarcane industry for its energy and nutrient potential is researched as part of three bilateral projects: i-NoPa (CAPES, DAAD, GIZ, 2014), PuresBio and ASHES (BMBF, 2014), all of which are coordinated by the FZ Jülich and Fraunhofer research centers.

The research is developed as part of partnerships between IFG and German agents such as the University of Rostock, the German Biomass Research Center (DBFZ), the Federal Institute for Research in Materials (BAM), the Karlsruhe

Institute of Technology (KIT), the Leibniz Center for Research in Agriculture (ZALF), as well as companies such as Schauermann Group, Cutec and Outotec. Brazilian partners include the Federal University of Goiás, the National Agriculture and Livestock Laboratory (Lanagro), Embrapa, CNPEM, and companies such as NG Bioenergia.

These partnerships and the support of GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit) in the project "ProBiogas" enabled the implementation of the green chemistry project with the Mining industry, in which biogas from sugarcane is used to generate reducing gases. It is all made possible due to support granted in Brazil and Germany, through the "Biogás Redutor" (Fapeg) and "ProBioSyn" (BMBF - Bioeconomy 2015) projects, which are respectively coordinated by IFG and FH Aachen.



**Prof. Joachim
Werner Zang**
Federal Institute of Goiás,
Goiânia Campus



**Prof. Warde Antonieta
da Fonseca-Zang**
Federal Institute of Goiás,
Goiânia Campus

BRAGECRIM – model for an international innovation network between scientific research and industry

The Brazilian-German Collaborative Research Initiative on Manufacturing Technology (BRAGECRIM) connects more than 30 Brazilian and German universities, research institutes and industrial partners on the topic of manufacturing technology. The goal of the cooperation is the strengthening of the industrial sector as well as knowledge and researchers exchange.

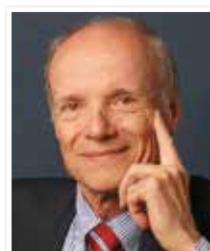
Since its launch in 2009, DFG, CAPES and partially CNPq have jointly funded more than 30 projects. They have a duration of two years (two more years in case of renewal). Five projects are being funded today, and submissions of new proposals can be handed in until June 2016.

Brazil and Germany have had many successful cooperation in all kinds of fields. Yet, there are some deficits hindering an efficient cooperation, which BRAGECRIM aims to minimize. Before BRAGECRIM, the cooperation between both countries were impelled by remote initiatives only. Thus, the network links strategic technological research actions with an international academic program and direct support to the industry. It boosts the knowledge exchange between both countries in research fields (e.g. quality management). A central coordination manages the whole network and an open knowledge forum, spurring the technology and knowledge transfer. Through open international and nation-

al workshops, as well as students' and scientists' exchanges, this program spreads the developed high-end technologies and knowledge.

Furthermore, BRAGECRIM is ought to be a pilot program to set the methodology for future international research cooperation also in other fields of knowledge.

Further information is available at www.bragecrim.rwth-aachen.de



**Prof. em. Dr.-Ing. Dr. h.c.
Dr. h.c. Prof. h.c. Prof. h.c.
Tilo Pfeifer**
RWTH Aachen



Prof. Carlos Eduardo Pereira
UFRGS

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5

Science, Technology and Innovation Institutions

In the last decade, Brazil has made significant progress in Science, Technology and Innovation (ST&I), by implementing and consolidating a comprehensive national policy on the subject. Some of the progress includes expanded training of human resources in several fields of knowledge; the expansion of the country's Research, Development and Innovation (RD&I) infrastructure, with dispersion and reduction of regional asymmetries; the creation and improvement of instruments to promote research and innovation, with advances to improve the business environment through a significant strengthening of the legal and regulatory framework of innovation policies, inducing major advances in the innovative effort of Brazilian companies.

The consolidation of an environment that is conducive to investment in innovation has benefited from initiatives such as the National Institutes of Science and Technology Program (INCT), the Inova Empresa Plan, the innovation programs of BNDES and Finep, the SI-BRATEC networks and establishment of EMBRAPPII. In recent years, Brazil has invested in the expansion of the university system and in the modernization of public research institutes. These investments were key to

producing a contingent of international-level scientists and research groups, increasing the impact of scientific research produced in Brazil in frontier fields of knowledge.

A robust national ST&I system depends on training, attracting and establishing qualified and appreciated human resources, inserted in institutions that are open to national and international cooperation, and which promote high-quality scientific and technological production. One of the policies adopted has been the promotion of research networks, through the integration of the best groups in cutting-edge and strategic fields for sustainable development.

The promotion of basic scientific research and technology is an important tool for finding sustainable economic development solutions. In this sense, mechanisms to connect the knowledge-generating centers and product users become necessary, as they allow access to higher-quality goods and services. Top-priority actions are: strengthening basic and technological scientific research produced by STIs; consolidation and expansion of the INCT program; promoting interaction between STIs and companies; consolidation and expansion of EMBRAPPII's activities; promoting the commercial uses of public research; and encouraging international cooperation with leading countries and institutions in strategic areas.



BookGabe / Pixabay

Major investments in laboratory infrastructure were carried out in the country, especially through funds from the National Fund for Scientific and Technological Development (FNDCT). Research institutes connected to the Ministry of Science, Technology, Innovation and Communications (MCTIC) And universities benefited in recent years from the acquisition of new equipment or the upgrading of existing structures. On the one hand, this progress reflects the nation's commitment to the sector, while, on the other hand, it reinforces the need to keep investment constant in order to ensure the maintenance and upgrading of facilities dedicated to research in Brazil.

Considered an advanced and very promising instrument to strengthen the system of governmental support towards innovation, EMBRAPPII reduces the risks of innovative projects required by companies in the pre-competitive stage by streamlining the innovation process needed to promote the competitiveness of companies, even in an international market.

It is important to strengthen the instruments aimed at expanding the innovation efforts in the Brazilian productive sector, and to improve the capacity of companies and STIs to create and use patents. In addition, it is essential to promote the connection between the business sector and universities and research centers, in order to boost innovative entrepreneurship and its impacts on regional development. Thus, the

generation of technological innovation in the academic environment in partnership with the business sector appears to be a promising path, either through licensing the technology to companies already in the market or by creating new, technology-based companies.

Germany has been a valuable partner in international cooperation programs with our universities. Expanding this cooperation to include technological development and innovation through initiatives that include our STIs and industrial companies is a natural step forward. Successful experiences such as the Bragecrim Program (Brazilian-German Collaborative Research Initiative on Manufacturing Technology), created by the Coordination Agency for the Improvement of Higher Education Personnel (CAPES) and by the Deutsche Forschungsgemeinschaft (DFG), can and should inspire new initiatives.



Alvaro T. Prata

Secretary for Technological Development of the Ministry of Science, Technology, Innovation and Communications (MCTIC)

5.1. Examples of Science, Technology and Innovation networks

EMBRAPII - Brazilian Company for Industrial Research and Innovation

SCS. Qd. 9, Bloco C, torre C, sala 1037 Edifício
Parque Cidade Corporate, Brasília – DF

Contact: Carlos Eduardo Pereira
Chief Operating Officer

Phone: (+55 61) 2196-7766

E-mail: cpereira@embrapii.org.br

AREAS OF EXPERTISE

Information Technology

Electronics and Sensors

Machinery and Equipment

Biotechnology

Smart Cities

Fraunhofer Gesellschaft

Rua Verbo Divino, 1488 - 3º andar,
São Paulo – SP

Contact: Andrea Mandalka
Director

Phone: (+55 11) 5187-5091

E-mail: andrea.mandalka@zv.fraunhofer.de

AREAS OF EXPERTISE

Energy and Resources

Health and Environment

Transport and Mobility

Material and Production Technology

ICT and IT security

Helmholtz-Gemeinschaft Deutscher Forschungszentren / Helmholtz Association

Anna-Louisa-Karsch-Str. 2, Berlin – Germany

Contact: Ute Gerlach
Coordinator of International Affairs and Public
Relations

Phone: (+49 30) 206329-74

E-mail: ute.gerlach@helmholtz.de

AREAS OF EXPERTISE

Energy and Resources

Health and Environment

Transport and Mobility

Material and Production Technology

ICT and IT security

Leibniz Gemeinschaft / Leibniz Association

Chauseestraße 111, 10115 – Berlin - Germany

Contact: Miguel Haubrich Seco
President's Office

Phone: (+49 30) 206049 37

E-mail: haubrich@leibniz-association.eu

AREAS OF EXPERTISE

Biotechnology

Energy

Machinery and Equipment

Technological research in agribusiness

Max-Planck-Gesellschaft zur Förderung der Wissenschaften e.V. /Max Planck Society

Hofgartenstraße 8, 80539 München

Contact: Dr. Andreas Trepte
Latin American Office Director

Phone: (+49 89) 2108-2560

E-mail: trepte@gv.mpg.de

AREAS OF EXPERTISE

Applied Science

Social Sciences

Natural Sciences

Life Sciences

SENAI National Department

SBN Quadra 01 Bloco C, 3º andar Edifício
Roberto Simonsen, Brasília – DF

Contact: Joselito Henriques
Industrial Development Expert

Phone: (+55 61) 3317-9426

E-mail: joselito.henriques@cni.org.br

AREAS OF EXPERTISE

Chemicals and Derivatives

Electronics and Sensors

Other(s)

5.2. Examples of Brazilian Science, Technology and Innovation Institutes and their competencies

Brazilian Space Agency

SPO, 5, Quadra 3, Bloco A, Brasília – DF

Contact: Thamy Ribeiro
Press Relations

Phone: (+55 61) 3411-5014

E-mail: thamy.ribeiro@aeb.gov.br

AREAS OF EXPERTISE

Machinery and Equipment
Transportation and Logistics
Software

USP Innovation Agency

Av. Torres de Oliveira, 76 - Jaguaré,
São Paulo – SP

Contact: Andréa Revoredo
Secretary

Phone: (+55 11) 3091-4495

E-mail: dir-inovacao@usp.br

AREAS OF EXPERTISE

Biotechnology
Education and Inclusion
Medical/Hospital
Chemicals and Derivatives
Information Technology

Integrated Systems Laboratory Association (LSI-TEC)

Rua Paes Leme 524 - 9º andar, São Paulo – SP

Contact: Renato Marcelo Franzin
Director

Phone: (+55 11) 98447-1675

E-mail: renato.franzin@lsitec.org.br

AREAS OF EXPERTISE

Information Technology
Electronics and Sensors
Smart Cities
Education and Inclusion
Other(s): Integrated circuits - design and manufacturing

Brazilian Center for Physics Research (CBPF)

Rua Lauro Müller, 455 - Urca, Rio de Janeiro – RJ

Contact: Marcelo Portes de Albuquerque
Senior Technologist

Phone: (+55 21) 2141-7277

E-mail: marcelo@nitrio.org.br

AREAS OF EXPERTISE

Energy

Software

Electronics and Sensors

Other(s): Nanotechnology

Nuclear Technology Development Center (CDTM)

Av. Presidente Antonio Carlos, 6.627 -
Pampulha, Belo Horizonte – MG

Contact: Waldemar Augusto de Almeida Macedo
Director

Phone: (+55 31) 3069-3263

E-mail: wmacedo@cdtn.br

AREAS OF EXPERTISE

Medical/Hospital

Other(s)

Center of Strategic Technologies of the Northeast (CETENE/INT-NE)

Av. Prof. Luiz Freire, 01, CDU, Recife – PE

Contact: Thelma Silva

Phone: (+55 81) 3334-7250

E-mail: thelma.silva@cetene.gov.br

AREAS OF EXPERTISE

Biotechnology

Information Technology

Energy

Medical/Hospital

Software

National Center for Research in Energy and Materials (CNPEM)

Rua Giuseppe Maximo Scolfaro, 10.000, ZIP
Code: 13083-970, Campinas – SP

Contact: Eduardo do Couto e Silva
Coordinator of the NIT/ CNPEM Innovation
Committee

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AREAS OF EXPERTISE

Biotechnology

Energy

Electronics and Sensors

Other(s): Nanotechnology, specialty and performance products
derived from biomass

Center for Advanced Studies and Systems of Recife (CESAR)

Rua Bione 220, Recife – PE

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Chief Business Executive

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AREAS OF EXPERTISE

Information Technology

Automobiles

Smart Cities

Education and Inclusion

Medical/Hospital

Brazilian Agricultural Research Corporation (Embrapa)

Parque Estação Biológica - PqEB s/nº Brasília,
DF ZIP Code 70770-901

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Phone: (+55 11) 4146-1353

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AREAS OF EXPERTISE

Biotechnology

Energy

Software

Chemicals and Derivatives

Other(s): Agriculture

Embrapa Food Agroindustry

Av. das Américas 29501- Bairro Guaratiba,
CEP23020-470, Rio de Janeiro – RJ

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Researcher

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AREAS OF EXPERTISE

Biotechnology

Other(s): Food Technology

Embrapa Information Technology

Parque Estação Biológica - PqEB s/nº.,
W3 Norte (final), Asa Norte, Brasília – DF

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Asset and Supply Supervisor

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AREAS OF EXPERTISE

Machinery and Equipment

Digitization

Software

Education and Inclusion

Information Technology

Embrapa Satellite Monitoring

Av. Soldado Passarinho, nº 303, Fazenda Jardim
Chapadão ZIP Code: 13070-115, Campinas – SP

Contact: Alan dos Santos

Phone: (+55 19) 3211-6200 (Ext.: 6209)

E-mail: alan.santos@embrapa.br

AREAS OF EXPERTISE

Transportation and Logistics

Software

Information Technology

Electronics and Sensors

Education and Inclusion

Oswaldo Cruz Foundation (Fiocruz)

Avenida Brasil 4365 – CEP 21040-900,
Rio de Janeiro – RJ

Contact: Maria Celeste Emerick
Technology Management Coordinator

Phone: (+55 21) 3882-9080

E-mail: maria.emerick@fiocruz.br

AREAS OF EXPERTISE

Biotechnology

Medical/Hospital

Education and Inclusion

Electronics and Sensors

Chemicals and Derivatives

Antônio Prudente Foundation - AC Camargo Cancer Center

Rua Professor Antônio Prudente, 211,
Liberdade, São Paulo – SP

Contact: Dr. Helano Carioca Freitas
Clinical Research Unit Coordinator
CAEP

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AREAS OF EXPERTISE

Medical/Hospital

Foundation for Centers of Excellence in Innovative Technologies

Rua Eng. Agrônomo Andrey Cristian Ferreira,
s/n. Caixa Postal 5053, Florianópolis – SC

Contact: José Eduardo Azevedo Fiates
General Superintendent

Phone: (+55 48) 3239-2150

E-mail: jef@certi.org.br

AREAS OF EXPERTISE

Electronics and Sensors

Medical/Hospital

Information Technology

Energy

Machinery and Equipment

Center for Research and Development in Telecommunications (CPqD Foundation)

R. Dr. Ricardo Benetton Martins, 1.000 –
Parque II do Polo de Alta Tecnologia,
Campinas – SP

Contact: Alberto Paradisi
Vice President of Research and Development

Phone: (+55 19) 3705-6200

E-mail: contato@cpqd.com.br

AREAS OF EXPERTISE

Information Technology

Smart Cities

Digitization

Software

Electronics and Sensors

Itaipu Technological Park Foundation (ITPF-BR)

Av. Presidente Tancredo Neves, 6731,
Foz do Iguaçu – PR

Contact: José Paulo Nunes
Manager

Phone: (+55 45) 3576-7003
(+55 45) 9922-5023

E-mail: jpnunes@pti.org.br

AREAS OF EXPERTISE

Electronics and Sensors

Energy

Education and Inclusion

Energy vectors and energy accumulators

Nuclear Facilities of Brazil (INB)

Rodovia Presidente Dutra, km 330 -
Resende - RJ

Contact: Mário Moura
Head of Security, Communications and
Information Advisory

Phone: (+55 24) 3321-8654

E-mail: mmoura@inb.gov.br

AREAS OF EXPERTISE

Energy

Electronics and Sensors

Machinery and Equipment

Transportation and Logistics

Recycling

Technological Research Institute of the State of São Paulo (IPT)

Av. Prof. Almeida Prado, 532, São Paulo – SP

Contact: Mari Katayama
Center for Technological Assistance to Micro
and Small Enterprises

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E-mail: katayama@ipt.br

AREAS OF EXPERTISE

Biotechnology

Construction

Smart Cities

Energy

Electronics and Sensors

Technology Institute of Paraná (TECPAR)

Rua Algacyr Munhoz Mader, 3775. Cic,
Curitiba – PR

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Technical Advisor to the President

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AREAS OF EXPERTISE

Biotechnology

Education and Inclusion

Information Technology

Other(s): Institute of Technological Research, Technology Parks and
Incubators

National Institute of Space Research (INPE)

Av. dos Astronautas, 1758.
CEP 12227-010, São José dos Campos – SP

Contact: José Daniel Reis Junior
Science and Technology Analyst

Phone: (+55 12) 3208-7325

E-mail: daniel.reis@inpe.br

AREAS OF EXPERTISE

Electronics and Sensors

Space Engineering and Technology

National Technology Institute (INT)

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Analyst

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E-mail: larissa.medeiros@int.gov.br

AREAS OF EXPERTISE

Biotechnology

Energy

Chemicals and Derivatives

Education and Inclusion

Medical/Hospital

Lactec Institutes

Rodovia BR-116, km 98, nº 8813, Curitiba – PR

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Technological Development Director

Phone: (+55 41) 3361-6046

E-mail: zimmer@lactec.org.br

AREAS OF EXPERTISE

Energy

Electronics and Sensors

Information Technology

Sanitation

Automobiles

National Laboratory of Computational Science (LNCC)

Avenida Getulio Vargas, 333 - Quitandinha,
Petrópolis – RJ

Contact: Marcelo Fragoso
Science and Technology Analyst

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E-mail: marcelof@lncc.br

AREAS OF EXPERTISE

Information Technology

Biotechnology

Software

Education and Inclusion

Energy

National Nanotechnology Laboratory (LNNano)

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Campinas – SP

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Project Leader

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AREAS OF EXPERTISE

Electronics and Sensors

Digitization

Energy

Other(s)

Pontifical Catholic University of Rio de Janeiro (PUC-Rio)

Rua Marques de São Vicente, 225,
Rio de Janeiro – RJ

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Dean of the Technical Science Center

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E-mail: smello@cetuc.puc-rio.br

AREAS OF EXPERTISE

Electronics and Sensors

Chemicals and Derivatives

Software

Transportation and Logistics

Information Technology

Pontifical Catholic University of Rio Grande do Sul (PUC-Rio)

Av. Ipiranga 6681, Porto Alegre
CEP 90619-900 – RS

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AREAS OF EXPERTISE

Medical/Hospital

Education and Inclusion

Energy

Smart Cities

Information Technology

Technology Park of São Leopoldo (Tecnosinos)

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AREAS OF EXPERTISE

Information Technology

Software

Biotechnology

Energy

Electronics and Sensors

Vale do Rio dos Sinos University (Unisinos)

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AREAS OF EXPERTISE

Education and Inclusion

Júlio de Mesquita Filho São Paulo State University (UNESP)

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São Paulo – SP

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AREAS OF EXPERTISE

Biotechnology

Education and Inclusion

Electronics and Sensors

Chemicals and Derivatives

Energy

Federal University of Bahia (UFBA)

Rua Augusto Viana, s/n, Salvador – BA

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E-mail: propci@ufba.br

AREAS OF EXPERTISE

Information Technology

Automobiles

Energy

Medical/Hospital

Biotechnology

Federal University of São Carlos (UFSCar)

Rod. Washington Luis, km 235, São Carlos – SP

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Agency

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E-mail: inovacao@ufscar.br

AREAS OF EXPERTISE

Education and Inclusion

Federal University of São Paulo (UNIFESP)

Rua Sena Madureira, 1500, 4º andar,
São Paulo – SP

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Phone: (+55 11) 3385-4112

E-mail: valquiria.fontalva@unifesp.br

AREAS OF EXPERTISE

Biotechnology

Chemicals and Derivatives

Education and Inclusion

Energy

Medical/Hospital

Centro Alemão de Ciência e Inovação – São Paulo



Alemanha País de Ideias

-  Diversas instituições alemãs de fomento, ensino superior, pesquisa e inovação reunidas em um único endereço.
-  Centro de informação e orientação para interessados em estudar e pesquisar na Alemanha ou cooperar com grupos alemães de pesquisa e inovação.
-  Ponto de encontro para docentes, pesquisadores e gestores interessados em cooperação acadêmico-científica Brasil-Alemanha.
-  Plataforma para ações conjuntas e individuais no Brasil das instituições alemãs de fomento, ensino superior, pesquisa e inovação.

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Iniciativa



Federal Foreign Office

Apoio



Federal Ministry
of Education
and Research

DAAD

Deutscher Akademischer Austausch Dienst
Serviço Alemão de Intercâmbio Acadêmico

Federal University of ABC (UFABC)

Av. dos Estados, 5001 - Bairro Santa Terezinha,
Santo André – SP

Contact: Andreia Oliveira
Executive Secretary

Phone: (+55 11) 3356-7622

E-mail: inovacao@ufabc.edu.br

AREAS OF EXPERTISE

Biotechnology

Smart Cities

Energy

Chemicals and Derivatives

Information Technology

Methodist University of Piracicaba (UNIMEP)

Rua Rangel Pestana, 762, Piracicaba – SP

Contact: Klaus Schützer
Director of the Computational Systems Laboratory for Design and Manufacture

Phone: (+55 19) 3124-1792

E-mail: schuetzer@scpm.unimep.br

AREAS OF EXPERTISE

Education and Inclusion

Automobiles

Digitization

Machinery and Equipment

Information Technology

Federal Technological University of Paraná (UTFPR)

Rua Sete de Setembro, 3165 - CEP 80230-901,
Curitiba – PR

Contact: Prof. Dr. Gilberto Branco
Director of the UTFPR Innovation Agency

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E-mail: gbranco@utfpr.edu.br

AREAS OF EXPERTISE

Smart Cities

Information Technology

Sanitation

Recycling

Other(s)

5.3. Examples of German Science, Technology and Innovation Institutes and their competencies

Baden-Württembergisches Brasilien-Zentrum an der Universität Tübingen / Brazilian Center at the University of Tübingen

Wilhelmstrasse 113, D-72074 Tübingen – Germany

Contact: Gisele Lenz
Coordinator

Phone: +49 7071 2974823

E-mail: gisele.lenz@uni-tuebingen.de

AREAS OF EXPERTISE

Education and inclusion

Biotechnology

Chemicals and Derivatives

Information Technology

Other(s)

Bundesanstalt für Materialforschung und -prüfung (BAM) / Federal Institute for Materials Research and Testing

Unter den Eichen 87, Berlin - Germany

Contact: Pedro Portella
Director of the Materials and Engineering Department

Phone: +49 30 8104 1500

E-mail: pedro.portella@bam.de

AREAS OF EXPERTISE

Information Technology

Chemicals and Derivatives

Energy

Other(s)

Christian-Albrechts-Universität zu Kiel (CAU) / Kiel University

Christian-Albrechts-Platz 4, 24118 Kiel
Schleswig-Holstein - Germany

Contact: Dr. Martina Schmode
International Center

Phone: +49 431 880-3719

E-mail: mschmode@uv.uni-kiel.de

AREAS OF EXPERTISE

Education and inclusion

Other(s)

Deutsche Forschungsgemeinschaft (DFG) / German Research Foundation

R. Verbo Divino, 1488 – São Paulo

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Director

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AREAS OF EXPERTISE

Sustainable Development of research collaboration for German and Latin American scientists

Policy monitoring

Requirement Analysis of topics to be promoted and funding instruments to be developed

Active maintenance of collaboration with partner organisations and development of joint funding programs

Stimulation of new ideas as well as bilateral or multilateral projects

Integration into national funding lines/programmes

Deutsches Krebsforschungszentrum (DKFZ) / German Cancer Research Center

Im Neuenheimer Feld 280, 69120 Heidelberg - Germany

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Scientific Assistant to the Managing Council

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AREAS OF EXPERTISE

Medical/Hospital

Digitization

Education and Inclusion

Software

Deutsches Zentrum für Luft- und Raumfahrt (DLR) / German Aerospace Center

Linder Hoehe, 51147 Cologne – Germany

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International Cooperation

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AREAS OF EXPERTISE

Energy

Other(s)

Deutsches Biomasseforschungszentrum (DBFZ) / German Biomass Research Center

Torgauer Str. 116, 04347 Leipzig – Germany

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Coordinator of International Technology
Transfer

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AREAS OF EXPERTISE

Energy
Smart cities
Other(s)

Forschungsinstitut Edelmetalle + Metallchemie / Research Institute for Precious Metals and Metal Chemistry

Katharinenstrasse 17, 73525 Schwäbisch
Gmünd – Germany

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Director

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AREAS OF EXPERTISE

Energy
Electronics and Sensors
Recycling
Medical/Hospital
Machinery and Equipment
Research

Freie Universität Berlin (FU)

Kaiserswerther Str. 16-18, Berlin - Germany

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AREAS OF EXPERTISE

Innovation Management
Technology
Medical/Hospital

Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU) / University of Erlangen Nürnberg

Schloßplatz 4, 91054 Erlangen – Bavaria -
Germany

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Spin-Off Consultant

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AREAS OF EXPERTISE

Education and Inclusion

Digitization

Medical/Hospital

Machinery and Equipment

Other(s)

Friedrich-Schiller-Universität Jena / Friedrich Schiller University Jena

Fürstengraben 1, 97743 Jena – Thuringia -
Germany

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AREAS OF EXPERTISE

Energy

Information Technology

Smart Cities

Medical/Hospital

Chemicals and Derivatives

Hochschule Osnabrück / University of Applied Sciences Osnabrück

Albrechtstraße 30, Osnabrück - Germany

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International Consultant for Technology
Transfer

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AREAS OF EXPERTISE

Smart Cities

Machinery and Equipment

Medical/Hospital

Biotechnology

Other(s)

InnoZ GmbH / Innovation Centre for Mobility and Societal Change

EUREF-Campus, Building 16 (once Torgauer Str. 12-15), 10829 Berlin-Schöneberg, Berlin – Germany

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AREAS OF EXPERTISE

Transportation and Logistics

Smart Cities

Digitization

Information Technology

Energy

Karlsruher Institut für Technologie (KIT) / Karlsruhe Institute of Technology

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AREAS OF EXPERTISE

Energy

Information Technology

Automobile

Smart Cities

Other(s)

Kiepenheuer-Institut für Sonnenphysik / Kiepenheuer Institute for Solar Physics

Schöneckstr. 6, 79104 Freiburg – Baden-Württemberg - Germany

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AREAS OF EXPERTISE

Education and inclusion

Electronics and Sensors

Machinery and Equipment

Information Technology

Ludwig-Maximilians-Universität München (LMU) / LMU University

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AREAS OF EXPERTISE

Biotechnology

Information Technology

Medical/Hospital

Chemicals and Derivatives

Other(s)

Physikalisch-Technische Bundesanstalt (PTB) / National Metrology Institute of Germany

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AREAS OF EXPERTISE

Energy

Other(s)

Technische Hochschule Ingolstadt (THI) / Ingolstadt University of Applied Sciences

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AREAS OF EXPERTISE

Automobile

Energy

Electronics and Sensors

Information Technology

Transportation and Logistics

Technische Universität München (TUM) / Technical University of Munich

TUM São Paulo - Liaison Officer for Latin America, Rua Verbo Divino 1488, Térreo, São Paulo – SP

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AREAS OF EXPERTISE

Biotechnology

Smart Cities

Energy

Machinery and Equipment

Information Technology

Technische Universität Dortmund / Technical University Dortmund

August-Schmidt-Str. 4, Dortmund - Germany

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AREAS OF EXPERTISE

Education and Inclusion

Chemicals and Derivatives

Transportation and Logistics

Biotechnology

UAS7 / German Universities of Applied Sciences

R. Verbo Divino, 1488 – São Paulo - SP

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AREAS OF EXPERTISE

Nursing

Biodiversity

Renewable Energies

Engineering

Universitätsallianz Ruhr (UA Ruhr) / University Alliance Ruhr

R. Verbo Divino, 1488 – São Paulo - SP

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AREAS OF EXPERTISE

Machinery and Equipment

Other(s)

Universität Siegen / University of Siegen

Adolf-Reichwein-Str. 2a, 57068 Siegen –
Nordrhein-Westfalen - Germany

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Head of Professional Education Department

Phone: +49 271 740 2685

E-mail: ulrike.buchmann@uni-siegen.de

AREAS OF EXPERTISE

Education and Inclusion

Digitization

Medical/Hospital

Other(s)

Westfälische Wilhelms-Universität Münster (WWU) / University of Münster

R. Verbo Divino, 1488 – São Paulo - SP

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AREAS OF EXPERTISE

Nano(bio)technology; Research in batteries; Medicine/ Biomedicine (Inflammation and infection, neuromedicine and cardiovascular medicine, molecular biomedicine); Imaging (Cell Visualization); Knowledge Transfer

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