

# INNOVATE TO ADD VALUE

**22 INNOVATION CASES**  
in Micro, Small, Medium and Large-sized Enterprises



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Brasília

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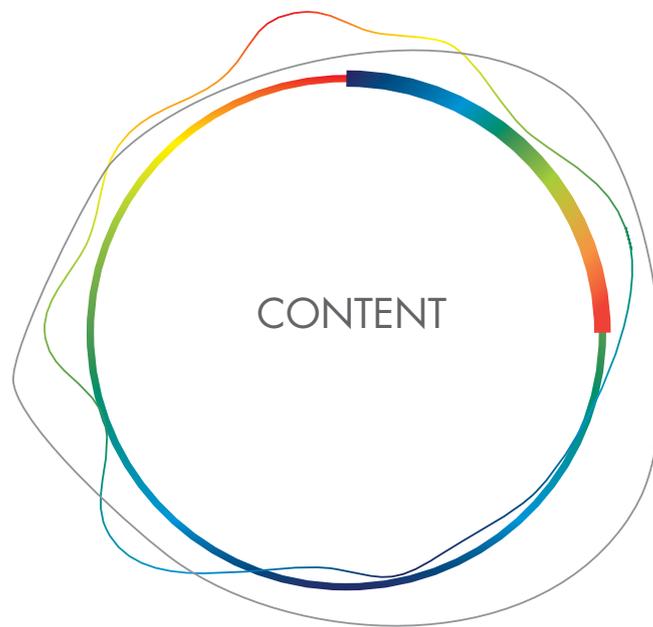
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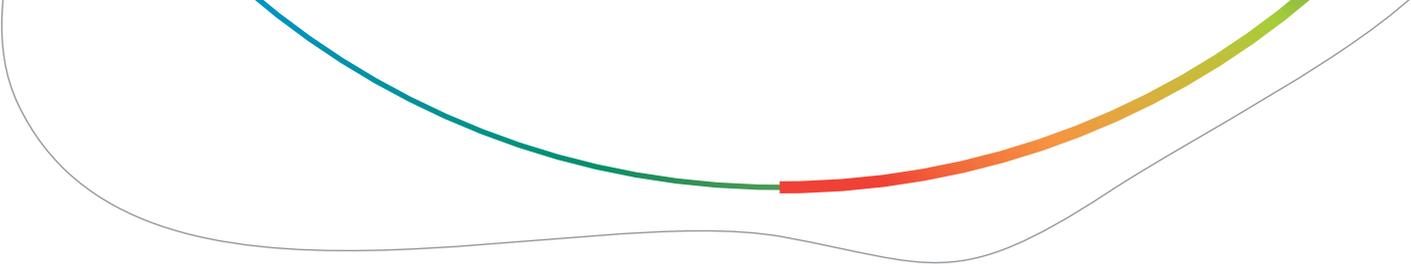
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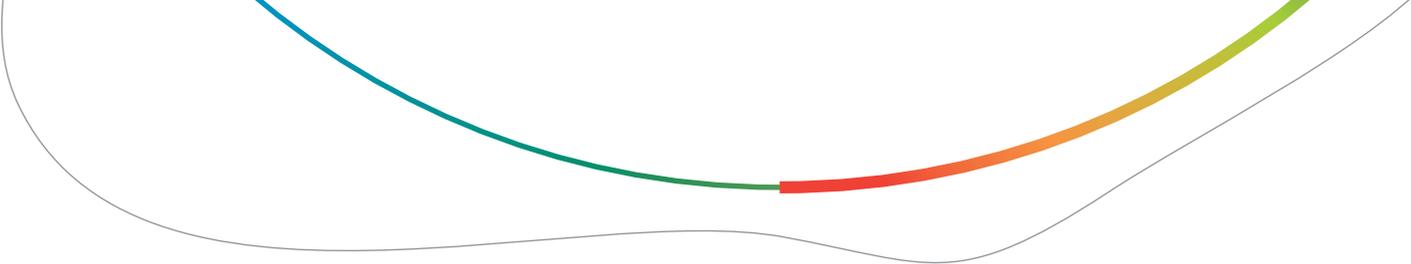
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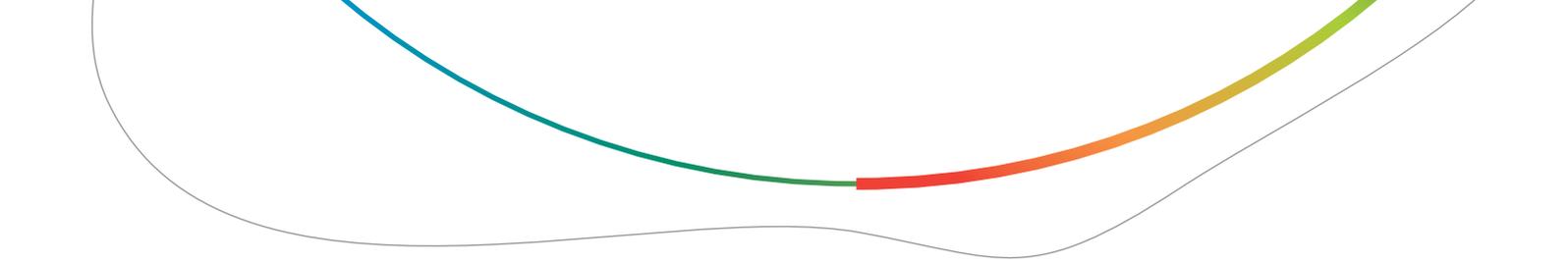
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Industry drives the technological development of economic activities based on solutions designed to consolidate advances in scientific knowledge and foster new business models. However, challenges facing industry in Brazil, ranging from foreign competition to domestic problems, have a negative impact on industrial productivity, undermining the foundations of its competitiveness and its role as the engine of the economy.

Given this scenario of mounting problems, the messages conveyed in this publication, which was produced by the National Confederation of Industry (CNI) and the Brazilian Service in Support of Micro and Small Enterprises (SEBRAE), bring a double sign of hope. The 22 innovations described in it consolidate a long process of reinvigoration of Brazilian industry through innovative methods, technologies and business models that reinforce the competitiveness of its enterprises and enable them to better position themselves in the market. These innovations are also indicative of a major achievement in promoting the purposes of the Entrepreneurial Mobilization for Innovation (MEI): placing innovation at the core of industry's corporate strategy.

The book provides examples of innovations to inspire companies wishing to open up new avenues for their development. It also provides examples for micro, small, medium and large enterprises; for domestic companies and subsidiaries of multinationals; and other examples based on their own technological development and on the timely utilization of

available knowledge. In short, it provides useful and valuable information for companies of all types and sizes, with either abundant or limited funds available.

Two key elements are common to all the cases described in this publication. The first one is a company's determination to improve, with some boldness, its position in the market. This boldness is increasingly translated into very solid foundations, with more structured teams and more organized methods to identify and reduce possible risks. The second element is the increasing importance of Brazilian innovation ecosystems and of the Brazilian institutional environment for innovation: in all cases, without any exception, innovation is embedded in a set of external relationships that tend to promote, rather than stifle, innovation.

In this publication, readers interested in evaluating MEI's role in improving the Brazilian innovation environment will find data that feed the reflection on and promote the dissemination of knowledge on the evolution of this ecosystem.

All those wishing to join in this great national effort in behalf of innovation, industry and development and to bolster, through it, the competitiveness of industry, while strengthening it, will also find valuable information and knowledge here.

Innovation counts on you. Good reading to all.

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## INNOVATE TO ADD VALUE

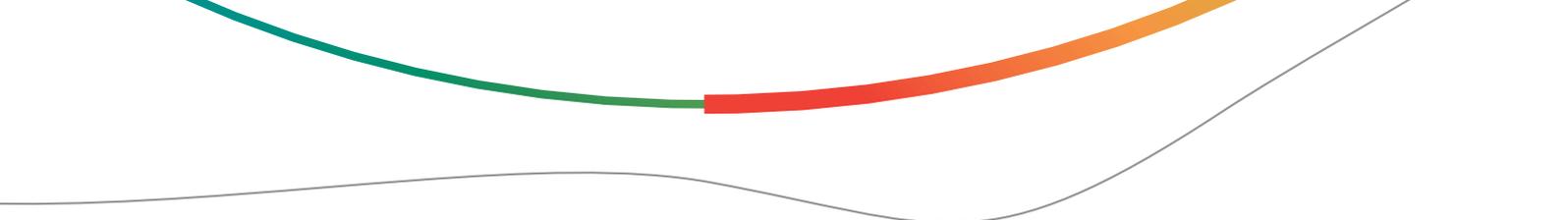
This collection brings 22 cases of enterprises that have been very successful thanks to innovation. There are micro, small, medium and large-sized enterprises; there are also startups, subsidiaries of foreign enterprises and Brazilian multinationals. Sebrae supported some of them; others were incubated or accelerated. Companies that received BNDES credit, Finep's economic grant, CNPq grants, research grants from state support foundations, angel investor funds or investment funds, as well as others that mobilized personal savings, from friends or from their families. Despite the diversity, in all of them innovating meant creating value for the company.

The innovation strategies described have either broadened participation or opened up a new market for companies. Often, in addition to higher revenues or higher margins, they have added intangible assets to the company's assets: intellectual property, image, culture of innovation, marketing or recognition, whether of customers or within the same economic group – especially subsidiaries of transnational corporations.

All these reports impress. While reading them, the reader will find a Brazil very different from the one that has appeared in the economic pages of our newspapers, not to speak of the national political coverage.

Going through the history of these companies, the enthusiasm and the vivacity that they discover are, at least, comforting: in them, another country breathes; one that bets on productivity and competitiveness. These are examples that deserve to be copied, emulated or adapted. They speak of the future; of what we can be and what each company can seek with the support of good public policies – but especially by self-determination. These are expressions of something very dear to the Business Mobilization for Innovation (MEI): the innovation agenda as an icon of the entrepreneurial protagonism.

These cases can be organized by various analytical sections: size, activity sector, use or not of public financing, support of incubators and accelerators, type of innovation, degree of technological effort, types of technical and entrepreneurial skills created, partnerships with research institutions, involvement of suppliers or clients, results for the company, among other cuts that allow to identify certain patterns in this plurality of situations.



This examination allows us to draw more general conclusions and useful lessons for entrepreneurs, innovation teams, professionals, academics and governments in the design of better public policies.

Regardless all of this, each of these cases illustrates the impact that innovation strategies have had on their respective companies. Each of them is rich enough in detail to inspire or suggest paths to similar new business initiatives.

In addition to indicating the common points of these trajectories, this introduction also highlights the richness of the following material worthy of a close reading. It is essential for entrepreneurs and for public managers, as it shows, on a case-by-case basis, the tools mobilized and the paths selected to face specific difficulties of each situation.

Among all possible analytical breakdowns, perhaps the most prominent, at first glance, is the determining role of the ability to undertake small business and startup management, vis-à-vis management structures and systematic innovation planning in large companies.

Before delivering results, the vast majority of startups and small and medium-sized enterprises had to face many difficulties and even deal with major failures. The reports show how the situations in which it is sought to adjust the focus and elaborate new business plans, redirect the actions and reorient the technological efforts are repeated. There are several examples of how persistence is critical to success.

Altave is a good example for being able to present its stationary balloon solutions at major events. It is also worthy of registration the long road that led to the development of biological larvicide Biovech by Neovech. PROSUMIR is yet another example: the failure of the first initiative resulted in the reanalysis of concepts and business models, until the development of an innovative product.

There are many similar cases, such as the Cervejaria Insana, with its innovative pinion beer, which faced a lot of idleness and negative economic results, until reworking its business model. Or the motorized kit of LIVRE, whose entrepreneurial DNA predates the creation of the company and is reflected in the persistence and creativity, aiming at the market search. Or Tecvix, a medium industry that was forced to redefine its strategy, increasing focus on innovation and creating a spin-off, focused on the oil and gas sector.

## LARGE-SIZED ENTERPRISES: CONSOLIDATED INNOVATION STRATEGIES

The cases of large-sized enterprises in this collection show a different reality, since they represent, as one would expect, consolidated R&D strategies, with prospecting activities and teams of significant size.

There are many projects impacting the global market – or very significant for Brazil – such as Embraco's oilless refrigerator compressor, L'Oréal's new sunscreen, Mahle's fuel filter, the biodegradable yarn created by Rhodia's unit in Brazil, or the qualification of Elekeiroz to produce butyric acid in the country. Here there are also difficulties to face, for which persistence and the ability to undertake are also necessary.

An emblematic case is Wisemotion, a global innovation of Embraco, developed in Brazil for the world market and not yet used in the country. Wisemotion is the first oil-free hermetic refrigerator compressor, which automatically regulates power with 20% gains in energy consumption.

Quieter, smaller and easier to manufacture, the product saves up to 20 liters of space. Its development took 10 years, with a team spread across four continents, which generated a hundred patents.

This is the result of an internal structure of professional management and competitive intelligence, which monitors patents, academic works, publications and market analysis. This is also the result of a close interaction with universities and research centers, especially the Federal Universidade de Santa Catarina (UFSC). The value it brings to the company exceeds the market dimension: it is a technology that strengthens its strategy and its image.

Developed in Rio de Janeiro, the L'Oréal sunscreen is another example that projects the image of the subsidiary next to the matrix. When set up in 2008, the R&D Center had five researchers and today has 117 people, being one of six hubs derived from the company's global innovation strategy.

The development of the product started in 2012 was based on the particularities of Brazil, with insights from consumers and dermatologists, as well as the innovation and marketing team. The goal was to innovate, combining high protection and dry texture.

The Anthelios Airlicium FPS 70 not only protects from the sun but also caters to other consumer desires by reducing glare and lessening skin imperfections. These good results derive from the use of Airlicium, a silica gel that has never been used in cosmetics, with properties other than classical silica, originally developed by NASA, to capture interstellar dust.

Rhodia Solvay's Amni Soul Eco developed at the Brazilian Innovation Center is the world's first biodegradable synthetic textile yarn. With the same properties of traditional polyamide, the yarn decomposes in less than four years, while nylon degrades in tens of years.

Its development required time, partnerships and specific ways to introduce it to the market. The challenge was to develop a polyamide that would maintain the performance of the conventional material but would undergo accelerated degradation under the usual disposal conditions, what was achieved through the insertion of modifications capable of making the polyamide attractive to anaerobic bacteria that prevail in landfills, where there is no oxygen.

The result is the strategy of bringing to Brazil the development of intelligent and sustainable fibers, which today are the company's flagship.

The Blindagua filter also changed the positioning of the Brazilian subsidiary of MAHLE, now responsible worldwide for the manufacture of new fuel filters. With a three times greater efficiency, without mountings and disassemblies – that caused breaks – with longer life and without metallic components, which facilitate the disposal, Blindagua has become a global product.

The MAHLE Technology Center in Brazil, with 300 employees, solved a demand placed for all the company's research centers around the world, thanks to partnerships with universities and institutes, such as Federal de Itajubá and National Institute of Technology (INT). This is the result of MAHLE innovation structure, guided by alignment with the company's strategy.

Elekeiroz was the first company in Latin America to produce butyric acid, used as a raw material for fragrances and in animal feed. The opportunity had a certain amount of chance, but its complete development was quite demanding because of the purification system.

This was the result of the strategy started in 2012 to reverse the unfavorable scenario of the industry and strengthen the company in the markets with high margins of profit and greater growth. To do so, the first step was the creation of an area of Innovation and Engineering, with a team dedicated exclusively to innovative activities, which is now positioned as a platform for new products.

Ciser's innovation management is also a differential of the company, then, in 2015, it won the first place in the National Innovation Award in this category. Ciser is the largest fastener manufacturer in Latin America, and the innovation reported is Nanotec, a nanoceramic surface coating that increases corrosion resistance by up to 20 times.

The path taken by Ciser is the result of a work of internal restructuring, focused on innovation, which was supported by the Euvaldo Lodi Institute (IEL), in Santa Catarina. Until 2008, when the company included innovation as part of its business vision and one of the pillars of its strategic planning, Ciser was a metallurgical company with no technological pretensions. Its bet on technology was the result of a strategy of adding value for the differentiation in the market.

The Arteccla's Artepowder is a similar case, which has won many awards and disclosed the company globally. It is the first power adhesive for tennis shoes, with advantages over traditional methods: the production uses less energy and water, does not require organic solvents, does not generate waste, allows the automation of the collage saving labor, besides significant gains in time and cost and lower consumption of raw material.

Many partners were involved in its development, such as the Federal University of Rio Grande do Sul (UFRGS), the Fraunhofer Institute (IFAM), from Germany and the Senai Institute for Innovation in Polymer Engineering (Cetepo), from São Leopoldo (RS), in addition to a strategic partnership established with a machine supplier for the footwear industry.

Large-sized enterprises can rely on larger R&D budgets and have more robust teams dedicated to prospecting, technological development and partnership prospection.

This difference is striking and easy to identify. However, it is not this greater capacity for leverage that attracts attention, but rather the way in which many of these companies have incorporated a strong culture of innovation, resulting from professional management dedicated to making the most of their options. This teaching adapted to each reality should be valid for all companies: whether large or small, national or foreign.

## INNOVATION AS A BUSINESS

While startups and small and medium-sized enterprises cannot rely on large R&D teams, there is in most cases a near-identical identity between company and research. When we look at what innovation represents for these companies, we find that in many cases it is the reason for existence of the company, for which business is innovation itself. This is very clear in startups and spin-offs.

An example is Sunew, a spin-off from CSEM Brazil and a non-profit joint venture between the CSEM (Swiss Center for Electronique et Microtechnique) and FIR Capital. After ten years of research, the company launched Sunew Glass, an application of organic photovoltaic cells (OPV) for glass facades of buildings, which represents a global technological innovation.

Sunew has had to overcome the challenge of producing large-scale OPVs and developing a method to laminate them along with glass. Today, Sunew has contributions from BNDESpar, FIR Capital and other energy companies. Its challenge is to reduce costs and research new materials: once again the technology remains the soul of the company.

Another example of innovation/ company identity is Cliever. Created with its own resources at Tecnopuc (PUC-RS), the company developed the first 3D printer in Brazil and is the largest national manufacturer of this product.

With initial difficulties in dealing with external competitors, the company focused on the quality of its products. With the support of SENAI, it invested in both mechanical design, optical problems and software, as well as in partnerships with resin suppliers.

With contributions from the Criatec Fund, Cliever was able to develop a line of products for the professional market, which differentiates itself by making the impression assertively from any drawing software.

Nexxto's young and talented team is its biggest differential and the reason for the identity between business and innovation. The company offers IoT (Internet of Things) solutions – using sensors in communication with the cloud, which collect parameters for monitoring products and processes in a simplified and optimized way.

Founded in 2010 as RFIDEAS, by students of the Politécnica of USP, it was incubated at Cietec – Center for Innovation, Entrepreneurship and Technology of USP-IPEN. With the support of the Research Program for Innovation in Small Business, Fapesp's Pipe, it rose rapidly, obtaining graduation in the shortest incubation time in the history of Cietec. With many awards, in 2015, Nexxto received a contribution from SP Ventures, partnering with a large software company to offer TIC solutions.

Brasil Ozônio is one of the cases in which technological training is inseparable from the company's trajectory. Its expertise involves producing and using ozone for various purposes. One of these uses is the treatment of low cost gaseous effluents, producing ozone in loco from the oxygen of the air, without the need to use expensive plants, as do their large competitors.

This development required partnership with suppliers and research centers, such as the Technological Research Institute (IPT). Like Nexxto, Brasil Ozônio was also incubated at Cietec and received support from Fapesp's Pipe, as well as resources from CNPq, Finep and BNDES. The decisive step was the leverage of the business in 2015 with the capital contribution from the Criatec Fund.

## INNOVATION: A MUST FOR THE WHOLE INDUSTRY

If we want to advance in the more general understanding of these cases, it is convenient to return to the analytical sections referred to. One such cutback is the business sector.

The most frequently encountered industry segments are the metalworking industry, with five companies, the chemical sector with four companies, and the information technology sector with three companies. Then there is a huge diversification: a company for each of the branches of activity: aeronautical, food and beverage, auto parts, biotechnology, civil construction, cosmetics, energy, medical equipment, precision mechanics and nanotechnology.

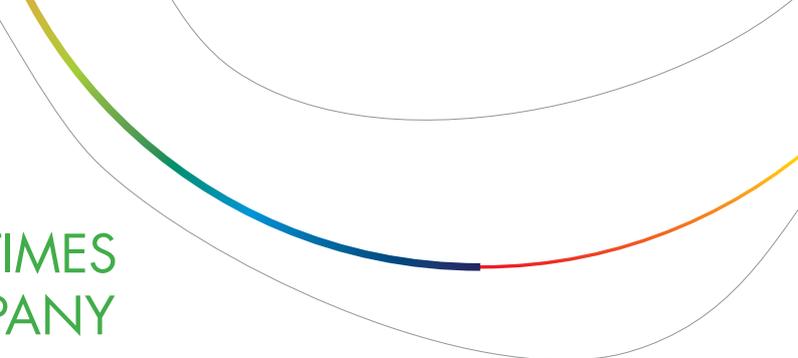
Even though the selection of these 22 cases is not the result of a random sample from the industry, this diversity is striking. The conclusion is almost straightforward: innovation is a theme for the whole industry: technology-intensive sectors, traditional sectors, consumer goods and capital. It permeates everything, as it is an essential requirement to increase competitiveness and survival in the market.

Even in traditional sectors such as construction, there is room for innovation. This is the case of the Precon Engenharia system, a company of more than 50 years. She conceived a chassis-based apartment building, that is, panels, pillars, beams and slabs, produced in the factory.

They are standardized, factory-ready structures to receive electricity and hydraulics. The solution enables eight-story buildings to be built in 30 days – with the work of only eight men – halving construction time. This allowed the entry into a new market and the restructuring of the company itself and the business, transforming a family and traditional company into an innovative company in which the culture of innovation became its main asset.

The Cervejaria Insana, which also operates in a traditional branch (beverages), was able to create the world's first pinion-based beer. The idea derives from the intention to contribute to the preservation of Araucárias and to draw attention to the populations that survive from the pinion.

The development of beer required partnerships and a special effort to achieve the desired flavor. The trajectory was not easy. But today Insana produces eight types of draft beer and eight types of beer, with about 60 distributors in Brazil, with great recognition inside and outside the country.



## INNOVATING IS SOMETIMES RETHINKING THE COMPANY

If for some companies innovation is often confused with business, for others, innovation is synonymous with reinvention. Tecvix, Intelie or PROSUMIR of the present day are companies recreated thanks to their innovative trajectories.

Just as in the case of Precon Engenharia, all of them faced radical changes, whether due to the shrinking of traditional markets, the opportunity to develop a new product, or the need to revise the paths of technological development.

Tecvix's innovation is represented by the creation of an insulated tube of high thermal efficiency for steam injection, which facilitates the exploration of oil onshore. The solution overcomes the competition in efficiency and costs, making feasible the production of wells, previously unviable.

The development was carried out in partnership with Petrobras, which sought to solve the problems resulting from breakdowns and frequent maintenance on this type of equipment. Its history is the history of reinvention of the company, created in 1999, with focus on the metallomechanical maintenance for the pulp and paper industry.

With the change of this market, in the late 2000s, Tecvix was forced to redefine its strategy. The decision was to increase their focus on innovation, by creating a spin-off, and reinventing itself. Success brought the invitation to develop the injector tube. If the plans for 2017 come to fruition, Tecvix will move from a maintenance service provider to an exporter of equipment with high technological content thanks to innovation.

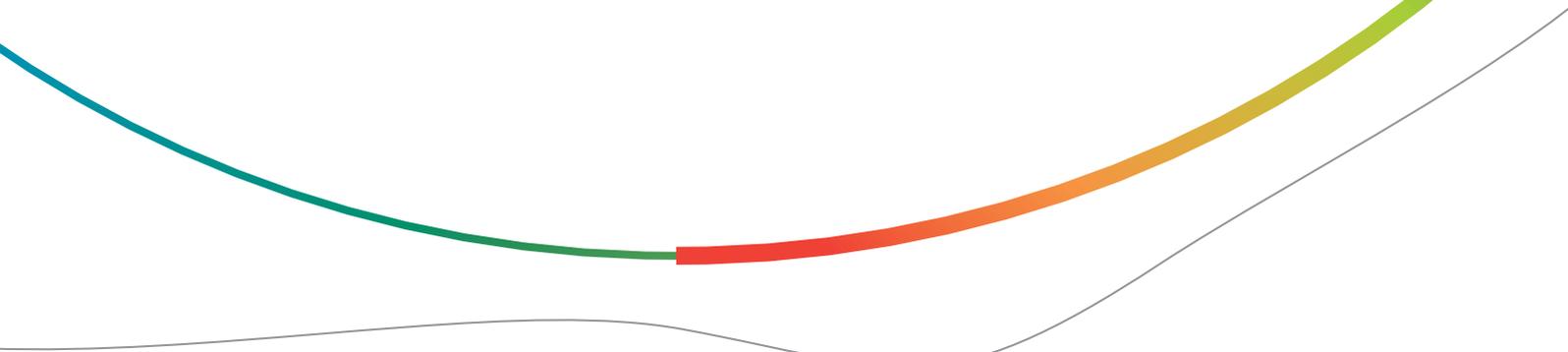
Intelie Live Solution is Intelie's technology platform for the oil and gas industry. It processes sensor data from drilling rigs, presenting them in an operational intelligence environment, tracking variables, predicting problems, and automating actions.

Incubated at the Gênesis Institute, PUC-RJ, Intelie was created in 2009. Its reinvention occurred when, after initial success – with machine learning tools – the company accepted the challenge of Petrobras to develop models to define the weight of fluid perforation in pre-salt regions.

The success of the solution has led to a new challenge: capture and focus data from all rigs in real time and apply intelligence to improve operational performance and management. In addition to awarding prizes and support, this reinvention has put the company on the threshold of competing with its international competitors on an equal footing, as well as initiating an internationalization phase by establishing a representation in Houston, Texas.

PROSUMIR is another case where innovation is associated with a reinvention of the company. It is a startup in Porto Alegre, which developed the Pressure Reducing Turbine (TRP), which generates energy by using the heat lost in industrial processes. It is a steam micro-turbine that converts thermal energy, which would dissipate, into mechanical energy that can, now, return to the process.

The first attempt to create the company was in 2006. However, the company closed in 2010, due to several difficulties. The resumption began in 2014, with new partners, new partnerships, many awards and some patents, as well as investor contributions.



## GOOD PUBLIC POLICIES LEVERAGE INNOVATION

Another important point – especially to improve innovation support policies – is the support of public institutions, whether in the form of partnerships, funding or government procurement. At least 15 out of the 22 companies reviewed reported using government support instruments, 12 of which reported using public funding.

As we have seen, they are various instruments and sources offered by Sebrae, Finep, CNPq, BNDES and state foundations for research support. In addition to these, the important role of Senai and IEL stands out.

Many companies could exemplify this type of support. Preamar and Neovech are two good examples. While the first one received support from Senai, from a Research Support Foundation, in Bahia, and Sebrae, the second was supported by venture capital funds, with Sebrae as one of its quota holders.

In addition, Neovech used the partnership with a public laboratory to access new knowledge, a partnership that later proved to be important for the development of its product.

The Preamar is a startup of Salvador, that has as partners four oceanographers, graduated in the Federal University of Bahia. It has created a port management software, the Coastal Modeling and Observation System (SOMC), which integrates an observation module and a forecasting module capable of assessing the risks of vessel movements in ports and shipyards, based on oceanographic and meteorological data.

Its differential consists of transforming complex information into quick understanding data for the user. Preamar started by being incubated at Senai Cimatec, which assisted in raising funds from the State of Bahia Research Foundation (Fapesb) and from Sebraetec mentoring. Its business model has evolved into the offer of services, with different types of plan, depending on the demands of each client.

The SOMC has been in operation since July 2016, at some terminals in the port of Salvador. The system was made available for free for a period of six months, for validation by the customer. At the Cotegipe terminal, the SOMC reduced ship waiting time by 53%, which represents at least USD 2 million of savings per harvest.

Biovech is a biological larvicide developed by Neovech, startup from Rio Grande do Sul, focused on biotechnology. It is a product harmless to humankind, but effective against *Aedes aegypti* larvae. Its formulation contains protein crystals produced by a bacterium (Bti), which kills the larvae.

In fact, the company was born with the purpose of undertaking in the oncological area. It quickly attracted investments from RSTec, a fund managed by CRP, with resources from Sebrae, and also mobilized grant resources.

The competence in biotechnology ended up opening alternatives, such as the development of a new product from a joint project with the Oswaldo Cruz Foundation, involving the cultivation of Bti and its possible uses. The challenge was to transform knowledge into a commercial product that is easy to apply without the need for approvals as for pharmaceuticals.

In two cases of this collection, government purchases were decisive, which shows how this instrument can be a great inducer of innovation. In the health area, with the example of the hearing aid of Wavetech Soluções Tecnológicas, and in the aeronautical case, the development of the Altave's stationary balloons.

WaveTech's hearing instrument says that innovation opens markets, as the company with its own technology is able to compete with international giants.

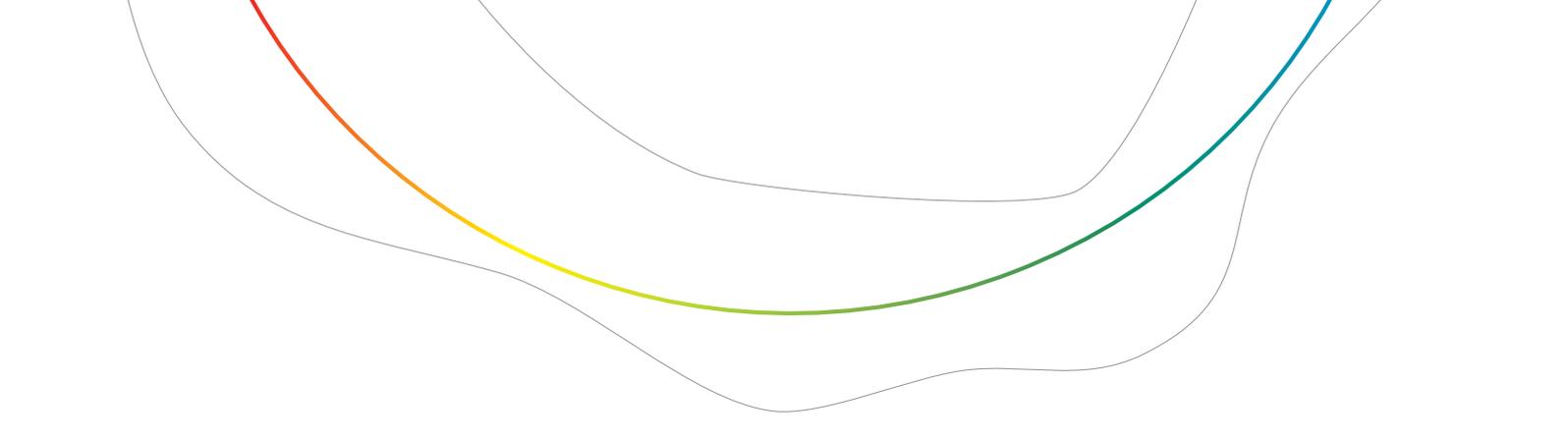
Incubated in 2012 in the Business Center for Advanced Technologies (Celta), in Florianópolis, the company brought to market a product that meets all the requirements of quality and aesthetics, with a price up to three times lower. Besides the cost, its differential is the creation of software, which allows simple adjustment of numerous parameters to adapt to the needs of each patient.

The company created a partnership with UFSC, had support from Finep and the Research Support Foundation of Santa Catarina (Fapescc), as well as Sebraetec. But its great leap was, after receiving authorization from Anvisa for commercialization, win bid to establish a Partnership for Productive Development (PDP) of the Brazilian Ministry of Health. With that, WaveTech was responsible for meeting 50% of the demand of the Unified Health System (SUS).

Altave is a company created by alumni of ITA, which made partnerships, took advantage of CTA's innovation ecosystem in São José dos Campos and used many of the available small business support tools, such as Fapesp's Pipe, the CNPq's RHAIE program and grants from Finep.

Its consolidation took place when it stopped being a R&D company to become a technology integrator, with monitoring solutions that included balloons, cameras, maintenance, and support services.

The next step was achieved thanks to a strong public order: to monitor the safety of the places where the Rio 2016 Olympic Games took place. This is a rather difficult road, which began well before 2013, when Altave was allowed to demonstrate in the Confederations Cup final, followed by other demonstrations, which allowed confidence in the solutions offered by the company.



## RECOGNITION AND VISIBILITY

Image and visibility also help companies – especially the new ones – to position themselves and attract investments. The many prizes and competitions that exist serve as a showcase, exposing these entrepreneurs to other companies, public agents and, especially, the financial system. This occurs with many of the companies in this collection, such as LIVRE and Nanovetores.

The motorized kit from LIVRE, startup of São José dos Campos (SP), turns any manual wheelchair into an electric tricycle. The first prototype was ready in 2011. However, reaching the market took another four years, which required many initiatives, such as intense participation in social media, the mobilization of “ambassadors” – athletes and public figures who use wheelchairs – and the creation of events to promote their products.

The results represent a return to the members’ ability to undertake, helped by the visibility generated by the awards that the company received: Santander de Empreendedorismo 2014; Contest Acelera Startup, from Fiesp, FedEx Contest for MPE in 2015 (of which it was winning); highlighted in the Sustainable Brands Innovation Open. Finalist in the 100 Open Startups Brazil; Finalist in the Creative Business Cup and the Brazilian stage of The Venture, Chivas Regal – the latter in 2016. Image and market go together in the strategy of creating value of LIVRE.

Nanovetores is a company specialized in nanoencapsulation, technology that allows controlled release of active principles through triggers such as temperature, humidity, friction, pH and enzymatic. Its business model is B2B, in the cosmetic, veterinary, pharmaceutical and textile segments.

It was the Nanovetores that brought to Brazil the concept of smart textile – woven with active ingredients nanoencapsulated in the thread plot, released during use as moisturizing or anti-cellulite ingredients.

In addition, in this case, the visibility of awards has helped the company to open markets. Created in 2008 and incubated at Tecnópolis, Nanovetores was the first to be awarded the Stemmer Prize for Innovation in Santa Catarina in 2011; the following year, it ranked second in the incubated category in the National Award for Innovative Entrepreneurship of Anprotec-Sebrae.

In 2016, it ranked second in the Deloitte / Exame de PME, which highlights the fastest growing companies in the country. It also won the best incubated awards in Brazil in 2014 and the best graduated company in Brazil in 2016 – both from Anprotec.

Due to the visibility achieved, Nanovetores received, in 2012, an investment from Criatec. With 41 employees, the company has already opened its first representation outside Brazil, being one of the main Brazilian companies in the nanotechnology segment.

## INNOVATION AND THE FUTURE: AN EXAMPLE FOR BRAZIL

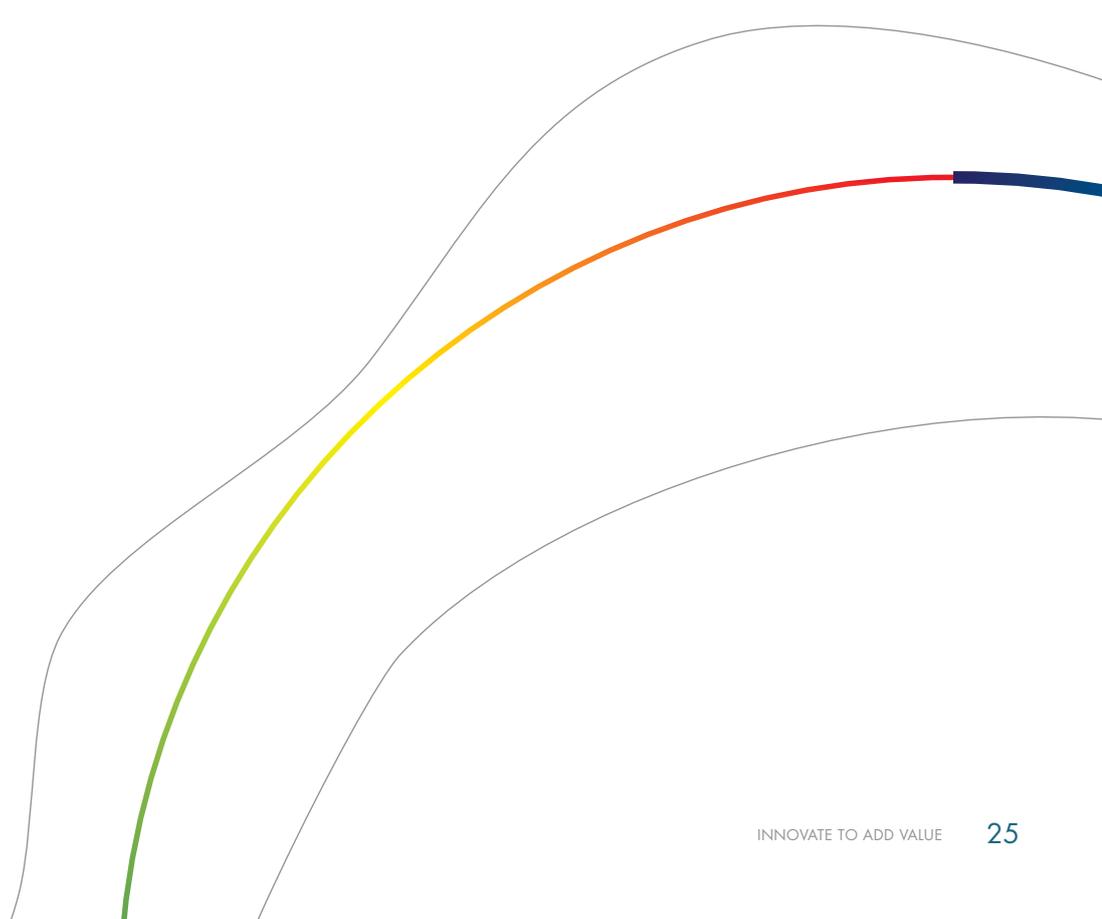
The 22 cases presented illustrate very well the diversity in the country, its instruments to support innovation, its deficiencies and weaknesses. Perhaps what is common to all is that innovation – is or was – in the DNA of each company or has turned into a strategy of creating value, which almost always meant growth and better margins.

But in all cases the innovation was also present, whether in the creation of different working and motivating environments, whether in the pride of its employees, in the image that the company shows to the world and with shareholders, i.e., specifically in the case of subsidiaries, the recognition of the matrix as these new skills.

Many of these leading companies are startups, what reflects the dynamism of small technology-based businesses and the importance of public policies to support them. Others are large national and transnational companies, all depending on the ecosystem where they are, where they seek partners and support. However, what essentially defines the role of innovation in each company is its strategies, and how it embraces the cause to add value to its business.

In arid times we live in, it is great to look at these examples. They reveal that it is possible to go beyond the obvious and the conventional and dare to create new things that revolutionize their business, which modify their companies and bring new values. In this complex and difficult country, it is good to know that the construction of values depends on the exercise of the will. In this sense, the reported cases are intended to inspire other companies to follow similar paths.

Maybe we can inspire ourselves and our country. After all, these are excellent examples that point to the future.







**ALTAVE**

## CAPTIVE BALLON THAT AID PUBLIC SECURITY

- ALTAVE
- São José dos Campos/SP
- Micro-sized enterprise
- MEI Agenda: Innovative SME
- 25 Employees
- Product innovation
- MEI Agenda: Innovative SME

*Startup born in ITA [Technological Institute of Aeronautics] is the first company in South America to produce and market balloons, focused on urban defense and security*

ALTAVE, founded by two aeronautical engineers graduated from ITA, is a pioneer in the production and marketing of solutions that employ aerostats – the designation name of aircraft lighter than air. This type of unmanned balloon allows a range of applications, ranging from telecommunications to monitoring large areas. ALTAVE OMNI is ALTAVE's solution for surveillance and monitoring of major events. The system includes the aerostat, high-precision cameras with 360° vision, and a trailer, which, besides providing the balloon anchorage, stores all the necessary items for the operation of the system, and can also act as a C<sup>2</sup> station (Command and Control).

Four ALTAVE OMNI systems were used, with great success, in monitoring safety around the places where the Rio 2016 Olympic Games took place, corresponding to an area equivalent to 13% of the city of Rio de Janeiro.

Participation in the event, guaranteed by means of a bidding process, which was attended by multinational competitors, confirmed the very high capacity of the ALTAVE team, inserting the company among the relevant players in the sector – the total value of the contract exceeded BRL 20 million, a remarkable feat for a startup.

### Vision of opportunity and courage to fly high

How did a startup manage to fly so high? Like most companies born in universities and other educational and research institutions, the innovation lies in ALTAVE's DNA, founded by two friends, recently graduated aeronautical engineers from ITA: Leonardo Nogueira and Bruno Avena.

Still in the third year of the course, the two ALTAVE's founders and three other friends, with an entrepreneurial profile, had the initiative to meet weekly to discuss business possibilities based on the knowledge acquired at the university.

The first idea involved working with drones. "But at that time the drones had a serious problem with regulation, and we did not want to get into something that depended on a lot of bureaucratic factors," Bruno explains.

In the middle of the fourth year, Bruno left for France to attend a interuniversity exchange graduation program, a modality of higher education in which the student carries out part of his studies in a foreign institution. Leonardo also opted for the same path, and went to Germany, to take part of an interuniversity exchange graduation program.

Although the meetings continued, they lost momentum over time, until at the end of the fourth year, only Leonardo and Bruno remained engaged in the entrepreneurial purpose.

Still in France, Bruno got the opportunity to start his master's degree and went to the United States to participate in the development of his research in NASA labs. There, the engineer had the opportunity to work on a balloon development project for the exploration of Titan<sup>1</sup>.

As this was an unknown area of the aeronautics until then, Bruno commented on this with Leonardo, who identified a research group for Airbus at the German university where he was studying, that was focused on the construction of unmanned dirigibles.

This aroused the interest of both, who discovered in their research that it was a state-of-the-art technology, used by the United States since World War II, when so-called 'barrage balloons' were used to bar enemy aircraft, as the name suggests.

These early balloons did not have any embedded system, something that has changed over the years: not only the US military, but also the Israelis began to incorporate sophisticated equipment to the aerostats.

The novelty and the high technological density of these devices aroused, in both friends, the desire to bring the technology to Brazil and make it their business.

The fact that they were working in the area and the identification of the existence of already established regulations for this type of equipment in the country were decisive for the partners to start structuring a project to develop the aerostats in Brazil.

After initially exploring the potential modern applications for balloons and dirigibles, they identified the use in telecommunications as an opportunity. Thinking of hard-to-reach areas and satellite coverage "holes", the idea of "disposable satellites" came up.

In mid-2010, Bruno and Leonardo subscribed, for the Santander Universities of Entrepreneurship Award, a business plan of what would be a balloon company, focused on telecommunications solutions, and ended up being among the semi-finalists. "We thought: if the people at the bank think our project makes sense, I think it's worth continuing. And so we decided to take the project even more seriously", says Leonar-



*The **Human Resources Training Program in Strategic Areas (RHAE)** was created in 1987, in a partnership of the Ministry of Science, Technology and Innovation (MCTI) and the National Council for Scientific and Technological Development (CNPq).*

*The Program uses a set of technological development grants, specially created to aggregate highly qualified personnel in research and development (R&D) activities in companies, as well as to educate and train human resources that work in applied research or technological development projects.*

*Micro, small, medium and large-sized private enterprises with headquarters and administration in Brazil (large-sized enterprises subject to 20% limitation of available resources) can participate.*

<sup>1</sup> Titan, Saturn's largest natural satellite and the second-largest in the entire Solar System, is the only satellite that has a dense atmosphere, and is also the only star object besides Earth, where concrete evidence of the existence of stable liquid bodies on the surface has ever been found.

Created in 1997, the **Fapesp Program Innovative Research in Small Businesses (Pipe)** supports the execution of scientific and / or technological research in small companies in the state of São Paulo.

Research proposals submitted to Pipe must be organized in three phases:

Phase 1 – with a planned duration of up to nine months, is intended to conduct research on the technical feasibility of the proposed research, with a maximum funding value of BRL 200 thousand.

Phase 2 – lasting up to two years, is intended to develop the research proposal itself, with funding of up to BRL 1 million.

Phase 3 – the small business is expected to carry out the commercial and industrial development of the products or processes, and there is no predefined range for financing.

do. The purpose of the project for Santander was to launch balloons with coupled radios and test the communication coverage.

Passionate about the possibility of being able to take internet and communication to all corners of the country, they spent the period between participating in the award (held in October 2010) and graduating, researching and studying business and technology.

In early 2011, after the validation of the Bruno's master's degree in France, Leonardo resigned the Brazilian airline where he worked, so that the two of them dedicated 100% to the creation of the company, investing their economies in it.

### External assistance and valuable advices

The next step was to seek additional resources, starting with participation in the Pipe / Fapesp and RHAÉ / CNPq Programs. In the latter, the project was approved in August 2011, receiving a contribution of BRL

218.400 thousand for the hiring of scholarship holders. "It was the first official support we had", says Leonardo. With the money, it was possible to hire trainees from ITA itself and, with a structured team, to advance in the research.

At the same time, Bruno and Leonardo decided to use the ITA's alumni network to contact the president of a large telecommunication company, also a potential customer, to validate the project and the business model. "He agreed to listen to us for half an hour, and when we talked about the balloon, he said that the idea had no future, that it would take us a long time to develop a commercial product; that, as the president of a telephone company, he would never buy something of the kind, concluding that we were going the wrong way", recalls Leonardo.

"He suggested that we think of a solution that was closer to the ground, a more specific application. We had already seen something about captive/static balloons, but we did not pay much attention, because the applications in the world, until then, were military, with cameras and radars. In that direction, the United States and Israel were great players; so was Russia. But at first we were more interested in civilian applications", he adds.

Today the partners see that moment as a watershed, because it generated a reflection that made them radically change the company that same day.

Bruno and Leonardo turned their attention to the study of static balloons to better understand their dynamics and functioning. That was when they identified the possibility of civilian applications, in the telecommunications sector itself.

Next, in September 2011, ALTAVE was awarded its first Pipe Phase 1, through which the company received a contribution of almost BRL 120 thousand to analyze the feasibility of placing electronic systems in static balloons and free balloons.

The next step was to enroll the project in the Incubators Network in São José do Campos. Approved in all instances, the next option was to incubate ALTAVE at Incubaero – incubator of companies linked to ITA, at the Department of Aerospace Science and Technology – DCTA, at ITA.

The fact that they stayed in the ITA provided other opportunities for advice and feedback with alumni, who are now entrepreneurs in large technology companies. “We never hid our idea: wherever we could discuss our project, we did. There was not much care or concern that anyone could steal our idea. We would talk to everyone and ask for opinions”, says Leonardo.

Thus, both the project and the business model underwent several changes throughout the development. “This happened a lot: we started to develop things and we realized that that way, by the technical or the legal route, it would not work. And then we changed the direction”, he summarizes.

The main of these changes came at the end of 2011, when Leonardo attended a seminar in Rio de Janeiro, where new technologies for defense and security were discussed.

In the event, ALTAVE had the first contact with the Brazilian Association of Defense and Security Materials Industries (Abimde), whose president at the time was from ITA (and the president of Embraer Defense and Technology). “He found what we did interesting and said that our idea had everything to do with defense and security,” says Leonardo. From that moment, ALTAVE became a member of the Association, and the application of static balloons in defense and the security theme were incorporated into the project scope.

### The idea begins to take shape

The first proof of concept were practically carried out with junk yard, counting on the support of the ITA and the Institute of Aeronautics and Space – IAE, through the Division of Atmospheric Sciences – ACA, which supported with some laboratory items, assisting in the first launches.

With the financial resources received through Pipe Phase 1, from Fapesp, two free balloons and one static balloon were purchased, all imported from the United States.

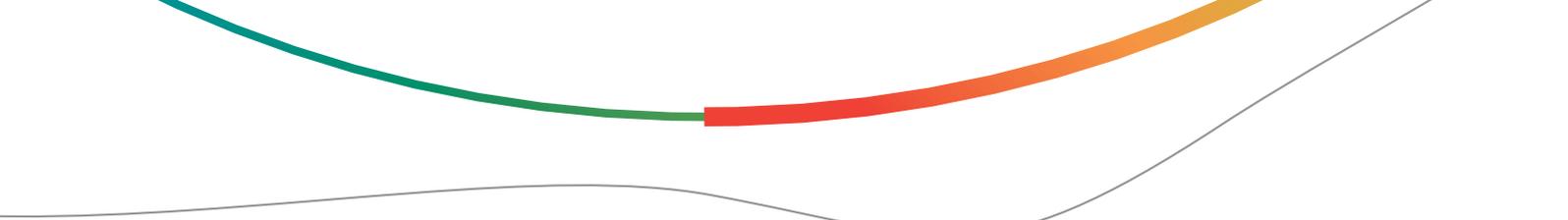
The first tests were much handcrafted, although there was already a better knowledge of the problems and uncertainties to overcome, which allowed for faster execution. “We borrowed four radios from a cousin of mine. Two of them were placed on the first balloon, and the others stayed with Bruno and me. We released the balloon, and as it went up, we walked through the city and through the road, each one to a different direction, talking to each other. We managed to get about 60 kilometers away, talking through the balloon. The funny part is that, at the end of the test, we lost the balloon and my cousin is still waiting for me to return his radios”, Leonardo laughs.



We never hid our idea: wherever we could discuss our project, we did. There was not much care or concern that anyone could steal our idea. We would talk to everyone and ask for opinions.

**Leonardo Nogueira**  
Founding partner at ALTAVE





In the first six months of the project, tests and studies have advanced. The team managed to place a cellular phone device in a static balloon, which increased the signal range from 200 meters to 2 kilometers. It was the proof that the best way to continue the project was to use the static balloon.

The report for the Fapesp's Pipe Phase 1 was then approved and paved the way for project approval – also in Phase 2 – which yielded more than BRL 850 thousand to continue the development (at the end of 2012 and early 2013), now focused on applications in both telecommunications and monitoring.

There were several participations in fairs and international events, through which partnerships were signed with telecommunications companies and a supplier of camcorders.

One of the most important partnerships, which was instrumental in the birth of ALTAVE OMNI, was established with IAI – Israel Aerospace Industries. The Israeli company, which works with cameras and optometrists, provided a camera (which costs around \$ 200 thousand) along with its codes of command.

With this material, ALTAVE developed the integration architecture of the camera to the balloon, to design a complete monitoring solution, very well accepted by the IAI, due to its quality and ease of use. From then on, the partnership strengthened, and ALTAVE was given *carte blanche* to continue working with the cameras, which generated a free publicity through the IAI.

At the same time, the participation in Abimde has gradually increased the exposure of the company and its project to defense and security customers. The Ministry of Defense was one of them, seeing in ALTAVE's solution a great potential to form the Integrated Border Monitoring System (Sisfron), one of the main strategic projects of the Army. "We were and still are the only company in the Southern Hemisphere that develops and markets products and solutions composed of captiveballoons", says Bruno.

The invitations to participate in a number of discussions at the Ministry drew the attention of several large companies, including Israel's largest defense company and one of the largest in the United States.

In addition, that was when ALTAVE made a big leap from being an R&D company to becoming a technology integrator and diffuser. "We started discussing larger projects, companies accepted us as platform suppliers and wanted us to accept an integration between platforms and technologies," says Leonardo.

It was also during this period, still in 2012, that ALTAVE received its first angel investment. "The money that we had received through the subsidy announcements had a definite destination and we needed a contribution that gave us the freedom to use capital in other areas to help us grow," explains Bruno.

This investor, also linked to ITA, believed in the project and contributed with the amount of BRL 700 thousand. Later that same year, a second angel investor, whom Bruno had known through ITA alumni network – Itanet – and who had already helped him financially on his trip to the United States – on the occasion of his work at NASA –, contributed another BRL200 thousand. All the injected capital was used to pay administrative charges and equipment manufacturing, over the next two years.

In 2013, with ready-made prototypes, ALTAVE's team effectively began to go out on the street, to make demonstrations and work on a sales effort, which could also serve as a validation of technology with customers. "It was the year in which we participated in the monitoring of Rio de Janeiro's Carnival, with the State Military Police, we carried out environmental monitoring with the State Military Police of São Paulo, and telecommunications tests with the Navy in Rio de Janeiro", says Bruno.

These jobs, although without significant results in billing, contributed to the company's beginning to gain experience and to optimizing its products and processes. Thanks to the subsidy + angel investment + sporad-

ic billing formula, the company was maintained until 2014.

### **Obstnacy (and luck) towards Rio 2016**

ALTAVE's journey to becoming responsible for the security monitoring of the Rio 2016 Olympic Games began in 2012, somewhat by chance. At a security fair held in Brasilia, the partners met another ITA's alumni, who worked for the Federal Police, and presented them to a colleague responsible for researching technologies for the security of the 2014 World Cup in Brazil, who ended up interested in getting to know ALTAVE balloon.

"We were desperate," says Leonardo. "We had taken a very ugly balloon, a poorly made prototype that needed a weight to not fly. Obviously the Federal Police personnel, who had been to Israel and seen much better balloons, did not like what they saw – telling us we needed to develop a bit more". The embarrassing situation was an impetus to develop a product that met that demand, the starting point for a hard work of product improvement, so that the ALTAVE balloons could be used in the World Cup.

After months of work – and already with a viable product in hand –, the partners went back to the Federal Police team about eight months before the 2013 Confederations Cup. "But they told us that our product was still not good enough and there was no more time to do something for the World Cup," says Bruno. Even so, ALTAVE was allowed to do a demonstration and install a balloon at the stadium, in the final match.

At the time, an apparently uncomfortable situation ended up generating positive results for the company. ALTAVE installed the balloon, which stood at a height of 150 meters, in an attempt to draw FIFA's attention to the product.

This really happened, but for an unusual reason: because it was the Confederations Cup, airspace was restricted to only nine registered helicopters that could fly over the stadium. The news spread through the authorities was that the ALTAVE balloon had invaded the military airspace!



After a few phone calls, the authorization process was granted, after checking that everything had been done correctly. However, the information did not reach the central agencies in time. "This made many people go see the balloon. An admiral arrived complaining, but he wanted to see what it was, as well as people from the Federal Police. We considered it a success, since the balloon was efficient in acquiring images, positively drawing the attention of potential customers", recalls Leonardo.

Finally, in 2014, after ALTAVE's participation in the *Copa Libertadores da América* final and the implementation of a project, with the Ministry of Communications, to bring broadband to remote regions, using balloons, the Federal Police decided to buy the solution for the Olympics.

Since it would be necessary to watch four locations at the same time for this event, it would be impossible to keep helicopters flying all the time. The second option, which would be the purchase of live images via satellite, was too expensive. Therefore, they chose the balloons.

However, it would not be so easy for ALTAVE: the company would still have to compete with other suppliers in a bidding process with international competitors.

### **David vs. Goliath**

The other competitors were large, well-established companies from Israel, the United States and France. At first, ALTAVE was sought out by all of them, with proposals to become equipment suppliers. "But we saw that if we became suppliers we would put a lot of technical and commercial uncertainties into the agreement. No potential integrator

we had talked to understood of captive balloons as well as we did; they understood of cameras, and there was a technical risk in the partnership, given the time for execution. In addition, we were willing to sacrifice all our profit to have the case, which would not necessarily be the position of integrators. Lastly, as the leading company, we would have the full exposure of the most innovative security project of the Olympic Games, taking an important step towards making ALTAVE a great company”, describes Bruno.

In addition, that was the strategic decision taken: to offer our own business proposal.

Initially planned for a maximum value of BRL 76 million, the bid involved a package with a large number of balloons, cameras, maintenance, and support services.

The dispute was held in December 2014, through electronic trading. “We had never disputed any bidding in our lives. We prepared ourselves to the maximum, trying to surround ourselves with people who understood the process”, says Leonardo. On the day of the trading session, the only competitors to submit proposals were TCOM, an American company, world leader in the market, and Safran, the largest French aeronautics company.

Whereas competitors submitted bundled packages totaling BRL 76 million, ALTAVE was prepared to offer a much cheaper deal, with limit values established only to avoid loss.

At the end of the bidding process, the TCOM representative had made a mistake in the documentation and the company was eliminated early in the trading session. “Our luck is that, as ITA students, we have been very well trained to make very rigorous reports. Also, we had the help of a company specialized in this type of negotiation, so that we did not make basic mistakes”, says Leonardo.

The dispute was then between ALTAVE and the French company, who had *carte blanche* to win the bid, regardless of the value. Thus, the trading session became very competitive, with discounts reaching BRL 2 million in a single bid!

It took teamwork, agility in the decision-making and speed to bid so that ALTAVE could

win. When the clock finally stopped, the final value was BRL 46 million, a figure that turned into BRL 24 million a few months later because the government canceled items to reduce expenses due to the financial crisis. That is, the company went from expecting considerable profit to zero-to-zero in financial terms. Still, the partners were very pleased, as the achievement was another watershed in the history of ALTAVE.

### **Overcome challenges and success in the Olympics**

Winning the bidding was only the first challenge of a new series. The object of bidding had very specific operational requirements, with a series of demands. The deadline to meet such demands was one of the biggest challenges: it was six months to go from the concept specified in the edict and reach the desired product that met all the parameters.

Among the technological challenges to be overcome, there were: to withstand winds of 60 km/h, to have the capacity of data transmission of 6 Gigabytes per second (something only achieved through fiber optics), to have the capacity for installation in confined spaces, to withstand rifle shots, in addition to manufacturing and supplying the balloons.

This last issue was a special case, as ALTAVE’s North-American supplier refused to proceed with the supply, which forced the company to find out how to produce the balloons and develop local suppliers to manufacture and assemble the equipment. All this in six months!

With the hard work of a team of 25 people, ALTAVE was able to meet all requirements and deliver the ALTAVE OMNI solution, which includes aerostats, cameras and a persistent monitoring system for large areas, which allows for a 360° situational awareness. Camera recording is continuous – 24 hours a day, 7 days a week – and the images have a resolution 60 times higher than High Definition TVs (Full HD).

ALTAVE balloons are comprised of two layers. The internal layer – the most important – is formed by a type of plastic that has a unique property: when hit by a projectile,

the plastic shrinks, and the rifle shot turns into a one-millimeter drill. That is, the balloon is pierced, but the air leaks very slowly. "In our tests, we fired 39 rifle shots, and the balloon continued to fly for almost three hours", says Bruno. This allows for the balloon, even if shot, to be pulled down, calmly and safely.

With so many embedded technologies, the final cost of each of the balloons was around \$ 5 million, with the camera taking up practically 50% of that value. This is a very modern camera, which has already been used in the Afghanistan war, which is actually a set of 13 cameras, arranged inside a sealed chamber. The images, collected in real time, allow opening a window in any region of the map with a click, to observe in detail all the people who are in that environment.

For Rio 2016, four captive balloons were delivered, supporting this camera equipment 200 meters high, allowing for continuous monitoring of a 160-km<sup>2</sup> area (40 km<sup>2</sup> per balloon). Thus, the four balloons covered the equivalent of approximately 13% of the entire city of Rio de Janeiro area and became the main security item of the Olympic Games. There was also training of the 80 employees of the State Government and the City Hall, who were responsible for the operation of the system.

### Continuous learning and improvement

Beyond financial return, the experience with the Olympics provided a series of important lessons and developments.

The project originated some patents. The most important is the winch. The balloon has some basic components: one is the cable that holds it to the ground and through which the fiber optic and gas pass; the other is the winch, which guarantees the system's support in a safe way.

When ALTAVE won the bidding, it was necessary to develop its own winch, the differential of which is the size. Whereas American and Israeli models are gigantic – and need a trailer for transport -, the ALTAVE winch fits in a box with less than 1 m<sup>3</sup> in volume. The project has generated an international patent, filed in the United States, Europe and Israel. Another very relevant patent, filed later, is related to the prospect of autonomous operation of the balloons.

In addition to patents, ALTAVE maintains industrial secret, regarding the production of balloons fabric, developed in partnership with a national supplier, with whom an exclusive contract was signed.

Moreover, what were the lessons learned? From the technical point of view, the major lesson was the importance of the variable scope to be able to develop innovations at short time intervals. According to Bruno, it was the use of the SCRUM<sup>2</sup> methodology that allowed the team to overcome all the technological challenges in parallel, within the deadline determined for the execution of the project.

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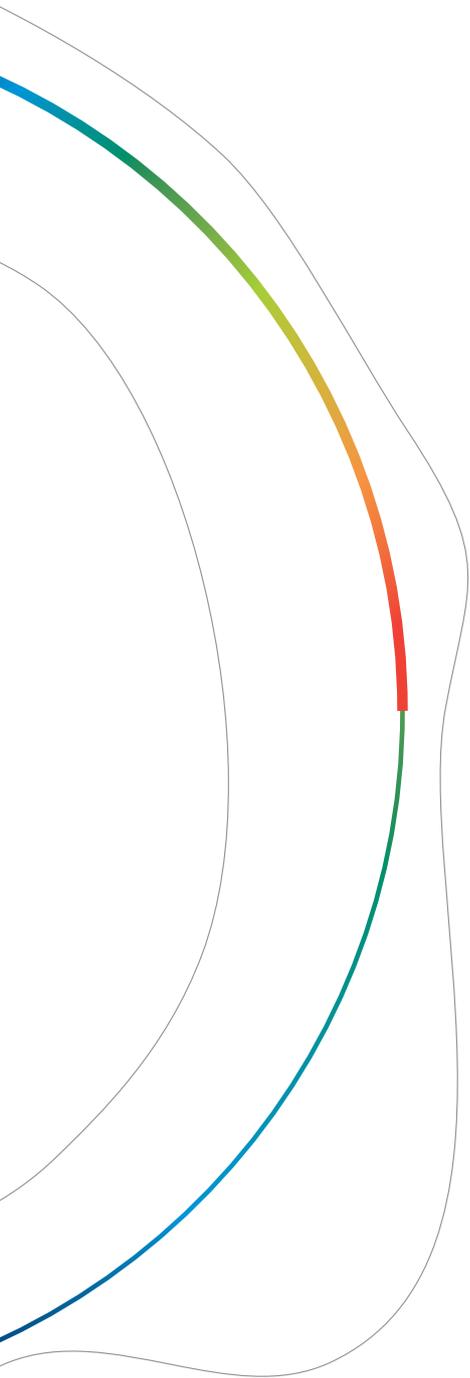
<sup>2</sup> Scrum proposes that a project be divided into several activity cycles, with frequent meetings so the team can change what it has been doing, and think of ways to improve the process with agility. This methodology proposes that the project be closely monitored and undergo changes in planning all the time in a free and flexible manner. – Source: <https://endeavor.org.br/scrum/>



We were willing to sacrifice all profit to have the case, which would not necessarily be the position of integrators.

**Bruno Avena**  
Founding partner  
at ALTAVE





In the organizational sphere, the project was a kind of test for the team, which proved to be extremely intertwined and so committed to the success of ALTAVE, whose engagement has now become a great differential for the company. "With a challenge as huge as the Olympics project, we had the necessity to keep working overnight. We even had a flight test campaign where, for thirty days in a row, we stopped at the São José dos Campos airport to tow the balloon from side to side, measuring speeds and analyzing its stability characteristics", says Bruno.

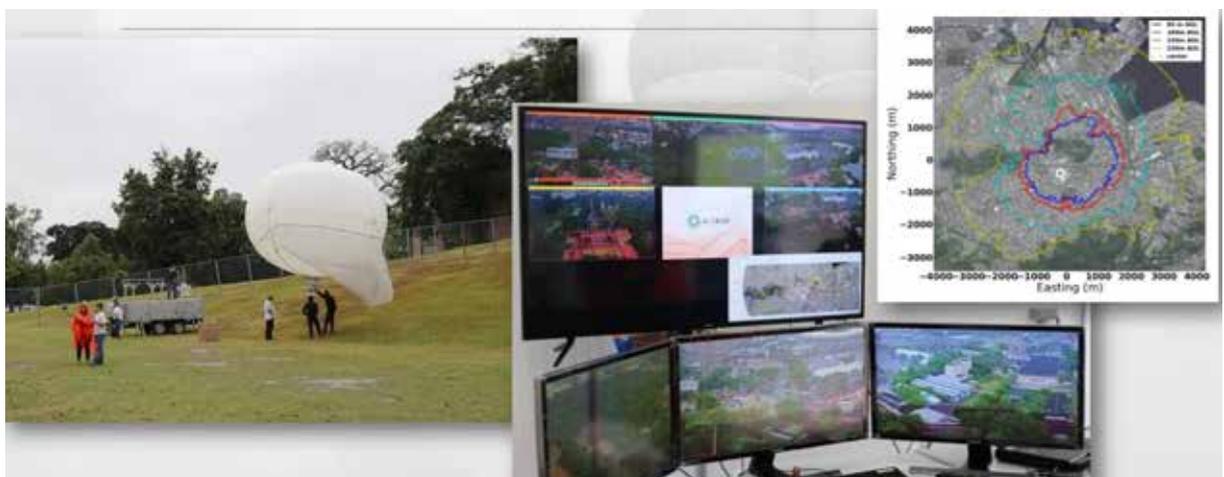
As this work could only be carried out during the night, the team itself volunteered. "On the delivery date of the equipment, the deadline was six o'clock in the morning, and when the trucks came to pick them up, we were all there, helping to clean the trailers", he adds.

### What are the next steps?

ALTAVE's focus is now in the development of new partnerships and applications for the balloon, which includes the development of new technologies and entry into new markets. For this, the strategy is to change the business model, which is now exclusively sales, and to offer services through strategic partnerships, prioritizing private segments. "In every niche market that is interested in our product, we seek to partner", explains Leonardo.

The main segment in which ALTAVE seeks to invest is agribusiness. "Imagine a sugar cane producer. He does not want a balloon operation team to monitor his crop. So the idea is to partner with the one who provides service to the producer, selling or renting the balloon, so that they can offer the monitoring service", he adds.

An important step, which has already been taken in opening up new markets, is the creation of ALTAVE EXPLORER, an evolution of ALTAVE OMNI. EXPLORER is the same captive balloon used in the Olympics with some improvements, optimized to reduce operational costs. For example, it is the only one in the market with remote lifting and retrieval without the operator's physical contact with the balloon or its ropes.





This evolution, also patented, allows greater availability, greater security and less space for installation. The innovation, together with the experience at the Olympics, has had great response – including abroad and in private markets. ALTAVE has already started exporting and has signed a distribution agreement for Europe, an initiative that will soon be replicated in other regions.

This distribution is a milestone, as the agreement was signed with Europe's leading captive balloon supplier, which evaluated the complementarity and uniqueness of ALTAVE technology, systems, documentation and company history, and then proceeded further. "This makes us quite pleased with the degree of innovation and technological maturity we have achieved, demonstrating that we are well positioned on the world stage", celebrates Bruno.

### **Technical competence + favorable ecosystem = recipe for success**

ALTAVE success is due, in large part, to the technical competence of the partners and its staff, all graduates from renowned educational institutions in the country. However, in addition to the academic knowledge, the network established between ITA's professors and alumni of ITA was, in several moments, crucial for the viability of ALTAVE's business, either through counseling or through financial contributions.

Investments and subsidies, by the way, were (and still are) the support on which ALTAVE was able to grow. So far, the company has summed over BRL 6 million in subsidies (in 2016, other four Pipes/Fapesp were approved and started) and almost BRL 2 million in investments, which makes ALTAVE another clear example of how the innovation ecosystem is vital for the survival of technology-based startups in Brazil.



ADESIVO EM PÓ - ARTEPOWDER





**ARTECOLA**  
QUÍMICA

# POWDER ADHESIVE REVOLUTIONIZES THE FOOTWEAR MARKET

- ARTECOLA QUÍMICA
- Campo Bom/RS
- Large-sized enterprise
- 800 Employees
- Product innovation
- MEI Agenda: Human Resources for innovation

*Brazilian adhesive company is the first in the world to develop a new adhesive concept that, in addition to being 95% more economical, reduces the application time by 70%*

Artecola developed the first powder adhesive for the gluing of soles in sports shoes. The advantages over the traditional adhesive, which uses organic solvents and requires manual application, are important: Artepowder has automated application and eliminates solvents. With this, innovation reduces process time by up to 70%, generating significant gains in the cost of the glued pair of shoes. In addition, the new technology, besides reducing consumption by up to 95%, does not generate waste, which is an advantage both from an environmental and occupational health point of view.

Artepowder's main market is Asia, where the production units of the major manufacturers of sports shoes are concentrated. That is also the reason why Artecola has implemented in China its production of auxiliary chemicals, used in conjunction with the powder adhesive.

The innovation reinforces Artecola status as a world reference in adhesives and its position as one of the Brazilian companies with global presence. With almost 70 years of history, the company has 11 production plants distributed among Brazil, Mexico, Chile, Colombia, Argentina, Peru and China, commercializing adhesives in more than 20 countries for applications in the most diverse markets, which include, in addition to footwear, the furniture, paper and packaging, automotive and construction sectors.



## Why a powder adhesive?

Until the emergence of Artepowder, the sole option of shoe manufacturers for the step of gluing the soles was manual labor. This type of process, in addition to being susceptible to large variations in quality and resulting in high rates of material waste, requires the use of solvent-based adhesives, which endangers the health of workers, by generating a large amount of waste.

In all markets where it operates, Artecola is always concerned with delivering solutions that take into account the needs of its customers. Therefore, the company keeps its eyes on the markets, in search of opportunities to offer new products, capable of generating better results, supplying deficiencies or anticipating trends.

This was how Artecola proposed to its research team the challenge of finding a solution that could simplify the production process of shoes while reducing the use of solvents, by seeing the need for an innovation in the gluing process in the footwear market from the suggestion of a partner, manufacturer of machines for the footwear industry.

The project started in 2006, when, after an extensive search for alternatives and rounds of ideation, it was defined that the development would be focused on powder adhesives, technology already existent and in use in other markets, with which Artecola itself and the footwear inputs industry, as a whole, did not work until then.

What justified this unconventional and risky choice was the comparison between technologies. A solvent-based adhesive has approximately 20% solid material, that effectively acts on adhesion between materials, which only occurs when all solvent evaporates.

A micronized adhesive is 100% solid, which means much less material will be required for the same bonding to occur without any solvent vapor being spread in the environment. In addition, during the bonding process with the powdered product, it is possible to remove the excess from the application, to recycle the material and to use it in a next application – impracticable in the conventional process, with the use of solvent.

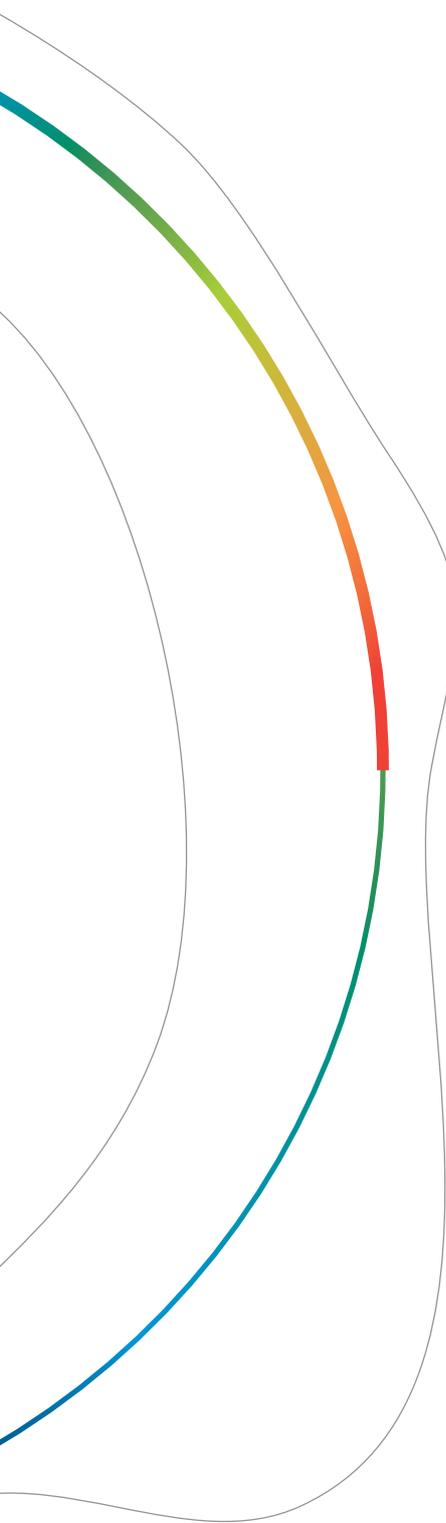
The principle of bonding with the adhesive powder is similar to that of a hot-melt adhesive: the powder is a type of polymer that liquefies by heat, which, when cooled, solidifies again, promoting adhesion between the surfaces in contact with the material.

One of the major technological challenges faced was to develop a polymer that could be micronized and would meet all the requirements and restrictions of the footwear sector. The sports footwear market in particular is highly restrictive and each brand has its own list of exclusive materials, which further increased the challenge of developing a product that would suit all companies.

In order to achieve the desired results and overcome the barriers that shoe manufacturers

*Fraunhofer-Gesellschaft is the largest applied research organization in Europe, with a staff of 24,500 people in more than 80 research centers, including 69 Fraunhofer Institutes in Germany. It carries out applied research of direct utility for public and private companies, with great benefit for the society. Brazil and Germany have been partners in science and research for more than 40 years. This partnership is reflected in the fact that approximately one-third of all Fraunhofer Institutes already carries out some type of activity in Brazil.*





could present to the new product, Artecocola had important partners: the Federal University of Rio Grande do Sul – UFRGS and the Fraunhofer IFAM Institute in Germany.

Fraunhofer, as it is known, is one of the most important research institutions in Europe (not just for adhesive technology), which contributed to the development of a special molecule, offering the opportunity for a part of Artepowder research to be carried out in their labs, during the Sandwich Doctorate<sup>1</sup> of the project lead chemist.

For the project success, it was also fundamental to establish partnerships with suppliers, as the new product would have development. That is, on the one hand, there was Artecocola, thinking of the properties that the final material needed to present; on the other hand, the suppliers of polymers, with great knowledge on how to do it, and especially if it was possible to do it.

### Essential partnership for innovation

At first, still in 2006, Artecocola's research team thought about dividing the project in two stages: the first one for developing the adhesive; the second one for developing the equipment to automate its application. Thus, already in 2007, the investigations and tests with solid adhesives began even without a machine to apply them.

However, the initial results fell far short of expectations, and the team realized that it needed to find a partner in the market that mastered the technology of adhesive application, so that both companies could think together about the creation of a complete adhesive/machine solution.

That was how in 2008 Artecocola started one of the most important partnerships in its history with Orisol<sup>2</sup>, a leader in the development of technologies to increase productivity and quality of the footwear sector, present at the main footwear centers in Brazil and worldwide.

Orisol already had the prototype of a machine for automatic adhesive application in shoes, but still did not have a partner to develop the adhesive. Both companies then decided to unite, to achieve the common goal of generating innovation: a perfect match between chemistry and mechanics.

Moreover, the textile, clothing and footwear industries have, since the English industrial revolution in the eighteenth century, this same characteristic to benefit from the gains generated by advances in mechanics and chemistry, the two pillars of its technological development, which results in the large number of process and product innovations.

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<sup>1</sup> A Sandwich Doctorate is an expression used in the academic environment to designate an intermediate period in which a doctoral student and researcher engages his activity in another institution after the initial development of his studies, before concluding (and defending) his thesis.

<sup>2</sup> On Orisol's website, the company is defined as "a world leader in industrial machines for footwear, automation and work methodologies. (...) Our core business strategy is built around the customer and their needs, justifying their investment in machines, and maintaining strong technical support." <https://www.orisolasia.com/>

Still in 2008, Orisol brought the machine from its Taiwan plant into the Artecologia laboratories. There were two years of intense joint work for the improvement of the product formulation and the machine system. "Our partnership with Orisol followed a very interesting work model because we developed the whole solution together, with the teams really working together. Nobody stayed in their comfort zone", says Geovana Bockorny, senior technology specialist at Artecologia.

At this stage, one of the major challenges was to achieve a powder that contained a particle size suitable to be applied automatically by the machine, homogeneously. "After the application, the adhesive and all the excess are put back into the machine. To make this flow inside the equipment, the adhesive needs to pass through suction, with a series of filters to prevent the material from being released to the environment. So it was not any granulometry that would work," explains Geovana.

In 2011, several pilot tests were carried out with a partner customer, active in the casual footwear market, until then Artecologia's target audience for the new technology.

There were three months of evaluations and adjustments, until the process was approved. The following year, the first patent of the technology was filed and the commercialization of Artepowder and the machine, named OPS 410, began. It was also in 2012 that the interest of the sports footwear market in the new technology began to emerge, a new fact that had a decisive impact on the project and business.

### Direction set by customers

Although early in the project Artecologia considered the casual footwear market, it was in the sports segment that Artepowder found more favorable conditions for application.

This happened for several reasons. The casual footwear market is very tied to fashion and therefore it works with three-month cycles, in which there are changes in the materials and treatments, both for the uppers<sup>3</sup> and the soles, "a difficult range to cover with a single product", explains Geovana.

Another important point is that the volatility of fashion trends, in the casual footwear segment, entails much smaller batches than in sports footwear segment.

In addition to dealing with large-scale production, the sports footwear segment manufactures shoes with a higher unit value that need good durability. These elements justify the investment in an innovation like Artepowder, which streamlines production and ensures uniformity and quality in the automated application.

However, until the powder adhesive creation, Artecologia did not have an expressive performance in the market of sports shoes. Orisol, on the other hand, works heavily in Asia, where production is concentrated: the

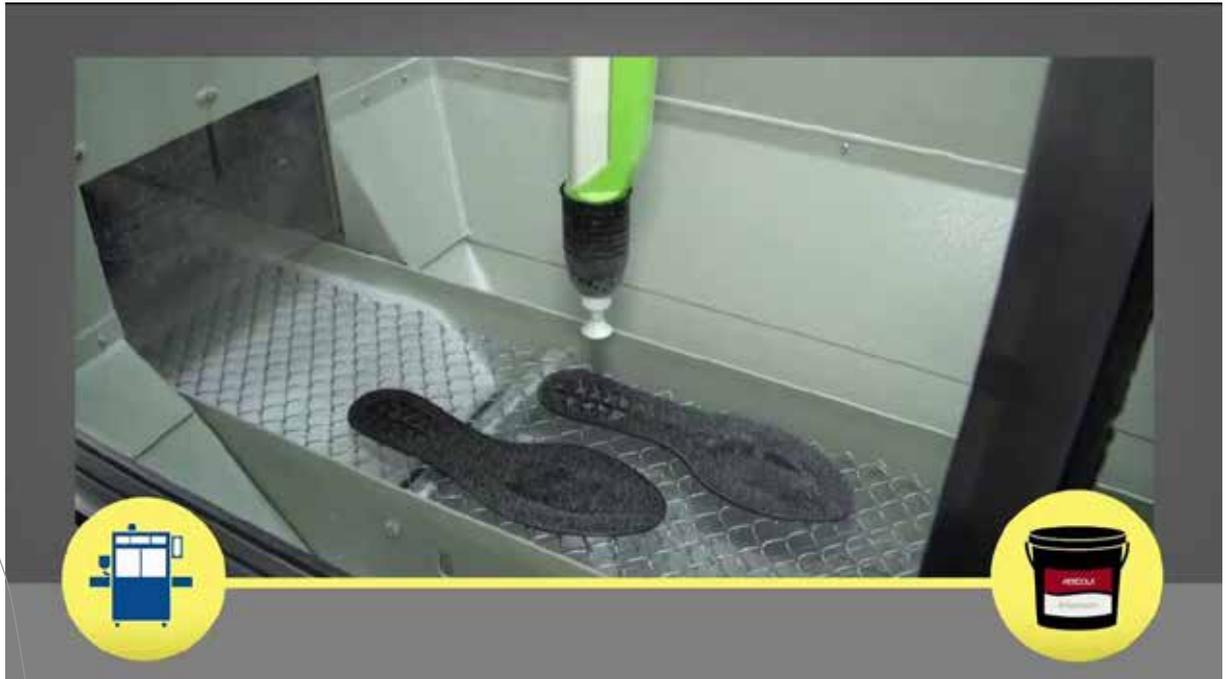
<sup>3</sup> The term upper refers to the upper part of the footwear, which covers the foot and composes, with the soles, the complete set. The final manufacture operation precisely consists of the bonding (or sewing) of the two parts.



Our partnership with Orisol followed a very interesting work model because we developed the whole solution together, with the teams really working together, nobody stayed in their comfort zone.

Geovana Bockorny,  
Senior technology  
specialist at Artecologia





largest manufacturers of sports footwear are in China, from where they serve 85% of the world market for sports footwear.

In order to operate in this gigantic market, Arteccla made a joint venture with Orisol in Asia in 2013. Since then, all the production of auxiliary chemicals, which participate in the process of bonding the soles, has been transferred to Asia. The adhesive production, for now, continues in Brazil: a strategic protection decision, while the product patent is not granted.

### How does the process work with Artepowder?

As with other types of adhesive, the first step for the bonding of the footwear with Artepowder consists of cleaning the sole and upper and applying a primer<sup>4</sup> on both, which can be done manually or by means of a robot.

The primer function is to chemically and physically prepare the surface for the deposition of the powder, which is the next step. The primer for the powder adhesive, however, is not the same used for solvent-based adhesives. Therefore, it was necessary for Arteccla to develop, in addition to the adhesive, the whole line of auxiliary chemicals, essential for the efficiency of the bonding.

The sole with the primer enters the machine through a conveyor belt, which leads to the nozzle, which releases the powder in the form of spray and deposits it on the sole.

Still on the conveyor belt, the sole passes through a light jet of air, which removes excess powder. The fact that the conveyor belt is a screen is crucial for excess powder to recirculate and return to the system for use in the subsequent applications.

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<sup>4</sup> Primer is a chemical product that has the function of preparing the surface to receive the adhesive.

After the air jet, it is time to “activate” the adhesive, through the heat. This stage represents a great differential in relation to other technologies. “Whereas in the bonding with traditional adhesives the footwear needs to go through a long heating tunnel to evaporate the solvent, in the process with Artepowder the sole passes quickly under a lamp to receive a flash at 70°C”, explains Geovana.

The next step is the pointing, which is the joining of the sole with the upper, done manually. The set is then pressed and the footwear is ready.

### Success on the other side of the world

Since its launch in 2013 Artepowder’s main market is China, where large brands already consume the product. Although the company does not disclose exact numbers, it is known that dozens of machines have already been installed and millions of pairs of footwear have already been produced with the new technology.

The sales growth in the largest consumer market in the world confirms the quality of the solution developed by Artecola and the competence of the team, which has been able to meet all the requirements of the project and to add other interesting attributes, sustainability being one of them.

Innovation has in itself the so-called sustainability tripod: social, environmental and economic. While the Artepowder production process consumes less energy and less water than the production of other types of adhesives, the bonding with the powdered product, compared to solvent-based adhesives, is 70% faster, more productive and standardized, as well as requires less manpower.



The automation allows to maintain greater control of the process and, consequently, greater yield, in addition to reducing the consumption (and the waste) of raw material in up to 95%. Finally, the nature of the adhesive itself contributes to a more homogeneous application and results in greater bond strength. An important gain, apart from the economic benefits, is the lack of waste and the suppression of workers' exposure to solvents.

The turnover figures prove the success of Artecocola innovation. While in its launch year Artepowder's contribution to the company's sales was just under BRL 600 thousand, in 2016 it reached the mark of BRL 900 thousand. Artecocola also received the following acknowledgments for the development of innovation, which revolutionized the footwear manufacture:

- Rio Grande do Sul Exports Award 2014, from the Marketing and Sales Managers Association of Brazil (ADVB), which distinguishes the companies that obtained the best market results and developed innovative strategies to expose and market their products in the international market;
- The Apex-Brazil Excellence in Exports Award 2014, promoted by the Brazilian Agency for the Promotion of Exports and Investments (Apex-Brasil), which recognizes the efforts of Brazilian companies and entities representing the productive sector, which have distinguished themselves with innovative export initiatives;
- Primus Assintecal/Braskem 2014 Award in the technological innovation in medium-/large-sized enterprises category, promoted by the Brazilian Association of Companies of Components for Leather, Footwear and Artifacts (Assintecal) sponsored by Braskem, which recognizes and promotes creative and innovative solutions that contribute to the improvement of its competitive position in the market, moving the component sector.
- Third place in the II Brazil-Germany Innovation Award 2014, created by the Department of Innovation and Technology of the Brazil-Germany Chamber of Commerce and Industry (AHK). The award identifies and recognizes innovative efforts made by Brazilian or German companies located in Brazil.
- Finalist of the 2014 National Innovation Award, in the Technological Innovation category, an initiative of the Entrepreneurial Mobilization for Innovation (MEI), carried out by CNI and Sebrae, the purpose of which is to encourage and recognize the successful efforts of innovation and innovation management in organizations operating in Brazil.

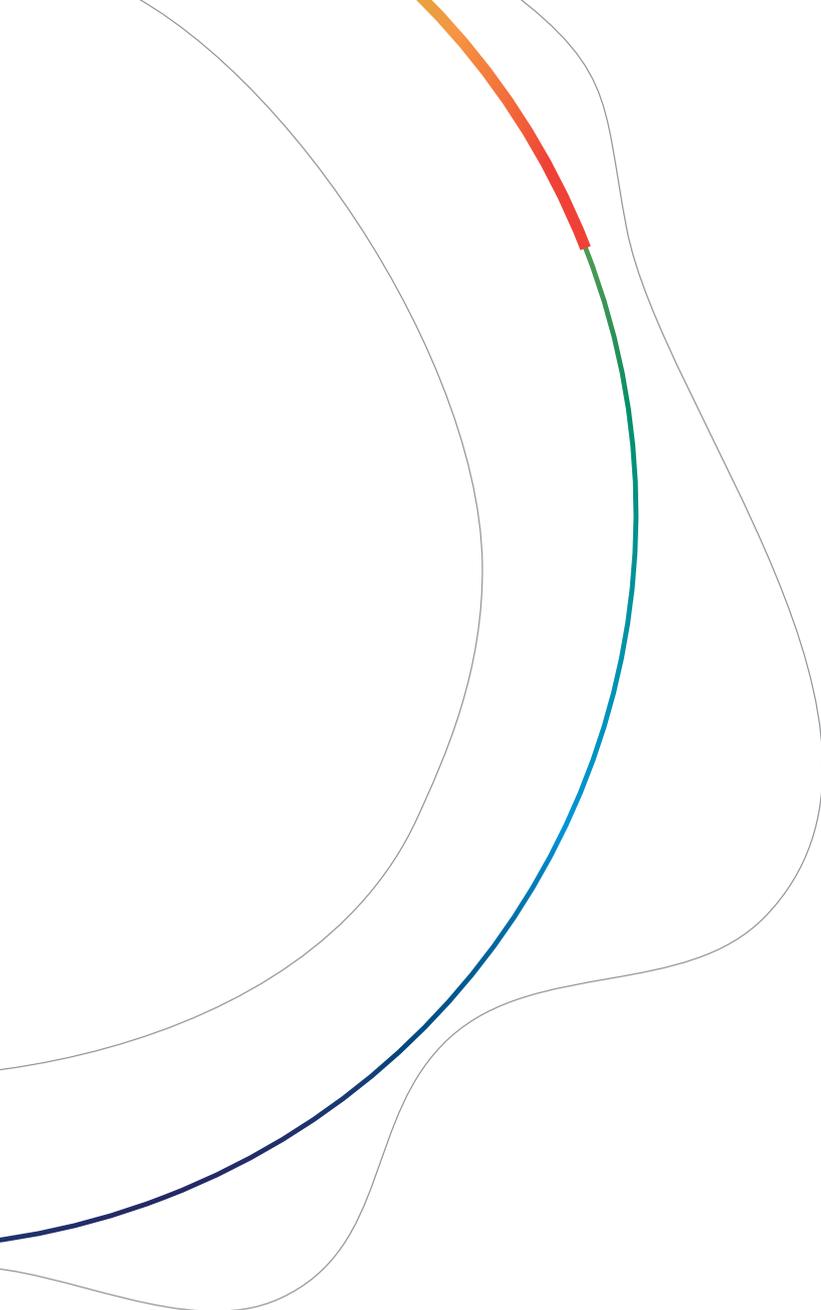
### **New businesses**

Aside from the positive results of Artepowder itself, the main success of the project for Artecocola was the creation of the joint venture, which introduced the Brazilian company into the Asian market and promoted a very expressive growth of its potential market. Previously operating only in the Latin American sports market, Artecocola achieved a small fraction (10%) of the world market.

Although the internationalization for Artecocola is not new – it is one of the most internationalized companies in Latin America and the adhesive company with the best geographic distribution of the continent – the entry in the region, which concentrates 85% of the world’s manufacturing, is a highlight.

Geovana points out, however, that the Brazilian market has contributed to Artecocola’s penetration in Asia. “As an adhesive manufacturer, we did not have such a strong presence in China with the major international brands, but we had – and we have – very strong participation with these brands here in Brazil, which was already a path for us,” she explains.

After having already taken the manufacture of auxiliary chemicals to China, the next step for Artecocola’s internationalization is to transfer the technology and the manufacture of the powder adhesive, to be closer to the customers. This is yet to happen, because there is no patent for the adhesive technology, and the filing still needs adjustments. In time: Artecocola has already filed two worldwide patents: one for the equipment and another for the process, which uses the adhesive and the equipment. In both patents, the holders are Artecocola and Orisol.



The project also had interesting developments for the businesses of both companies. Artecola has created a division to work with the new technology, since it does not fit into any of the company's adhesive divisions.

Orisol brought to Brazil the assembly of the machine, which parts come from China and Japan. This option comes from the fact that all the assembly know-how of the new equipment was developed – and is mastered – by the Brazilian team.

In this mutual-profit partnership, there is a lever of extraordinary potential for Artecola's global business, since it has a partner that occupies a prominent position in the worldwide industry of industrial machines for footwear, heavily inserted in the world's major footwear manufacturing centers.

### **Innovation is not made alone**

Artecola's experience in seeking partnerships for the development of its product is an emblematic example of how important this type of initiative is to enable innovation. The company used this tool in a very perspicacious manner to overcome its deficiencies and established partnerships with private and public entities in Brazil and abroad.

Much of the know-how that the company did not have internally for the development of the chemical part of the technology, which involved the creation of a new molecule, was achieved through research partnerships with the Federal University of Rio Grande do Sul (UFRGS) and With Fraunhofer IFAM.

The lead chemist of the project made her doctorate at UFRGS and a period of research at Fraunhofer, under the Science Without Borders program. For the development of the machine, the partnership with the SENAI Institute for Innovation in Polymer Engineering (Cetepo), in São Leopoldo (RS), was fundamental, which provided the necessary support for Artecola and Orisol teams to adapting the equipment to work with a powdered adhesive polymer.





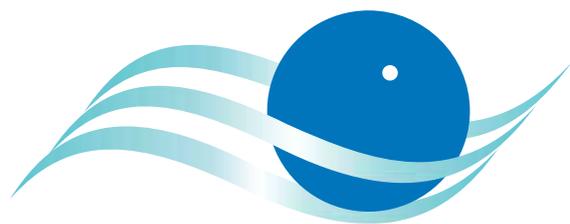
This work model highlights two interesting points: first, the importance of public initiatives for the establishment of partnerships with international research institutions for the generation of innovation in Brazil; second, the importance of the innovative company to open space, so that its team “leaves home”, qualifies and internalizes the knowledge acquired.

Although Artecola already promoted the exchange of employees among its units – in addition to encouraging them to acquire a solid academic background – Artepowder’s project was the first in which an employee was allocated in a partner institution.

Artecola’s case clearly shows that the potential of innovation is realized through collaborations. They are the ones that allow joining forces and building success trajectories.

In this case, the main collaboration took place with a leading global machine company for the Artecola industry, and the new relationship – centered on a combined innovation of two elements of the production process: machine and glue – should provide a new impetus for the global expansion of the Southern Brazilian company.





BrasilOzônio

# EFFECTIVE DECONTAMINATION THROUGH OZONE

- BRASIL OZÔNIO
- São Paulo/SP
- Small-sized enterprise
- 14 Employees
- Product innovation
- MEI Agenda:  
Innovative SME,  
Innovation financing

*Brasil Ozônio develops deodorization and decontamination equipment for industrial gases, water and effluents using ozone*

Upon hearing the word ozone, the first mental relation we make is with the layer of the atmosphere that absorbs the ultraviolet rays of the sun, which are incident on the planet. What certainly few people know is that ozone, as well as a powerful germicide, acts as an oxidizing agent in the treatment of water and living industrial waste, among others – and therefore has much to offer.

These were the unique properties that the São Paulo-based company Brasil Ozônio turned into business. The company specializes in ozone technology solutions, including processes for the treatment, sanitization, sterilization and oxidation of water, air, fluids, food, raw materials, instruments and industrial, liquid and gaseous effluents. All of Brasil Ozônio's processes use the same principle: the on-site production of ozone, obtained from the oxygen of the air.

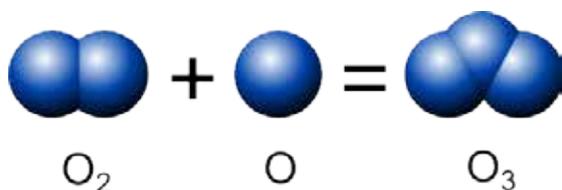
Among the processes listed, we highlight the decontamination and deodorization of industrial gases. Although there are alternatives, Brasil Ozônio's solution is the only one in Brazil and in the world to carry out this process successfully, on an industrial scale. This is the company's flagship, accounting for 40% of its revenue. There are dozens of facilities in various companies in various industrial segments, such as fertilizers, food, chemicals and automobiles.

## What is the ozone?

Chemically, ozone is a molecule made up of three oxygen atoms ( $O_3$ ). It is a gas that forms when oxygen molecules ( $O_2$ ) are broken and the separate atoms individually combine with other oxygen molecules, being, therefore, extremely unstable.

This high oxidizing potential makes ozone treatment the most effective. It is also the most environmentally correct process since ozone decomposes into oxygen in a short period of time. Moreover, ozone is also a powerful germicide, which "attacks" organic molecules, such as those present on the cell walls of microorganisms, degrading them completely.

Ozone sterilization efficiency is well known and documented, and the death rate of microorganisms such as fungi, bacteria and viruses is very high. It is due to these characteristics that ozone has been increasingly used as a sanitizer and decontaminant of water, gases and food.



## Curiosity that became business

It was in the year 2000 that entrepreneur Samy Menasce first heard about the utilities of ozone. The former Safra group executive was intro-

duced to the technology by a doctor, who had been researching ozone for years – including in medical applications.

At first glance, the technology seemed simple, and together they decided to dedicate themselves to producing their own machine. The play between friends turned into business as of 2004, when, after several frustrated attempts, the first equipment worked: it managed to clean a swimming pool, which had been left uncleaned for two weeks. “We used a dirty mini swimming pool with greenish water, and our equipment made it totally colorless. That was then we knew we had a product”, recalls Samy.

The two friends designed a project to scale up the equipment and create a marketable model. With this project, they participated in the Cietec selection, USP’s incubator of technological companies, for which they were approved in April 2005.

Then Brasil Ozônio was born. According to Samy, the incubation was essential for the development of the equipment and the consolidation of the company and its business, for several reasons.

The first one is the credibility that the association with the University of São Paulo gives to the company and to the product; the second is that the incubator provides assistance for the elaboration of projects to raise funds for innovation projects.

These funds, from the CNPq, Fapesp, Finep and BNDES development lines, have contributed both to the remuneration of the researchers hired and to invest in the equipment development.

There is also a third reason, due to the access that the incubator makes possible to a network of relationships between incubators and university professors and researchers.

This contact was crucial for Brasil Ozônio, whose partners, an executive and a physician, had no knowledge based on the technology. The incubator is located on the USP campus, and it was with the help of university researchers and the Institute of Technological Research (IPT) that entrepreneurs were able to understand the processes and solve the

problems – which were not few. “The first 10 equipment we built caught fire”, recalls Samy.

It was thanks to the help of the IPT researchers that, after four months of much research, the cause of the fires was discovered, and a solution could be devised. Until that moment, Brasil Ozônio used ambient air as a raw material to produce ozone. What happens is that the nitrogen of the air under the intrinsic conditions of the ozone generator undergoes a chemical reaction that generates a compound that clogs the system causing the fire.

The solution was to change some materials in the equipment composition and to look for an alternative to separate and to use only the oxygen of the air. This replacement of the ambient air with oxygen as a raw material is also important to increase the concentration of the ozone produced. To be effective as an oxidant and germicide, ozone has to be introduced into the systems in high concentration.

Seeking alternatives in the marketplace, Samy found that the four major global companies that worked with ozone used very large and expensive systems with oxygen generating plants. Something that went totally against the business idea, which was to provide equipment at affordable prices, and therefore, on a smaller scale.

The solution came out in a curious way. During a visit to a hospital patient, Samy was introduced to a device called oxygen concentrator, used to generate the oxygen delivered to patients with respiratory problems.

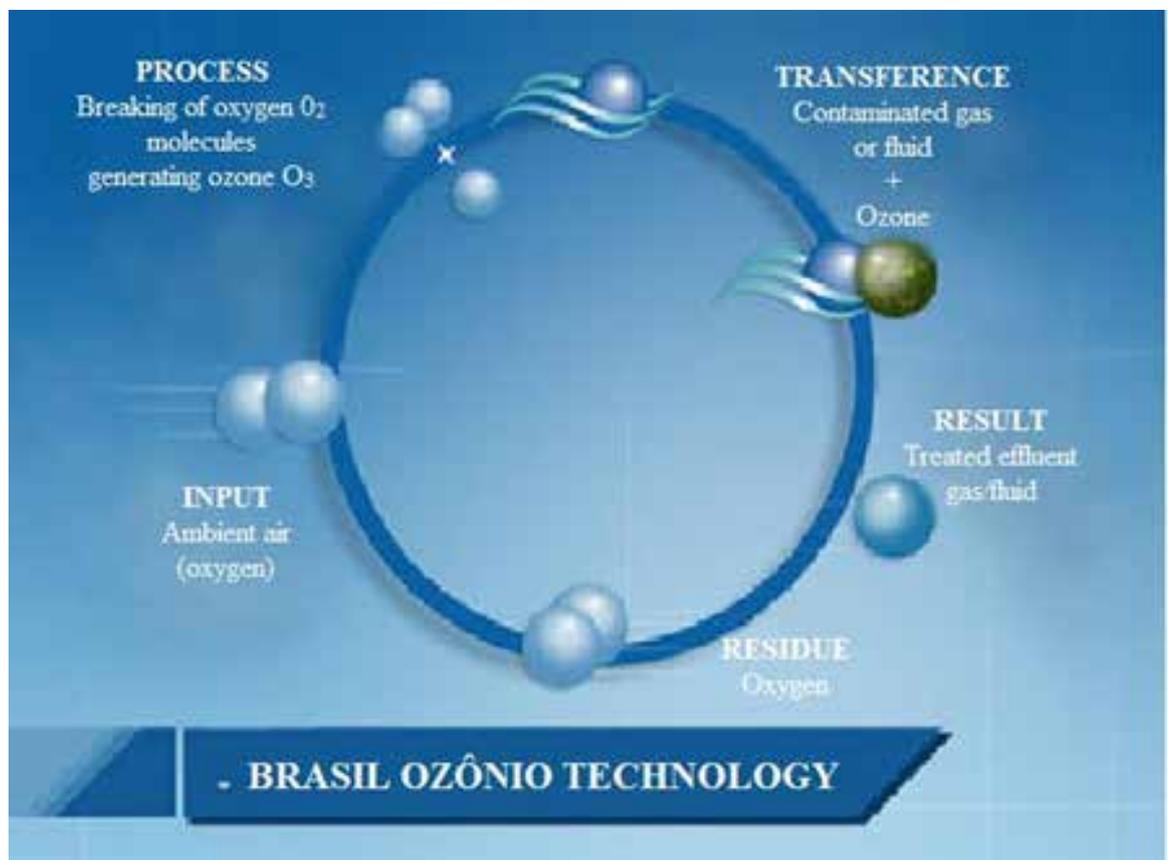
This equipment, used both in hospitals and in the home care, captures the air of the environment, uses a system of molecular sieves to separate the oxygen and discards what is left over. It was exactly this equipment that Brasil Ozônio used – and uses to this day – to produce the raw material for its ozone generating machines.

Over time, Brasil Ozônio ceased to be only the buyer of the concentrator and partnered with Airsep, the supplier company, which already had plans to develop a product aimed at the industrial market. The result is that today Brasil Ozônio has an exclusive oxygen concentrator, becoming the Airsep’s representative in Brazil.

According to Samy, the decision to use the oxygen concentrator was a watershed for the company because all the technology had to be rethought and the equipment redesigned.

It was at this moment, in 2009, that Brasil Ozônio obtained Fapesp's first investment, through the Pipe – Innovative Research in Small Businesses program. Until then, the only financial contribution that the company received was from the CNPq's RHAE (Human Resources Training Program in Strategic Areas), which offers scholarships for companies to add highly qualified personnel to research and development activities.

Another important technological aspect in the development of the ozone generator was the size control of the generated gas bubble. If the bubble is too large when entering the water, it quickly returns to the environment, without interacting with the contaminants, which Samy calls "bubble tourism". To avoid this phenomenon, the equipment was designed to release ozone in the form of thousands of micro bubbles, increasing its surface contact with contaminants.



With the redesigned and optimized equipment, the company began producing ozone on a larger scale and thus was able to start exploring the technology industrial applications, ceasing to be just a supplier of swimming pool cleaning equipment.

### **From the water to the air**

Although the first approach in the industrial environment was aimed at water treatment, it was the treatment of gaseous effluents that eventually became one of Brasil Ozônio flagships.

Gaseous effluents are a recurring problem for industrial companies due to the annoyance that the odor arising from some of the processes causes in the surrounding communities. Eventually, in addition to image problems for companies, the involvement of oversight agencies can lead to penalties ranging from fines to the interdiction of the company's operation.

Conventional treatments demand high consumption of chemicals and not always solve the situation, keeping the company at risk. Ozone, due to its highly oxidizing and sterilizing nature, removes odor, neutralizes existing toxic substances, oxidizes particulate matter and acts on biological contamination.

Brasil Ozônio's entrance in this market occurred through the contact with a fertilizers company that looked for a solution to its problem with odors.

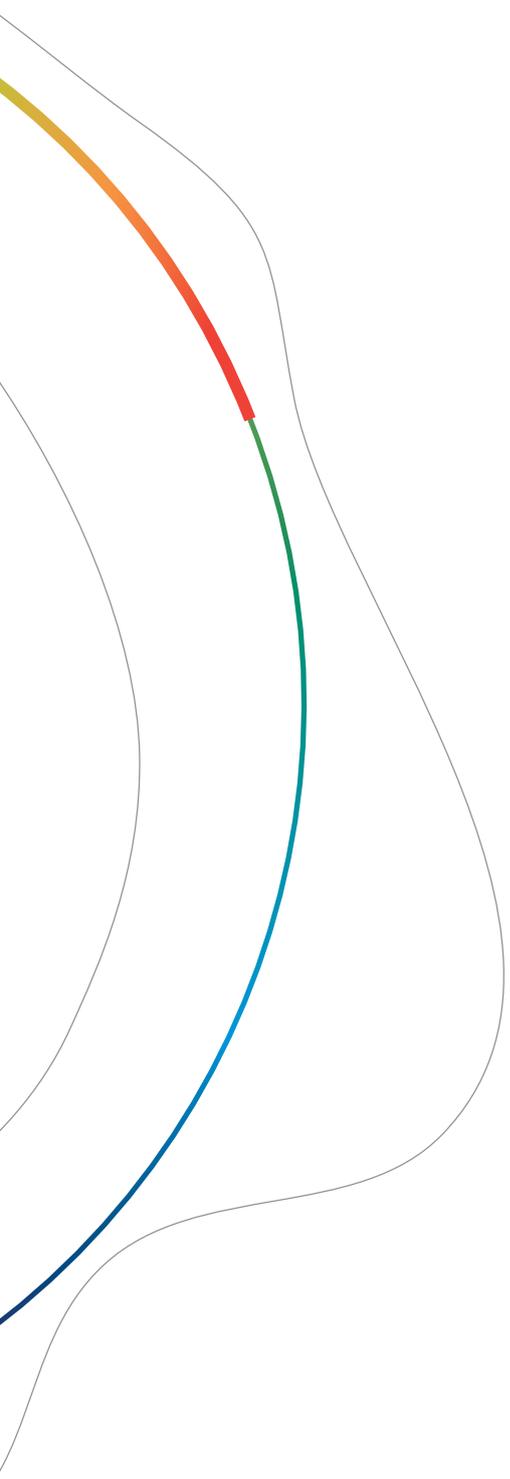
To develop a solution for industrial gases, it was necessary to face a major challenge: the high temperature. In general, gaseous effluents are hot, and elevated temperatures destabilize ozone, accelerating its degradation in oxygen.

To solve the problem, a system that generates higher concentration of ozone was created, to offset the temperature. The system does the treatment directly on the gas discharge piping to the environment, usually part of a gas scrubber, the equipment through which the gaseous effluent passes.

Although this gas scrubber has the function of eliminating particulate matter, which may be in suspension, the apparatus is not effective for the elimination of odors.

The name gas scrubber comes from the process of flushing the gases, which occurs through its passage through a series of showers, where water droplets carry the solid particles. In general, the ozone generator is positioned next to the showers, since the humidity acts in favor of ozone. When the effluent comes out in the form of gas, without going through a washer, it takes much more ozone to achieve the same performance.





In order to avoid excess ozone, the equipment is always sized for each customer. "The key to our effectiveness is to know where to inject ozone. It depends on the pressure, on the temperature, on how the mixture occurs. If it is not injected in the proper place, the ozone consumption is much higher, which ends up making the project financially unfeasible", explains Samy.

The process success in the fertilizer industry paved the way for companies from other segments to seek Brasil Ozônio's solution to solve problems with odors. An interesting case is that of a chemical company, which needed to eliminate the benzene (a carcinogenic chemical compound), a problem that was solved thanks to the ozone's oxidizing power.

Although the potential market is large, the companies usually look for Brasil Ozônio only when they are facing legal issues or fines. "We have already visited and conducted tests on hundreds of companies", says Samy Menasce, "but most of them shelve the project because they have not yet been notified by any supervisory body".

### **The business model**

Every sale that Brasil Ozônio performs is extremely technical, as the solutions the company offers are thought out with basis on the problems generated in each situation, and customized in accordance with each customer's needs.

To assist in sales, the company has small mobile ozone production units installed in vans that drive to the potential customer and perform on-site tests with real-time results.

The purpose is to allow the customer to evaluate immediately the physical aspects of the ozone action, such as changing the color and odor of effluents, for example. The strategy has proven to be effective and has contributed to sales effectiveness.

Another interesting model, arising from the customers' own demand, is the leasing of equipment, which contributes to the diffusion of Brasil Ozônio's solutions.

There are two leasing modes: short-term and long-term. In the short-term model – which lasts from two to three months – it is possible to lease pilots for tests on small scale.

This model, created when the company started offering solutions for the treatment of large volumes of water and liquid effluents, arose from the team perception that the initial offer of a pilot-test would be more attractive to the customers, who could then prove the equipment effectiveness before purchasing it.

If they then decide to purchase the equipment, part of the amount paid for the lease will be deducted from the equipment's total price.

The long-term lease appears as an alternative to the purchase; it is still in the implementation phase, but according to Samy, it has been a very attractive modality for the market.

Whether by sale or lease, Brasil Ozônio offers a package of services, which includes detailed study of the customer's application to size the equipment and the process, the assembly of the system, the startup and the training of the team responsible for the process internal monitoring. "Ozone is the cheapest solution that exists, because the cost lies only in the equipment and in the implementation of the system. Then, there is no need to buy raw material, there is no stock or waste, and the system is all automated", summarizes Samy.

The post-sales is also a concern for the company, which offers a one-year warranty, as well as maintenance throughout the entire life cycle of the equipment. According to Samy, 20% of the company's revenue today comes from maintenance.

In the treatment of industrial effluents, Brasil Ozônio has no competitors in the country. All of its equipment – except for the oxygen concentrator – is manufactured in Brazil. The company is careful, however, to spread the suppliers to maintain the industrial secret, which is the assembly of the equipment. "One supplier produces one plate, the other produces one screw, and so on. We have over seventy suppliers registered in Brazil. This is how we safeguard our process", explains Menasce.

### The ozone success

Brasil Ozônio was able to create a solution that is comparable in efficiency to the equipment of major ozonizers manufacturers, at a much lower cost. "Whereas their equipment reaches 10% ozone concentration and costs millions of dollars, ours reaches 6% efficiency and cost a few thousand Reais", celebrates Menasce.

Furthermore, the Brasil Ozônio's solution brings significant socio-environmental gains to customers. In addition to mitigating the need to use hazardous chemicals and the waste generation, the system has the following advantages:

- use of ambient air as the sole raw material;
- ozone generation at the application site;
- reduced operational cost of the system (close to zero); and
- oxygen as the sole process residue.

These differentials, compared to alternative processes, have led to more and more industries choosing ozone for the water and liquid and gaseous effluents treatment.

Gas treatment represents today about 40% of Brasil Ozônio's sales and 40% of Brasil Ozônio's revenues. The largest facility of this kind is installed in the largest auto parts manufacturer in Brazil, located in São Bernardo do Campo (SP). There are treated annually 250 thousand cubic meters of odorous gases.



Ozone is the cheapest solution that exists, because the cost lies only in the equipment and in the implementation of the system. Then, there is no need to buy raw material, there is no stock or waste, and the system is all automated.

**Samy Menasce**  
Founding partner  
at Brasil Ozônio



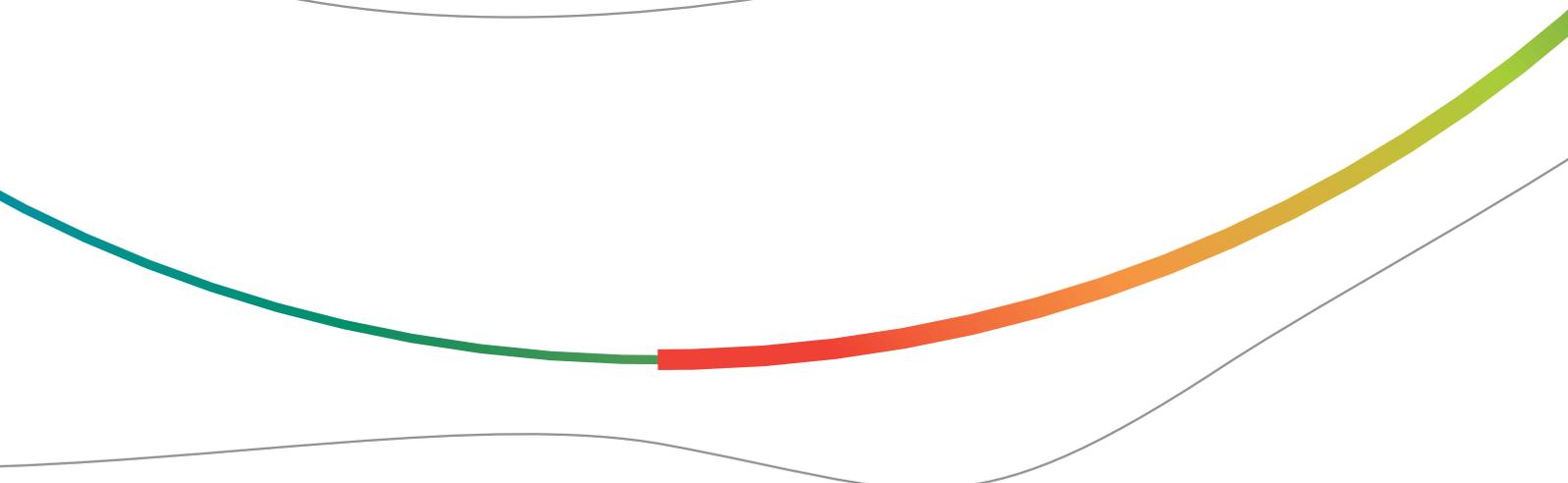


One particularity of this customer is the dual use of the equipment: by day, to treat the gases; at night, to treat the water. The most recent installation, which took place at the end of 2016, opens the prospect of a new area of activity, through the treatment of gases coming from the most modern hospital waste treatment unit, inaugurated in São Paulo.

### **Endless possibilities**

The company's revenue in 2016 was approximately BRL 2 million, and the forecast for 2017 is BRL 5 million, mainly due to the leverage of the business, which began when part of the company was acquired by two investment funds in 2016.

The idea now is to increase the customer base, both in number and in coverage. Which is not difficult, considering that ozone offers almost endless opportunities, and the company is very active in developing new markets and in taking up new demands.



The latest came from mineral water companies, who sought ozone as an alternative to disinfecting gallons. Until then, these companies used chlorine for this purpose, with a risk of water contamination by product residues. Ozone seems to be the ideal solution as it leaves no residue, is 100 times more potent than chlorine and acts much faster.

One of the largest and most interesting projects that Brasil Ozônio has ever carried out – and the one of greatest repercussion – began in 2013, based on a demand from INB – Indústrias Nucleares do Brasil SA, which sought a solution for treatment of water, effluents and soil contaminated by heavy metals from a uranium extraction mine located in Caldas, Minas Gerais, deactivated since 1995. The environmental liability was estimated at 2.5 million cubic meters of contaminated water.

Carried out in partnership with the Universidade do Extremo Sul Catarinense – Unesc and with the High Technology Park Foundation of the Iperó Region and Adjacencies – Patria, with BNDES investment through Funtec (grant of BRL 9.6 million), the project was completed in July 2016.

The results showed that the treatment with ozone is effective in the decontamination process: all heavy metals were removed and could even be reused, and water was able

to return to the environment because it complied with environmental legislation. Faced with the scientific proof of the efficiency of its process and the success achieved, the way was paved for Brasil Ozônio to enter the mining sector.

It is also noteworthy that, in terms of effluents, Brasil Ozônio is closing its first major deals in the textile sector.

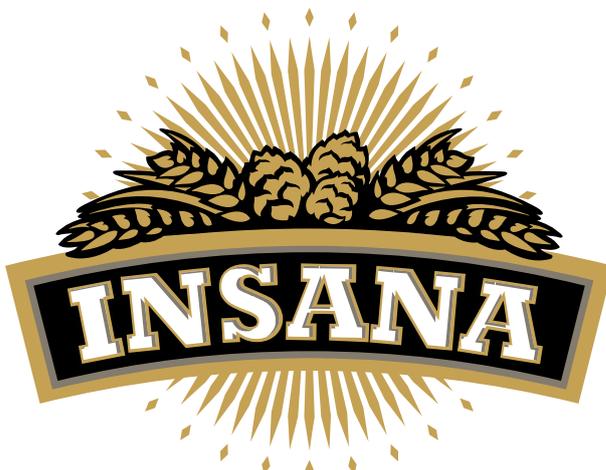
### **Reliability seal**

Brasil Ozônio is another case of technology-based startup, which used the insertion in an ecosystem of innovation to transform a promising project into a successful business.

The incubation at USP's Cietec and fund-raising, through the country's main agencies of innovation development, in addition to contributing to the financial consolidation of the company (to date, there have been more than BRL 10 million in non-reimbursable funds), have provided what the Brasil Ozônio's founding entrepreneur himself calls a seal of quality and reliability.

It is a support that he considers important, although today Brasil Ozônio's products success and business evolution alone prove the technology effectiveness, the business model consistency and the company quality.





# INSANA PINHÃO: BREWING INNOVATION COUPLED WITH SUSTAINABILITY

- CERVEJARIA INSANA
- Palmas/PR
- Small-sized enterprise
- 37 Employees
- Product innovation
- MEI Agenda: Innovative SME

*Small craft brewery from the state of Paraná innovates by using traditional regional produce for beer production, contributing to the environmental conservation*

Insana is a craft brewery in the Southwest of Paraná, which created the first world beer produced with pinion. The idea came from the desire to contribute to the preservation of Araucária and to draw attention to the issue of environmental conservation.

Insana *Pinhão* is only produced at the time when the seeds harvest activity is allowed by law. It is a beer with origin identity, which carries the vision of sustainability of the Araucária forest, vegetation typical of the South and of the populations that produce and survive from the pine.

It is a different beer, flavor of which has conquered tasters and admirers in Brazil and abroad, proving that it is possible to create innovations, even from traditional and consolidated products.

## How did pine become beer?

Araucária is the symbolic tree of Paraná, and the pine, Araucária seed, in addition to being important for feeding and maintaining the local fauna, is much appreciated and consumed by the population, especially in the winter.

The Araucária forest, which originally covered an estimated 20 million hectares (or 200,000 km<sup>2</sup>), has continued to decline alarmingly – a reduction of over 95% since the beginning of the twentieth century.

Coupled with the predatory cut for the timber exploitation and the low rate of reforestation, this is accompanied by the continuous advance of the agricultural frontier.

All these factors have resulted in the inclusion of the Araucária in the Red List of the International Union for the Conservation of Nature and Natural Resources<sup>1</sup>, with the status of “critical danger”, which means extremely high risk of extinction in nature.

According to Pedro Reis, founder partner and CEO at Cervejaria Insana, the desire to contribute to the preservation of Araucária was one of the main motivators for the creation of Insana *Pinhão*. The Southwest region of Paraná, where the brewery is located, is a major pine



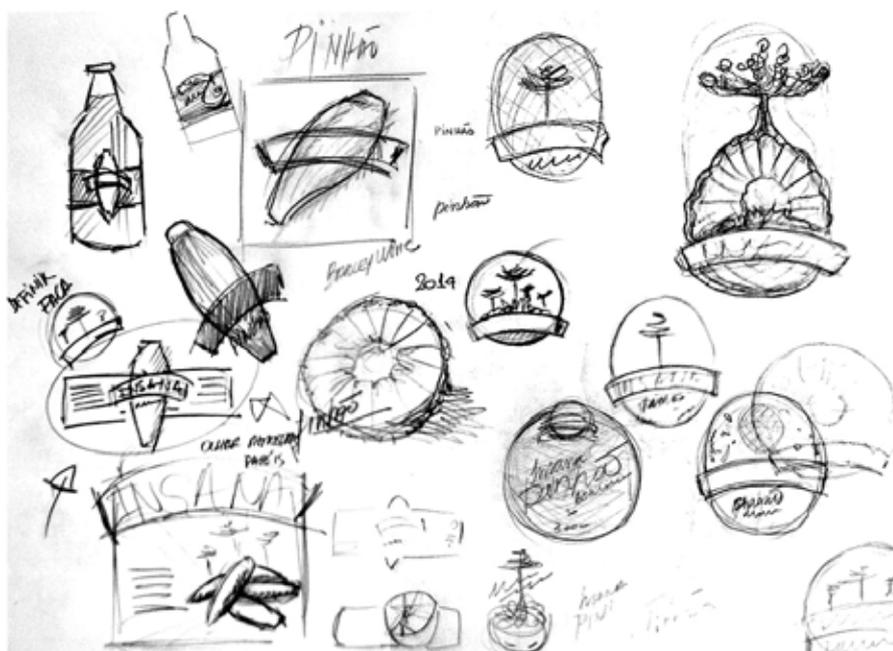
<sup>1</sup> IUCN. Lista Vermelha das espécies ameaçadas da IUCN. Versão 2016-3. Available at: <<http://www.iucnredlist.org/details/32975/0>>. Accessed on March 28th, 2017.

producer, since it is surrounded by important preservation areas such as the Araucárias National Park, the Caçador Forest Reserve and the Irati National Forest.

The Forestry Law of Paraná (Law 11.054, 1995) provides that the pine harvest be made between late April and early September – The Environmental Institute of Paraná, in 2015, anticipated the beginning of the harvest to April 1<sup>st</sup>. The rest of the year is the period necessary for the pine to grow and mature, serving as food for animals such as squirrels, azure jay and red-spectacled parrot, the latter two also endangered species.

The Law, however, is systematically violated, either for lack of knowledge or for lack of consideration, a transgression that has been contributing to the degradation of the state native forest. For this reason, Insana's strategy is to produce and commercialize the pine beer only at a time when the activity is permitted by law, thus helping to promote and raise awareness among consumers and the community.

Seasonality also embodies strong commercial and marketing appeal: customers wait for the right time to be able to consume their beer and are willing to pay more for it – Insana *Pinhão* is currently the most expensive label of the brewery – the 300 ml bottle price, sold to the final consumer, ranges from BRL19.90 to BRL22.00.



We had the desire to create a Brazilian style of beer. If there are American, German, Belgian styles, why not a Brazilian style?

**Pedro Reis**  
Founding partner and  
CEO at Cervejaria Insana





**Certi** – Reference Centers for Innovative Technologies Foundation, established on October 31, 1984, in Florianópolis, is an independent, non-profit institution. It originated from the activities of Labmetro – Metrology Laboratory of the Mechanical Engineering Department of UFSC – Federal University of Santa Catarina.

*In the first two decades of existence, the Foundation has expanded its activities to other areas of technological activity, becoming a national and international reference for its projects, services and ventures.*

*It is currently comprised of eight Reference Centers, which work in synergy and cooperation with Brazilian and foreign partner entities, working with a focus on recognized skills generating innovative technological solutions for the society and the Brazilian market.*

The issue of regionalism also had a strong appeal in the decision to invest in the development of a pine beer. “We had the desire to create a Brazilian style of beer. If there are American, German, Belgian styles, why not a Brazilian style? Our idea was to use traditional national ingredients, and as the pine is our symbol, with great availability in our region, this became a natural choice”, explains Pedro.

### **The flavor challenge**

When Insana partners came up with the idea of Insana *Pinhão*, brewing was still more of a hobby than a business. Right from the start, they identified what would become the great challenge of the project: how to give beer a distinctive flavor?

The pine nut, which is the edible part, has a mild taste. “It’s almost like a chayote”, jokes Pedro. It took several attempts with other parts of the plant (even pine branches were tested), so that they could finally identify the pine shell as the input from where the flavor could be extracted. “If you shell a pine to cook, it becomes tasteless: it needs to be cooked with the shell. So we developed a production system that uses the shell in order to extract the pine flavor”, he explains.

So how does the pine get into the composition of the beer? First off, the pine is shelled, and nut and shell follow different paths. The nut, cooked and milled, goes through a physical-chemical pretreatment to transform the starch into sugar, which takes part in the fermentation to generate the alcohol.

The shell is used for flavoring by means of a complex procedure: the shell is inoculated in the filtration process, so that the beer passes through it with controlled contact time between liquid and shell, so that the flavor becomes pleasant. If the shell remains in contact with the hot water for too long, the beer gets a bad flavor, "it tastes like tree", summarizes Pedro. The dwell time of the shell and the water temperature are, therefore, critical parameters for the success of the process.

In addition to the complexity of the flavoring stage, another technological challenge for beer production was the shelling and milling process. As there was no suitable machinery available in the market in 2014, all the shelling and milling were done manually by the employees. It took 30 days to process 200 kg of pine, which turned into a batch of eight thousand bottles.

Due to the lengthy process, this first batch of beer was only made available for commercialization with a little delay (at the end of July 2014), since the idea was to present it as seasonal winter beer. Even so, the acceptance was very great. All the bottles were sold quickly, and the beer made the news.

### A good turn deserves another

By the end of 2014, when the team had already identified the need to develop some kind of equipment to speed up the pine processing and to continue the beer production, Pedro was contacted by the Certi Foundation, which introduced him to the **Araucária+** project, an economic valuation initiative of the forest with Araucária to foment new businesses and to promote their conservation.

The project encourages producers, industry, retail and society to participate in a sustainable network of consumption and production, to add more value to the forest and reap the benefits of conservation.

"It was a perfect match: they were looking for solutions that required the pine industrialization to increase the profitability of producers, while we wanted our product to have a social and sustainability nature. We wanted to make sure we were contributing to preservation", explains Pedro.

As part of the partnership, signed in 2015, Insana helped develop, along with a cooperative of producers, an equipment capable of performing the shelling of the pine. After training, local suppliers are able to deliver processed nuts nowadays. This has accelerated Insana production, which is now able to produce in greater quantity and with guarantee of origin. The numbers confirm the partnership success: in the first year, 800 kg of processed pine were produced, producing 35 thousand bottles of beer.



## Hobby that became business

But, doesn't Insana produce only pine beer? In addition to Insana *Pinhão*, there are seven other different labels – three of which are awarded – which contributed to raise Insana to the rank of one of the best microbreweries in the country.

Inspired by the wineries of the South of Brazil, the Insana brewery complex has 30,000 m<sup>2</sup>, 750m<sup>2</sup> of which represent useful area. The name of the brewery, located in Palmas, the coldest city in the state of Paraná, was chosen by the partners, who were considered insane for wanting to produce differentiated beers in the countryside of Paraná.

The key to success? Dedication, business vision and passion for beer.

Like many microbreweries in the country, Insana was born from a hobby, a desire to produce and consume their own beer.

It was in 2009 when friends Pedro Reis, Evandro Marini and Francelo Carraro began to produce the beverage in a very amateur fashion, in the garage, with the aid of a kit purchased on the Internet. "We started out in jest. We had no idea of what raw material to use, we knew nothing. We just bought the kit and followed the steps. And the outcome was a very bad beer", Pedro laughs.

It was through Internet discussion forums that the friends found out that they were not alone and started forming a network of fellow amateur brewers, with whom they learned the secrets of making good beer.

In 2010, producing beverages with much better quality, they decided to send three beers to the National Contest, promoted by the Brazilian Association of Homemade Brewers. Two of them were awarded: Brown Porter, which got the silver, and Indian Pale Ale, which got bronze.

With the award, came the first idea of turning the hobby into something more serious. "We thought this could turn out to be a company and we started doing business plans, all on our own. We used the learnings from the Administration school and we kept doing, testing, searching, and producing beer at home", says Pedro. At the time, the capacity was 60 liters per production. Each lot took about

40 days to get ready, but considering the production frequency, it generated generated about 200 liters per month.

The production was for own consumption, and some bottles were sold to friends, relatives, neighbors. Until that, by late 2010 and early 2011, the demand for differentiated beers – especially in the capitals such as Rio de

**Araucária+** promotes conservation of Araucária (Norfolk Island pine) by social and economic inclusion of owners of natural areas in innovative productive chains.

Local producers are connected to a differentiated market, comprised of companies, which adopt innovation and sustainability strategies in their products, demanding inputs from sustainable origin, with aggregated information and traceability. To access such differentiated market, the producers begin to adopt productive systems according to a Sustainable Standard. To that effect, they are provided with technical guidance, training and differentiated price.

In addition to the Conservation strategy by Use, through Production Sustainable Standard, the initiative also provides economic mechanism that enables Full Conservation of remnants of Araucária Forest, arousing the interest of the communities in preserving remnants without exploiting forest resources.

Janeiro, São Paulo, and Curitiba – began to increase. Moreover, as in these regions, the demand was greater than the supply, the bars began to look for the breweries. Thanks to the visibility gained with the prize in the competition of the Brazilian Association of Homemade Brewers, the friends were sought after and began to supply their beers, already labeled Insana.

This closeness to the bars was also an opportunity to understand the market and to study the feasibility of transforming the craft production into an industry.

The conclusion was that the dream of having a large industry did not fit the market in which they were inserted. “The niche of craft beers is very specific. There is no loyalty. The customer always wants to try something new. So it does not make sense to think of producing large volumes”, explains Pedro Reis.

Postponed the plan to set up a factory, it was necessary to expand production to one thousand liters per month, still in the craftmade and homemade model. “In three days of the week, we worked from 6:00 pm to 2:00 am to meet the demand and during the day we still had our jobs”, he says. This pace continued, until they discovered that they would have to stop the commercialization because they did not have the products registered at the Ministry of Agriculture.

This stop turned out to be crucial for the consolidation of the company, because it was the moment for them to catch their breath and to look into the business plan.

All alternatives, however, ran into the logistic issue. Because it was located in the countryside – and therefore far from the big centers – the costs made it impossible to produce large volumes, since they could not dispose of the products in a competitive manner.

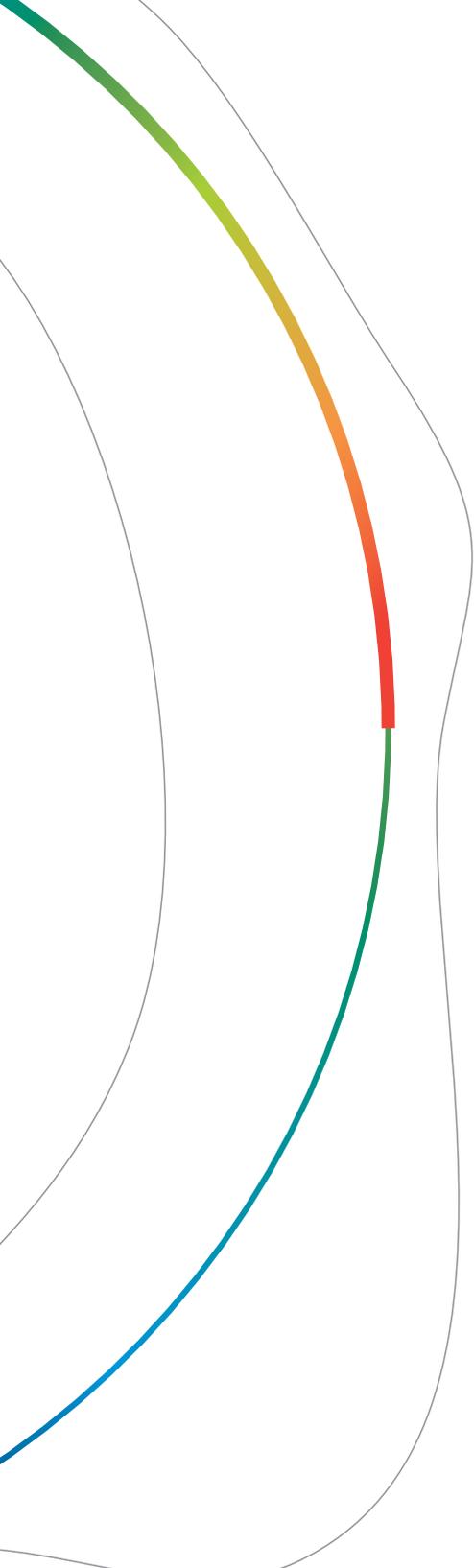
The alternative chosen was to build a mini plant, with a capacity of 3,000 liters per month. The plan was to hire a person, who would be responsible for the production, service to the existing customers – who consumed 1,000 liters per month – and the sale of the remaining 2,000 liters, in Palmas and in the neighboring cities.



The niche of craft beers is very specific. There is no loyalty. The customer always wants to try something new. So it does not make sense to think of producing large volumes.

**Pedro Reis**  
Founding partner and CEO  
at Cervejaria Insana





## Learning from mistakes

Before production began, in 2012, the entrepreneurs were sought after by Peterson Cantu, owner of a wine distributor. Thus, the company gained its fourth partner, who would solve the logistics problem and would contribute to the business with a commercial expertise that none of the other partners had. At the same time, Alexandre de Carli, a graduate chemist and owner of the land where Insana was built, was incorporated into society.

Peterson also proposed a strategy that the others had not considered until then: to make the company grow, to put the brand in the national market and then to sell it. The other partners bought the idea, and the factory project jumped from 3,000 liters per month to 30,000 liters per month.

Each of the partners invested between BRL 150 and BRL 200 thousand, and the rest of the capital was paid through BNDES' Finame financing, in the amount of BRL 2 million, for the construction of the plant, protected by the assurance that the wine distributor would market much of the production.

However, the good results were hard to come by. "We found that producing was actually the easiest part, what we needed was to understand the tradingside. Peterson had expertise in this area, but it was in the marketing of wine, not beer. And only then do we realize that wine and beer constitute totally different markets, although the sales outlets are the same", explains Pedro. Unpreparedness and lack of understanding of the market were expensive. There were two years of idleness and negative results between 2013 and 2015.

The solution to work around the problem and generate flow volume was to start focusing on the production and marketing of draft beer in the Palmas region, since it is a product with regional reach, due to the short shelflife of 30 days under refrigeration.

For that, it was necessary to contribute another BRL 1 million for the acquisition of new equipment. This time, the return was surprising: Insana draft beer was a success, with orders within a 300-kilometer radius around the factory and sales volume enough to put an end to idle production and improve financial flow in 2015.

The strategy of alternating beer production and draft beer production is also adopted by other breweries, as it makes the cash flow feasible, since craft beers are not marketed in large volumes.

Insana's differential was to adopt the commercial strategy of one release per month. "Every month a new product is put on the market and another is discontinued". The variety ends up creating the customers' loyalty because they always want to know the news and because they follow the releases, waiting for the re-release of their favorite draft beer.

Nowadays Insana produces eight types of draft beer and eight types of beer. For the draft beer, a logistics was set up with trucks and drivers owned by the company. Insana has approximately 60 beer distributors in Brazil, from Acre to Rio Grande do Sul.

According to Pedro Reis, the secret of success lies in the resilience of the partners, the ability to learn from mistakes and to rebuild, as well as the perfect synergy between different personalities. “Francelo is the big daddy, the one who supports us in everything. Peterson is the visionary, the dreamer, the creator of ideas. Alexandre is the down-to-earth person, who demands planning. In addition, I am the administrator, who takes it all in and learns a lot. And it works”, he summarizes.

To support legal issues – the brewery is supervised by Anvisa, the Ministry of Agriculture and municipal health surveillance – which also includes maintaining the quality of beers. Moreover, speaking of quality, it was implemented at the end of 2015 a modern Laboratory for improving the quality control. Another highlight is the water used to make draft beer and beer. This water, from an artesian well, located on the brewery’s own grounds, undergoes a treatment that guarantees strictly standardized parameters.

These parameters vary according to the style of beer that will be produced. “For Weissbier, for example, which is a wheat beer, we want a very German standard, so we recreated water from the Bavarian region of

Germany. We have the same salts existing in the water there in our water here”, explains Pedro Reis.

### The pine triumph

Among the company’s eight types of draft beer and eight types of beer, *Insana Pinhão* is undoubtedly the product that deserves more attention. It is an innovative product that, three years after its release, already accounts alone for 50% of the brewery revenue in the winter, and 12% of the total annual revenue, which is around BRL 3 million.

The rapid growth of production also evidences *Insana Pinhão* success: 5 thousand bottles in 2014, 25 thousand bottles in 2015 and 45 thousand bottles in 2016. For the 2016 production, one ton of pine was used, which corresponds to the production coming from an *Araucária* forest of more than 40 hectares. *Insana*’s plan is to use, by 2018, 10 tons of pine per crop, which means contributing to the preservation of almost 500 hectares of forest.

The commercial development is also evident. The first batch, in 2014, was marketed in the distribution channels *Insana* already owned:



supermarkets and specialty beer bars in Paraná, Santa Catarina and São Paulo.

In the following year, the *Insana Pinhão* 2015 crop generated greater spontaneous media, and the large networks began to take an interest in the product. Sam's Club was the first to place an order and "after it did, it was easy to convince the other big networks", celebrates Pedro.

2016 was considered by Insana to be the year of recognition, when 80% of the production was sold, and beer was included in the main Brazilian media, both for its innovative character and strong socio-environmental appeal.



Furthermore, *Insana Pinhão* was awarded in the main beer competition of the country, the Brazilian Beer Festival, with the bronze medal as the 3<sup>rd</sup> best aging beer, which attests the high quality of the product.

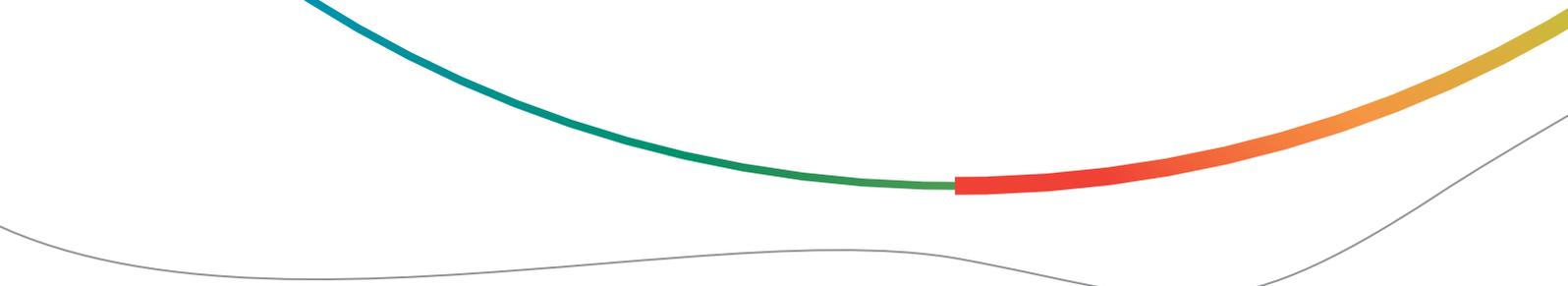
With so many qualities, one would expect the company to choose to protect its innovation through industrial property registration. However, Insana's philosophy is exactly the opposite, and the purpose of sustainability speaks louder. "Our intention, from the beginning, is preservation. Therefore, we spread our production model, so that more people begin to industrialize the pine. The greater the production, the greater the area preserved", argues Reis.

What about competition? Since there is no product or brand loyalty in the craft beer market, there is practically no such concern. "The customer does not want loyalty, he wants to taste. We joke that our competitor is not Brahma, but the *brahmeiro*, that figure that Brahma itself created. The person who only takes Brahma is a competitor, not the beer he consumes. He has it in his head that he is only going to drink that, he does not want to taste anything new. Then, the more beers and breweries enter the market, trying to teach people that there is a world beyond Brahma, the more consumers I will have", he adds.

### From Paraná to the world

Besides the financial results, the pine beer opened a new niche for the company, called "sustainability market". In this sense, Insana today has a project with German importers, who were interested in this environmental appeal and want to take the product to Europe.

In addition, speaking of export, this is one of Insana's strategies to seek stability, an alternative to be able to allow the estimated growth for the **Araucária+** project.



In fact, Insana has already been exporting other labels to Japan for two years, in order to learn how the export mechanism works. What is the reason for choosing this country? “As the Japanese are extremely demanding, if you export to Japan, you will be able to export to any market in the world”, summarizes Pedro. “We export only 15 pallets per year, we have already made many mistakes and learned a lot. To date, all the exports we have made have given us some trouble”, he says.

Now, more prepared, Insana is structuring an export project for other countries, among them Paraguay, with which negotiations are already in an advanced stage, and the United States, the focus of which is steakhouses networks.

The flagships, in both cases, are pine beer and coffee beer, for the differential of being Brazilian products. In time: in 2016, Insana released an Indian Pale Ale beer, made with coffee beans, which brings the geographical indication of the region, known as Northern Pioneer of Paraná.

For Europe, a line of at least three labels of pine beers is under development. According to Pedro Reis, as the production cost of pine is high, it is necessary to create lines that add value to the product, so that people are willing to pay more. Moreover, Europe pays very well for the social appeal, “unlike the Brazilians who do not pay the price of our beer for the pine, but because of exclusivity, because it is a scarce product. Here we sell exclusivity”, he says.

### **Challenges to undertake**

Insana’s success and the speed with which it has grown and established itself are mainly due to the entrepreneurial competencies and skills of its partners. The innovation created by the company, although it has an empirical characteristic, does not owe anything

to scientifically-based innovations: Insana’s case is proof that it is possible to be innovative, without being inserted in ecosystems aimed at innovation.

In the financial sphere, unlike many small technology-based companies, the brewery did not rely on subsidy announcements, offered by public sector development institutions, neither on angel investors nor venture capital funds.

All the investment was made by the partners themselves and by means of Finame/BNDES financing. From the first to the last Finame granted, the company saw interest rates rise from 4.5% to 12.5% per year. According to the CEO, this burdened Insana in such a way that, according to his calculations, from 2014 until today, the company practically worked to pay interest.

The tax burden also weighs: because it is an alcohol company, regardless of size, Insana cannot be included in the National Simples taxation regime, which means that it does not benefit from the reduction of tax rates and simplification of procedures provided for in this regime. “We questioned Revenue Service several times, and the answer is always that we produce drugs, which generates a very high health cost for the government. Now that the wine has been admitted to Simples, the microbreweries can also be admitted, as of 2018, as long as they do not sell to distributors, they have to sell straight to the retail”, says Pedro.

The benefit is still far away, but it is a help that can contribute to the consolidation of the brewery, which has managed to integrate environmentalism into its business model. The Araucária appreciates it.





**CISER**

# PIONEERING IN THE USE OF NANOTECHNOLOGY FOR THE FASTENER MARKET

- CISER
- Joinville/SC
- Large-sized enterprise
- 4,000 Employees
- Product innovation
- MEI Agenda:  
Regulatory framework  
– nanotechnology

*Ciser is the first company to use a nanoceramic as a sealant to increase the corrosion resistance of nuts and screws*

Ciser, a Brazilian company and largest manufacturer of fasteners in Latin America, is a pioneer in the use of nanotechnology in its industrial segment. The company invested in technology and innovation as a differentiation strategy in the market and brought to Brazil, with exclusivity, a nanoceramic surface coating that increases in up to 20 times the resistance to the corrosion and presents high resistance to the abrasion.

Nanotec® can be used on various metallic and non-metallic materials – including previously prepared metals with electrolytic or organometallic processes. The solution greatly increases the durability of the parts, without interfering in their aesthetic characteristics. Versatile, it can be used in a huge range of applications, from simple locks and screws to refrigerators, stoves, sanitary metals, parts and complex metal parts stamped for various industries – such as automotive, among others.

In addition to providing the Ciser Nanotec® fastener line, Ciser has the exclusive distribution and licensing of the system in Latin America.

## How to innovate in a screw?

Stop and look around you and see how many screws exist in so many objects of our everyday life. Even in those where these small parts are not visible, screws are critical for fixing. Only an automobile, for example, has more than 500 types of screws. “But we only pay attention to the fasteners when they begin to give a problem and fail to fulfill their function”, recalls Adelton Jose Rosseto, manager of the company.

One of the main causes of failure in the performance of metal fasteners is corrosion. In addition to direct costs, there is a number of indirect costs that are often related to it, including impacts on the safety of people and property, public health, and the sustainability of natural resources.



Some treatments, used on the surface of metallic materials, still use heavy metals such as chromium, harmful both in the application – when the operator handles the product – and at the disposal stage. As it also happens in other areas, there is no concern to dispose of metallic materials properly, which can lead to water and soil contamination.

Analyzing this scenario, Ciser had the initiative to seek a solution that would increase the durability of its fasteners, as a manner to stand out in the market. “In our market, there are several surface treatments to prevent corrosion, many of which have been used for almost 100 years. The novelties and innovations are extremely rare. So we set out to bring innovation to our fasteners, seeking a new technology, unlike anything that existed until then”, explains Adelton.

The conventional anti-corrosion surface treatments are divided into two main types: base coats and top coats. The base coats are applied directly to the metallic part, with electrolytic zinc, zinc alloys and organometallic products being the most commonly used materials.

The top coats are applied over the base coats, increasing their performance and adding special characteristics such as coloring, higher hardness and friction coefficient adjustment<sup>1</sup>.

When the Ciser development team thought about innovating in surface treatment, they realized that the best option would be to work with a top coat. Why? So the client could apply it on traditional coatings without the need to change their process. Otherwise, the product acceptance by the market would be very difficult.

The great challenge was to acquire expertise in a completely new area of knowledge; it was necessary to train the entire team, from the professionals involved in the development process to the sales team.

Partnerships with universities were also established for the use of laboratories and training of its technical staff. Ciser laboratory also had to be equipped for Nanotec® application testing.

As it turned out, the transition was difficult: it took three years of hard work, from identifying the product to the release of the new fasteners line. During this period, a machine was developed to apply the coating to the parts, and a team of technicians was formed to operate it.

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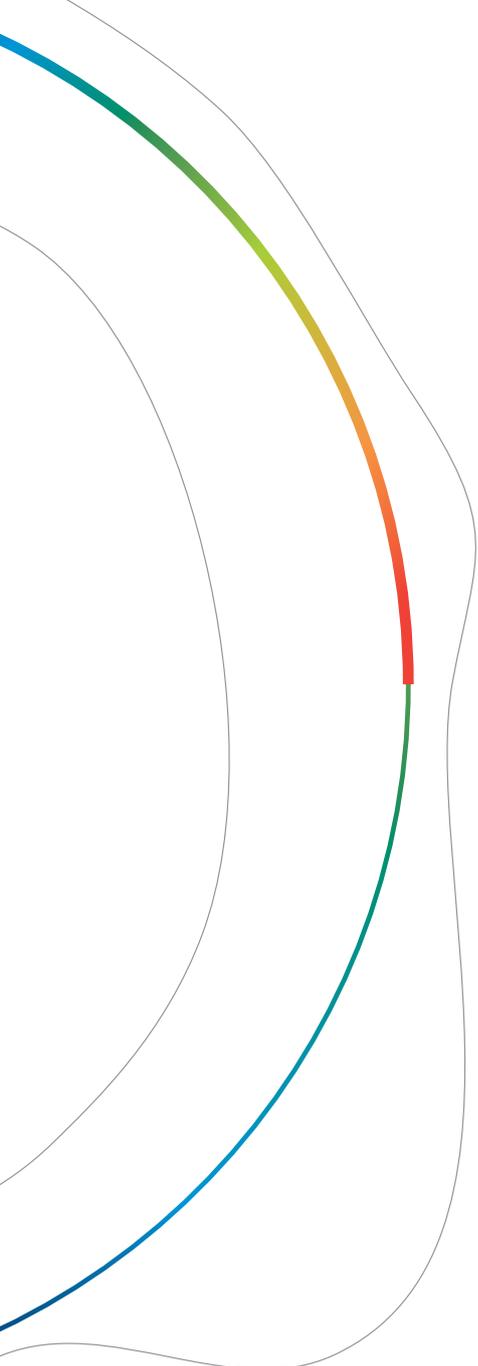
<sup>1</sup> The friction coefficient is a determining factor for a fastener application, as it influences the torque required to ensure a good fixation. For this reason, it has become an integral part of the coating specifications, so the user can ensure that their process will not be compromised.

“

In our market, there are several surface treatments to prevent corrosion, many of which have been used for almost 100 years. The novelties and innovations are extremely rare. So we set out to bring innovation to our fasteners.

Adelton José Rossetto  
Manager

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## How is the nanotechnology coating applied?

Despite being a high-tech product, its application is very simple. The material is a liquid, low in solids, which can be applied by immersion or in the form of spray, depending on the geometry of the part to be coated. In both cases, it is necessary for the parts to go into a furnace after the application, so that the product dries and the anti-corrosive layer forms.

This layer is a very thin ceramic film, on the order of a micrometer (or a thousandth of a millimeter), formed from the penetration of the nanometric particles into the pores of the base coat, which ensures that the layer is homogeneous and smooth. It is exactly this characteristic provided by nanoceramics that increases resistance to corrosion as it prevents corrosive agents from penetrating the material.

Other interesting features of Nanotec® are the very high hardness, which prevents abrasion removal (which often occurs with other coats) and the possibility of adjusting the coefficient of friction by adding special additives in the immersion bath.

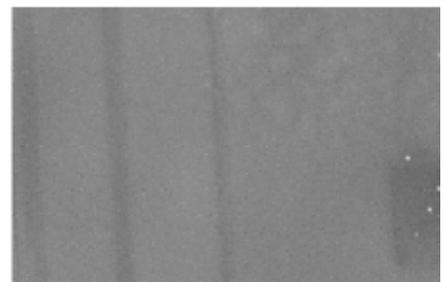
This latter property is particularly interesting for the automotive industry, whose fastening processes are already automated, and the screwdrivers have a predetermined torque adjustment, which requires that the friction coefficient is always adequate to the established specifications.

## Solution beyond the screw

This concern with the specifications and problems faced by customers in their processes was one of the central elements of the project, from its original idea to the introduction of the innovation in the market. Yet, "as in every innovative project, there are hits and misses. We believed that the market would accept new technology more easily, but many segments are resistant to change. To facilitate our work, we chose to identify the customers' problems, then solve them with our technology and earn their trust in the innovation", says Adelson.

With this proposal, Ciser started to offer not only a fastener, but also a complete solution, adapted to each need, with technical assistance and specialized personnel, to assist in projects that require specific applications.

A good example of the success of this customized approach comes from a large Brazilian mining company, which had been suffering from serious corrosion problems for years, causing enormous losses due to the need to carry out periodic maintenance shutdowns. The use of Nanotec® line fasteners practically eliminated the problem.



Microscope images, showing the uniformity of the surface coated with Nanotec® (on the right) when compared to traditional coatings (left image).

Successful cases such as this ended up contributing to Ciser stand out in the national scenario, as a reference in corrosion resistance and in nanotechnology solutions, which ended up consolidating the company's differentiation strategy.

### **Innovation from the inside out**

The way to reach this threshold began well before the Nanotec® project and is the result of an internal restructuring work, focused on innovation. Why should a company with so many years of tradition and market leader innovate? "We have over 25,000 items in our line and could still survive in the red ocean<sup>2</sup>. But that is not what we want. We are looking for the competitive edge, in order to maintain ourselves in the position of leader in the fastening market, and the key for that is innovation", explains Karollyne Correia, head of Ciser's Innovation department.

It was in 2008 that Ciser included innovation as part of its business vision and one of the pillars of its strategic planning. In this process, the company had the assistance of the Santa Catarina IEL unit, to structure an internal innovation center, which works in partnership with the new business area.

Ciser understands the innovation as a program that permeates all areas and not just as a department of the company. For this reason, Ciser's Innovation Center has representatives from different departments, forming a team of 22 people.

The starting point for innovation projects is insights, which can come from any contributor, even if they are not in the Center. "From the operator – who is there on the factory floor, experiencing the difficulties of day-to-day production – to the president, anyone can come up with an idea, whether be it a breakthrough innovation or a process or product improvement", explains Karollyne.

The prioritization of ideas and projects is carried out by the Products Committee, a group of seven people that meets weekly. When a project is defined, a multidisciplinary team is set up – always with at least one member of Engineering – and starts holding meetings periodically, with the presence of a member of the Committee. This Committee also focuses on the customers' specific demands, which, in most cases, require some kind of innovation or technical change to be met.

All innovation projects are divided into four phases: a) approval of the idea; b) approval of the concept; c) preparation for the market; and d) closure and follow-up, for 48 months. The results of each phase are evaluated by the Committee and, after the approval of this team, the project moves on to the next phase.

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<sup>2</sup> In reference to the contents of the book "The Blue Ocean Strategy" by W. Chan Kim and Renée Mauborgne, in which Red Oceans represent all industries currently existent, the known market space, while Blue Oceans are industries that do not yet exist, and which therefore represent the unknown market space.



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**Adelton José Rossetto**  
Manager





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**Karollyne Correia**  
Head of Ciser's  
Innovation department.



Another interesting approach is the existence of what Ciser calls “valuation policy”, which rewards the developer who generated the idea, according to the number of phases that the project passes. In other words, the further the project progresses, the greater will be the pay received. The amount of the prize also varies according to the complexity of the idea: if it is a simpler idea, it is awarded a certain amount – which will be almost doubled if the idea generates a patent.

In terms of intellectual property, Ciser has an office in Joinville, hired to carry out patent management, perform prior searches and analysis of patentability, as well as filing the patent, when applicable.

In addition, the company carries out the monitoring of patent banks in Brazil and abroad, as a strategy to identify market movements and trends.

The structuring of an Innovation Management model was decisive for Ciser to achieve the differentiation it sought in the market. The good results came in the form of innovative projects such as Nanotec®, as well as other products that will soon be available in the market. Due to its outstanding performance, in 2015 the company ranked first in the National Innovation Award, in the Innovation Management category.

This positive repercussion contributed to the strengthening of the brand, and the company came to be recognized as innovation generator. This particular award, aside from the national repercussion, allowed the acceleration in access to the Sesi / SENAI Innovation Announcement.

### **The innovation triumph**

Nanotec® is undoubtedly a product with a positive result in the restructuring of Ciser's Innovation. In 2015, just over a year after releasing the innovation to the market, the sales success was so great that by 2016 it already accounted for more than 80% of net operating revenue from innovation items.

Considering that, out of the 25,000 items produced and out of the more than 400 lines of different fasteners produced by Ciser, about 30% incorporate this new technology.

The result is even more remarkable when one considers that after a period of product maturation – in which Ciser has dedicated itself to presenting the innovation to the market – the interest of companies in various niches for the nanotechnology solution has been increasing continuously, even though it is more expensive than other anti-corrosion surface treatments.

With the Nanotec case, Ciser shows the importance of having a strategy for differentiating itself from its competitors to achieve competitive advantages through Innovation.

At the moment, the product is in the homologation phase in several industries and, therefore, the sales should increase considerably. The homologation process is especially time-consuming in the automotive segment, because often the approval of a new component in the Brazilian branch depends on prior approval by the parent company, which takes time.

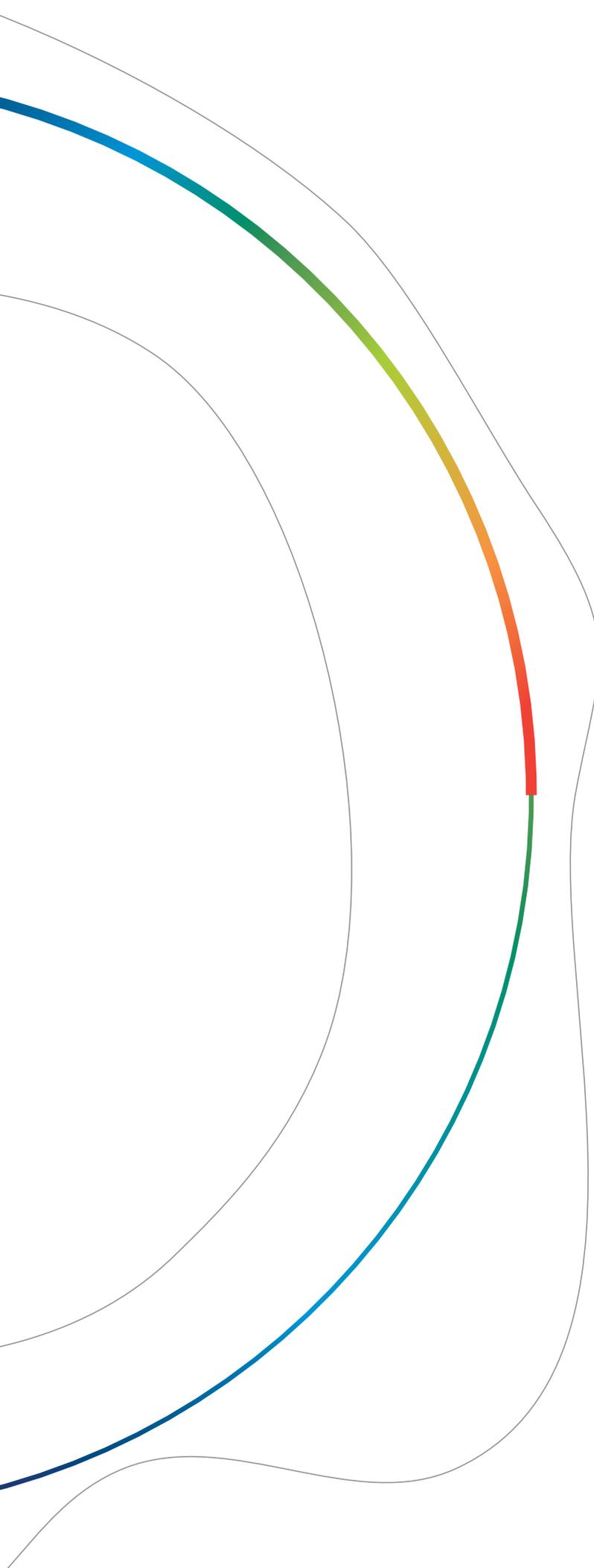
In terms of exports, Argentina is a great market promise for Nanotec®. Virtually all the products that the country buys from Ciser currently carry the nanoceramic coating, and the Argentines are very pleased with the results, like all other customers, in Brazil and in other countries.

How not to be satisfied with a 20-fold increase in corrosion resistance? This result was proven by Ciser, through the test called saline chamber: samples are inside a closed chamber, exposed to a highly corrosive saline mist, in which the time of corrosion is measured. While a sample with electrolytic zinc treatment withstands corrosion for 100 hours, the result for the part with Nanotec® can reach 2,000 hours.

The **National Innovation Award** is an initiative of the Entrepreneurial Mobilization for Innovation (MEI), carried out by the National Confederation of Industry (CNI) and the Brazilian Micro and Small Business Support Service (Sebrae).

The purpose of the award is to encourage and recognize the successful efforts of innovation and innovation management in the organizations that operate in Brazil.





## Success beyond expectation

This performance has caught the attention of markets dealing with surface treatment in general, overtaking the fastener frontier. This is how Ciser also became the exclusive distributor of the technology in South America, increasing its scope of work.

Adelton explains that, in order to apply Nanotec<sup>®</sup>, it is necessary to use a suitable applicator equipment, which is why the product must be purchased by a company that meets certain requirements. This way, Ciser first verifies the technical capacity of the potential buyer to carry out this work, and only then grants the supply.

The range of companies that have come to Ciser for corrosion-resistant surface treatment solutions is wide and diverse, ranging from simple parts manufacturers, such as clips and springs, to larger companies working with copper and brass wires and laminates, that need to treat rolls of one thousand meters in a continuous line.

An interesting case is that of a company in the agribusiness segment, which manufactures hatcheries, that despite of not suffering from corrosion problems, treats its equipment with Nanotec<sup>®</sup> to stand out in the market for the appeal of durability.

This not initially foreseen development of the project ended up resulting in a positive projection of the quality of the products and of the Ciser brand. The company gained visibility, both in the media and in specialized events in the automotive and nanotechnology sector – it has participated for three years in the Nano Tradeshow, the only fair in Brazil focused on the nanotechnology market. “Ciser started to be seen not only as a fastener company, but as a company providing anti corrosion solutions”, summarizes Karollyne.

The new positioning also worked to make Ciser turn its look to the chemical part and begin to consider, in the long term, the entry into a new branch of action: that of solutions in surface treatment. For this, the company is working on the local development of similar product, with its own technology, thinking of increasing agility and reducing process cost.

Short-term plans include the development of an exclusive, high-performance base coat – also with nanotechnology –, which is already in the final testing phase. With this, Ciser takes another step towards consolidating itself as a reference in the nanotechnology coatings market in Brazil.

### **Innovation from the outside in**

The case of Ciser is interesting, especially due to the fact that the company has become a reference in nanotechnology, even though it is not responsible for the development of the nanotechnology product.

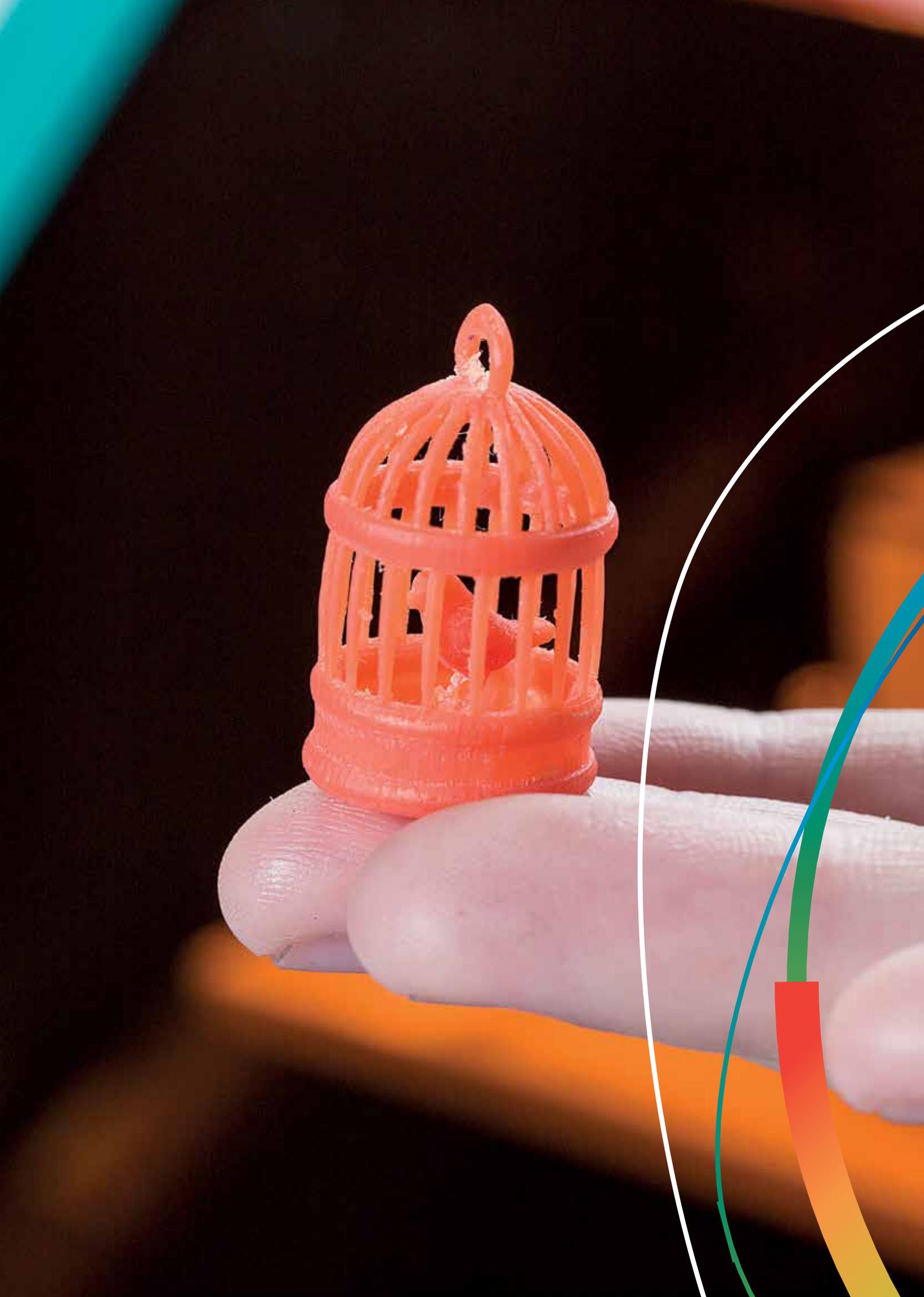
It was able to revolutionize its acting market without ever having an expert in nanotechnology in its R&D team. This therefore makes it an example that it is possible to be an innovative company, bringing outside elements that enable innovation.

Changes in trajectory and repositioning are part of Ciser's essence since the beginning. The company was born as a commercial hardware, founded by the German Karl Schneider who, having just arrived in Brazil, imported the products from Europe.

Later on, by seeing the great demand of the local market for fastening elements, the founder decided to change radically the business and to become a manufacturer and supplier of the same products that until then he commercialized.

It is this same essence of market vision – more commercial than technological – that has led the company not only to incorporate the nanotechnology product into its products, but also to become a commercial representative of the coating, increasing the scope and competitiveness of its business.

Another point worth mentioning is Ciser's geographic location. Headquartered in Joinville, it contributes to the consolidation of Santa Catarina as the country's nanotechnology center, which has companies recognized in the field, such as TNS and Nanovetores, as well as important research groups at the Federal University of Santa Catarina.





cliever

# SMALL COMPANY FROM RIO GRANDE DO SUL IN THE VANGUARD OF THE 3D PRINTING TECHNOLOGY

- CLIEVER
- Porto Alegre/RS
- Small-sized enterprise
- 21 Employees
- Product innovation
- MEI Agenda: Innovative SME

*Cliever launches the first Brazilian high-precision 3D printer using stereolithography technology*

Manufactured in Brazil, Cliever SL1 is the first high-precision 3D printer using stereolithography technology, at a much lower cost than the imported alternatives. This technology allows the printing of extremely complex objects with a degree of precision that can reach 25 microns, equivalent to almost one-third of the thickness of a hair!

Acting in several segments and in all the layers of the industry, Cliever, today with more than 900 machines sold, was pioneer in the development of 3D printers in Brazil, commercialized at an affordable cost for companies of all sizes.

## Stereo... What?

The most popular 3D printers that have helped made this type of technology popular use a method of fusion and deposition of material, known as FDM (Fused Deposition Modeling).

In it, a plastic resin, in the form of filament, is melted at temperatures around 200°C, allowing the deposition of successive layers of plastic, which solidify with cooling and give rise to the three-dimensional object. With this technique, it is possible to achieve precision of the order of tenths of a millimeter.

In stereolithography, the process is quite different. In this method, one of the most advanced in the 3D printing market, the deposition of successive layers, technically called additive manufacture, is based on the polymerization of an acrylic photo-resin, that is, a resin that solidifies in the presence of light, at a given wavelength.

In other words, in stereolithography, a laser causes the resin to harden and form the layers that will make up the object – rather than the temperature, in the method used by traditional 3D printers.

This technology allows the creation of pieces with high dimensional and superficial precision, with excellent external finishing, which is why its main application consists of the reproduction of small pieces and/or complex shapes.



The equipment for printing of such kind consists of three main components: a tank, where the resin is deposited in liquid form, a mobile platform where 3D printing is made, and a laser, which has its movements controlled by a microprocessed system.

The laser beam polymerizes the resin, that is, it successively changes its state from liquid to solid, layer after layer, as the platform rises, thus building the 3D printing final object.

### Accurate Bet

How was a small company from Porto Alegre able to reach such technological level and develop a printer that uses such a complex technique?

Cliever was born at the height of the first boom of 3D printing and additive manufacturing technologies in Brazil. Its founding partner, Rodrigo Krug, worked in the family's carpentry when, at the age of 15, he took a technical course on automation and control at SENAI. That was when the interest for the mechanical area arose. In 2012, after two failed attempts to found his own company, Rodrigo saw the growth of market interest in 3D printers as a niche for his new venture.

At that time, the high cost of 3D printers, available only through import, made it impossible for small and medium businesses to incorporate this innovation into their creative process, reducing costs through greater assertiveness in product development.

While looking at the still unexplored market during the Engineering course, the entrepreneur decided to dare and bet on the new technology. He then founded Cliever with his own resources and incubation support at Tecnopuc (PUC-RS) "in an 11-m<sup>2</sup> room", as he likes to remember.

Since the first equipment, using FDM technology (which still makes up its portfolio), Cliever is dedicated to developing and producing both the hardware and the software of the printers.





We did everything from scratch: the routines, the tests and we were solving the problems as they were being identified. The project became increasingly complex, and prototyping times were increasing.

Rodrigo Krug  
Founding partner  
at Cliever



The molten filament was also developed by the company, in partnership with a large plastics company, which continues to be the supplier of this raw material. This material is extremely important for both the performance and quality of the print and to obtain, at a lower cost, very satisfactory results, comparable to the imported equipment.

Cliever first sales occurred in a very peculiar way. Participating in a fair, Rodrigo was approached by a reporter from a major media outlet, who asked him about the value of the equipment.

He says that the question took him by surprise and, without any previous calculation, he estimated a value, which, he admits, was far short of what would be acceptable. The price was then included in the publication, and orders quickly began to appear. "I was immature and had not prepared myself. It was crazy, but in the end, it worked", he says.

A pioneer in the country, Cliever saw its billing quadruplicate between 2012 and 2014, and the company became the largest domestic manufacturer of 3D printers.

In the initial concept of the business, the machines produced by Cliever would be intended to recreational, industrial and medical applications. However, with the ever-watchful eye, the company began to identify, as of 2013, a change in the 3D printer market in Brazil: there was a very pronounced growth – with the entry of Chinese and North American products –, which ended up leading to a significant price reduction. Cliever then recognized that there was a need to differentiate itself in this environment.

The first approach in this sense was to focus on the professional application, which would bring high added value to the companies. The second was to improve the quality of the products, so that the price was not the only differential – but the final result of the product.

Within the first approach, Cliever identified the niche of high precision and speed of print, still little explored. In this sense, new applications were being created for emerging markets (such as the medical and dental areas), with new demands for this type of technology and no national supplier to meet them – the machines existed abroad, but at inaccessible prices to the entire domestic market, ranging from USD 400 thousand to USD 600 thousand.

Once again, Cliever decided to dare and get ahead in the development of the first Brazilian stereolithography printer.

### Partnerships to face the challenge

It was 2013, when Cliever made the decision to take on the challenge of developing Brazil's first high-precision 3D printer. At the time, the company had only two people focused on R&D – one of whom was its founding partner –, and acknowledged that the project complexity level was very high, a challenge that had not been faced until then.

To achieve the very high precision offered by the technology, the equipment control system is extremely sophisticated, and its development requires a high level of programming and computational knowledge.

In order to face this technological barrier, the chosen path was to seek external assistance, through the SENAI Innovation Announcement. Thus, for a period of two years – the life cycle of the projects of this announcement – Cliever and SENAI teams worked together.

The biggest difficulty was to optimize the equipment to achieve the desired precision. Each millimeter of laser movement requires that 65,000 points be calculated and, as the laser moves at high speed, all the algorithmic routines applied to other Cliever printers had to be rethought.

Optical problems also needed to be solved. When it angularly rebounds in mirrors, the light is distorted. “The biggest difficulty, which delayed the project, was when we saw that there was geometric distortion in large formats. It could be corrected by a lens, which cost a fortune, or software, which also cost a fortune”, explains Rodrigo.

The solution was to develop a proprietary software and import the electronic actuators from Taiwan, which are the root of the process, and this multiplied by 10 the estimated cost. Also due to the geometric dispersion, the mechanical design needed to be reviewed to ensure that the entire equipment was extremely aligned to avoid distortions. “At first, we had no idea we would have to face this kind of problem, because we did not have a specialist in optics”, says Rodrigo.

“We did everything from scratch: the routines, the tests and we were solving the problems as they were being identified. The project became increasingly complex, and prototyping times were increasing”, he adds. The result, at the end of the estimated two-year period, was a structured basis for the technology, but which still required development. Cliever’s own internal team, which had already doubled in size, took over the rest of the development.

Resins were also a challenge: an extremely functional machine would be useless if there were no local supplier capable of assisting in this development. To solve this issue, Cliever entered into a partnership with a company from São Paulo and another from Rio Grande do Sul – both developers and suppliers of resins.

Together, they have been able to develop a specific resin for Cliever’s equipment, with variations that allow it to produce rigid, flexible and cast parts (the latter enables the object itself to be used as a mold to produce castings).

In addition to these variations, a resin for the dental area is currently under development, considered one of the main commercial focus for the new printing technology. The idea is that the surgeon himself is capable of doing all the work, from the examination and evaluation to the production of prostheses inside his own office, without relying on



third parties' service. Currently in Brazil, only imported machines are capable of carrying out such work.

The process works as follows: the surgeon scans the patient's mouth and the 3D printer, based on these images, can create models for preoperative study, surgical guides and/or prostheses. "The prosthesis gets a perfect fit, so that the patient has no injury or irritation. The guide is produced with the exact angle and allows making a precise implant with a lower risk level to the patient", explains Rodrigo.

For those people who associate dentistry with suffering, stereolithography promises to eliminate this perception: with images from the patient's mouth, it is possible to print molds without having to undergo the procedure that uses molding with plaster – which is time-consuming and extremely uncomfortable.

At the end of 2015, when the resins challenge was overcome – and with the development of hardware and software for the stereolithography printer in an advanced stage, Cliever decided to seek external financing to finalize the project, to stagger production and to start the business feasibility. The strategy was to seek the venture capital investment from the Criatec 2 Fund, which contributed with BRL 2 million.

*Conceived as a continuation of the Criatec project, initiated by BNDES in 2006, Criatec 2 fund has a Committed Capital of BRL 186 million, with the purpose of investing in approximately 36 companies. Its expected duration is 10 years, with its first four years referring to the Investment Period. During this period, managers have the mission to use resources to invest in innovative companies, with annual net sales lower than BRL 10 million, earned in the year immediately prior to the approval of the investment by the fund, in order to promote its capitalization and accelerated growth. Furthermore, managers have as purposes the implementation of good management practices and the increase of corporate governance in the invested companies.*

In April 2015, Cliever SL1 was released to the market – a portable, silent, compact and easy to use equipment, which can print models of up to 12.5x12.5x10 cm, reaching the precision considered as project pre-requirement (25 microns), at print speed 50% higher than that of other models until then available at the company.

In addition to medical applications, all precision industry sectors can benefit from the SL1 print quality: the finish obtained does not require any type of rework or finishing, and the parts leaving the printer can already be applied directly to the final product – even those with a high level of detail. Thus, the new technology opened a new market for Cliever, with more value than its previous equipment.

### **Positioning that made the difference**

With five years of existence, Cliever is proud to have defined a line of products for the industrial market in Brazil, always having the low cost as a differential of its business, offering products with prices ranging from BRL 5 thousand to BRL 32 thousand (current price of SL1).

This range allows the actuation in the most diverse segments of the professional markets. In addition to the printers, Cliever also manufactures all the inputs, the plastic filaments and the accessories that accompany them. All products are 100% national: technology, suppliers, raw materials and team of professionals.

Focused on industrial prototyping for product development, Cliever's activity today focuses on four main areas: a) processing industry, for the development of prototypes by companies of all sizes; b) educational institutions, in the most diverse courses, from the traditional areas of engineering to medicine; c) health area, main focus for the development of SL1; and d) design and architecture.

The applications are diverse. From functional prototypes to ergonomics testing to manufacturing tools – many Cliever customer automakers use printers to manufacture assembly guides or even internal product components – to the production of end-use parts, replacing some traditional manufacturing processes.

The positioning for the industry is, according to Rodrigo, the key to Cliever's success, although, over the years, increasingly diverse applications have appeared for 3D printing. "Two years ago, there was a move pointing out that people would have 3D printers at home. I have always been skeptical about the popularization of technology in this range, towards personal consumption. However, with this wave, companies started making cheap machines, and we started losing sales. We focused 100% in the industry, not served by the cheap machine nor by the BRL100 thousand machine. It was this repositioning that saved the company and allowed us to get where we are", he explains.

Nowadays, even though Cliever's machines are the most expensive in the country, the sales volume is substantial, and the company stands out in the domestic market. The secret? Quality and content. "We provide not only the product, but content for the customer. We do a lot of work to show the advantages of using 3D printing in your process and we calculate the return on investment, which is always very fast", says Rodrigo.

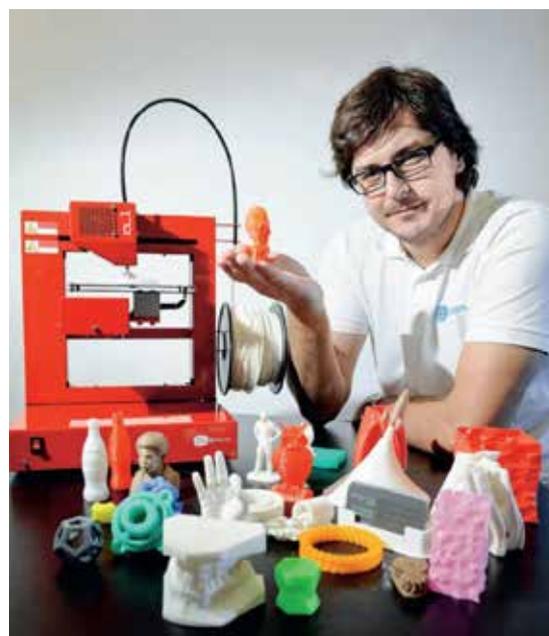
### The advantages of the 3D prototyping

To get an idea of these advantages, Cliever has customers in the electronics industry that used to spend between BRL 10 thousand and BRL 20 thousand per month with prototyping, while the printer, that can do all this work for many years, costs BRL 12 thousand.

The reality is that the industry in general, for lack of knowledge, created some kind of resistance to 3D printing because of the cost of the equipment, without, however, taking into account the advantages of using them.

It is a triad: increased productivity, reduced time and cost.

The high level of detail that can be achieved allows prototyping things previously unimaginable: from small objects with internal cavities to organic shapes.



“

What makes our product have such great acceptance and such a satisfactory use experience is the software, the platform that accompanies our products. Even someone who has zero contact with 3D printing or modeling technologies can get good results. You export the model of a part, click 'Print' and let the equipment do its work.

**Rodrigo Krug**  
Founding partner  
at Cliever

”

It is also possible to carry out tests on material that imitates the final characteristic of the product without having to invest in matrix, avoiding the loss of investment if the result does not meet the necessary standard or does not meet the needs.

In other words, it reduces material waste and validates the physical form of the product, with a much lower investment than it would be with the alternative option (usually machining).

Saving time also draws the attention of businessmen, because, in addition to increasing the productivity, it allows to maintain the focus in the outcome quality. There is more time to evaluate details, which increases the chance of making it right with the first prototype. That means no more rework (which usually costs a lot for the industry in general).

### **Differentiation is necessary**

In addition to the advantages of prototyping, there is an important differential in Cliever printers, which also contributes positively to the positive evolution of sales. Thinking coldly, the 3D printer is nothing more than a robot that produces an object, through a certain technology. "What makes our product have such great acceptance and such a satisfactory use experience is the software, the platform that accompanies our products. Even someone who has zero contact with 3D printing or modeling technologies can get good results", explains Rodrigo.

Cliever's machines offer a universal tool that reads the formats and prints assertively, from any design software.

The option of not being a modeling tool comes from the fact that each application area uses a software with its own characteristics. "Our software reads 13 file formats, the most common. Thus, the user draws on any modeling software. They just need to export the model of the part, by using a USB or memory card, click 'print' and let the equipment do its work", explains Rodrigo.

This applies to all the equipment that Cliever markets, not just SL1. It is an automated process: printers turn files into machine language, a complex operation, but the user does not even see it. In other words, the software "sees" the model and repositions it, ensuring better print quality without any interference from the user in the process. Other competing machines, even the best among the imported ones, do not perform such work.

The printers' connectivity is also a differential of the solution created by the company from Rio Grande do Sul. In addition to USB and memory card slots, uncommon in competing equipment, Cliever machines have man-machine displays that allow their use without the need to connect to a computer. This is an advantage when working with prints that can take days.



### Promising launch

Since the launch in April 2016, 20 units of the SL1 printer have been sold. In addition to these effective sales, there is an equal number, at an advanced phase of commercial prospecting. Customers are from the precision industry, the biomedical area and the jewelry industry.

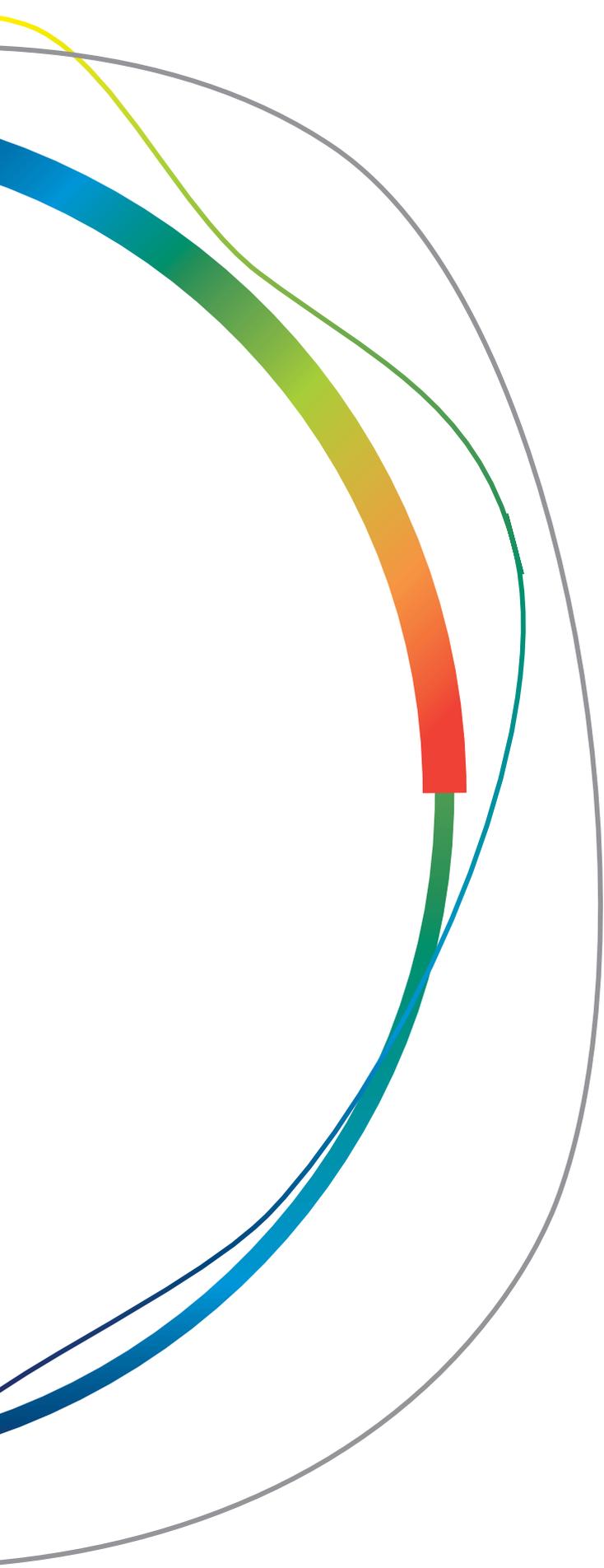
The jewelry industry is actually, together with the dental area, a great potential market for SL1 and casting resin. The idea is that the goldsmith can design a model, print a hundred molds and, from them, make countermodels in plaster. Then simply heat the system for the resin to drain and obtain the mold in plaster, where the gold or other material is deposited. The process becomes much shorter and faster, in addition to ensuring the precise uniformity of the parts.

At a cost of BRL 32 thousand, SL1 has already contributed to the increase in Cliever's average ticket, which in 2015 was BRL 4.5 thousand, and increased to BRL 10 thousand by 2016. Without significant competitors in Brazil for stereolithography – according to the company, only two multinationals, one Israeli and one North American, develop solutions in this area, but the cost of equipment and resin is extremely high – the growth outlook for 2017 is very promising. While in 2016 the revenue stood at BRL 3 million, the target for 2017 is to earn BRL 7 million.

### Advancing step by step

To achieve these results, Cliever's focus with SL1 is the opening of new markets, especially in the educational and design areas, as well as the consolidation of the jewelry market.

The company also aims at the manufacturing 4.0 future market, where spreading the production should be a trend. Therefore, Cliever's idea is to take manufacturing to geo-localized environments, that is, not to have only one factory, but several small factories spread throughout the country.



However, the plans are not just commercial. In Rodrigo's words, "the SL1 project was only the first step." What is missing? The impression of the final prostheses, which has been a desire since the beginning of the project. With the technologies available today, it is now possible for health professionals to make extremely accurate diagnoses, but the tools for end use are lacking. Therefore, Cliever currently works in the development of resins that meet the demands of such medical applications.

Another important front of work, with a future focus, concerns initiatives that improve the efficiency of products. Cliever believes that, in the next 5 or 10 years, it will no longer be selling 3D printers, but rather its use.

With this vision, the company is developing a project that aims to use the idle capacity of the equipment that is in the field – from the 900 machines installed throughout Brazil, "I can guarantee that less than 10% of them are in operation right now", says Rodrigo. For this, Cliever is setting up a strategy, focused on small – and medium-sized enterprises, able to make the connection between those who want to use with those who have the tool, to generate some sort of revenue.

### **In search of internationalization**

Rodrigo's dream, from the beginning, is to build an international company. Cliever has already exported to 10 countries, but not on a regular basis. In terms of technology, he states that Cliever's product can compete with any international product, including that of large multinationals. "But we cannot be competitive abroad because of the Brazilian disadvantages, especially when it comes to taxes. How will we be present without economic competitiveness against competitors?", he asks.

The fact of becoming a joint-stock company, a requirement to participate in Criatec 2, reduced the company's competitiveness, reducing profitability by almost 40%. "Several costs tripled for us. The accountant cost, legal cost, taxes. I cannot become competitive if I do not aim for the market. Moreover, geographically, we already consider ourselves out of the world, because we are in Rio Grande do Sul, outside the main center", he concludes. Another problem is the lack of financial strength to invest abroad, an environment that already has very well consolidated brands.

As persistence and audacity are at Cliever's core, the plans for internationalization have recently been resumed. The company sought assistance from Anprotec – National Association of Entities Promoting Innovative Enterprises and Apex Brazil – Brazilian Agency for Promotion of Exports and Investments, which are planning to develop a network of distributors for South America.

Through them, Cliever participated in a mission in Peru, where the first opportunity appeared in the educational market. The Peruvian government is making a great move to introduce technology in education, both in technical and in elementary schools. "Our equipment has very great educational appeal. We took the opportunity and we are putting together material in Spanish, also focusing on Chile and Argentina", comments Rodrigo.

Another proof that, if it depends on audacity and courage, Cliever will go far.







 **Elekeiroz**

# INNOVATE TO DIVERSIFY: A NEW TRAJECTORY FOR A CENTURY-OLD CHEMICAL COMPANY

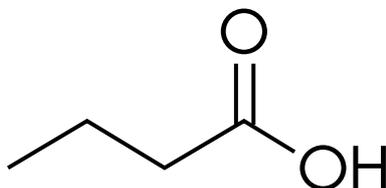
- ELEKEIROZ
- São Paulo/SP
- Large-sized enterprise
- 600 Employees
- Product innovation
- MEI Agenda: Global inclusion through innovation

*Elekeiroz is the first chemical industry to produce butyric acid in Brazil, an important input for the flavor and fragrance and animal feed industries*

In 2015, Elekeiroz became the first company in Latin America to produce and commercialize butyric acid, a product previously only available in the market through imports – with the main players being the USA, Europe and Asia. The starting material, which is the basis for obtaining the acid, is a chemical intermediate in the oxo-alcohol chain.

Butyric acid is used as raw material by the flavor and fragrance industry and by the animal feed industry – sodium butyrate, derived from butyric acid, is a feed additive that helps control microorganisms in the intestinal flora of animals, allowing for greater absorption of nutrients and reducing the need for the use of antibiotics.

In 2014, the world market for butyric acid stood at 45,000 tons, having moved in 2016 more than USD 150 million, with a predicted of growth of two digits by 2020. Globally, the largest consumer market for butyric acid is animal feed (61%), followed by food flavorings (12%).



Both industries are important in the Brazilian economy, and the country occupies a prominent position in international terms, one more reason for the development of inputs that promote the integration and competitiveness of their productive chains.

## Eureka!

In science, it is not uncommon for important discoveries to happen by chance<sup>1</sup>. Penicillin is undoubtedly the most historically famous example, but there are countless other cases. The discovery of the revolutionary and controversial blue pill for erectile dysfunction, created as a result of side effects observed in clinical trials during a research for the development of a drug for heart disease, is perhaps the most notorious example of our recent history.

Just as in science, the opportunity for Elekeiroz to become the first company in Latin America to produce and market butyric acid happened with a good dose of chance. While looking for processes that are more

<sup>1</sup> The history of science is replete with cases of serendipity. Serendipity originates from the English word created by the British writer Horace Walpole in 1754, from the Persian tale The Three Princes of Serendip. The story tells the adventures of three princes of Ceylon who were constantly making unexpected discoveries, results of which they were not seeking. Thanks to their capacity for observation and wit, they “accidentally” discovered the solution to unthinkable dilemmas. This characteristic made them special and important, not only because they had a special gift, but because they had an open mind to the many possibilities.

competitive in order to produce one of its products, the company noticed that it could launch a new product. It's like aiming for one target and hitting another.

The team was assessing a fermentation process for the production of butanol (in which butyric acid is an intermediate product converted to butanol) when one team member, a plant operator, asked if butyric acid could not be separated and marketed. It happens that in this particular process, separating butyric acid would be difficult, costly and economically unfeasible, as it is diluted in water.

That was then the "eureka moment" happened. "The person who asked if he could not separate the butyric acid from the aqueous medium had no thoroughly established concepts. We had an intermediate used in a process from another productive chain that could be oxidized to generate the acid. That's how the tip came up, a bit by chance", explains Rafael Pellicciotta, Elekeiroz's executive manager of innovation and engineering.

The production of butyric acid is simple in general aspects: the intermediate is converted into the desired product from the oxidation reaction with the air oxygen. "Obviously it is not that simple, but we decided to research and we discovered that the product marketed and used in Brazil was not produced domestically", says Rafael.



The chemists in the team then carried out a technical pre-analysis, concluding that Elekeiroz could produce butyric acid through a simple conversion – similar to that already existing in the plant – only by developing new process parameters.

That was how the Aroma project – name chosen in reference to the use of butyric acid by flavor and fragrances industry – came up, which quickly went through the stage of ideation. To test the hypotheses, quick laboratory tests were performed, through which practically pure butyric acid was obtained.

In the next stage, the studies for industrialization were carried out, with pilot-scale production before moving to the industrial plant. This is a critical stage of development, since in the chemical world what is achieved in the small-scale laboratory is not always so successful when it is moved to the industrial scale, especially when it comes to process risks.

In this specific case, as production would occur through small modifications in an already existing productive process, the industrialization phase was performed faster than usual.

In terms of technical challenges, the stage following production – which is the purification of butyric acid – was the most demanding. The first application identified by Elekeiroz for its new product was as raw material for the flavors and fragrances segment.

The industries in this segment convert butyric acid into other chemicals called esters, responsible for the characteristic odors. Examples: n-butyl butyrate = pineapple odor; Propyl butyrate = pear odor and hexyl butyrate = apple odor.

It turns out that subtle changes in an ester chemical composition are capable of dramatically changing the odor. Thus, if there are other acids, such as contaminants, they are also converted into flavorings, such as butyric, interfering with the expected odor. Therefore, in the flavors and fragrances segment, it is imperative that the raw materials have a high level of purity.

Elekeiroz therefore needed to invest in the development of a purification system with

several stages, capable of ensuring the fulfillment of potential customers' prerequisites.

A curiosity: although the esters have pleasant aromas and fragrances, the butyric acid itself has a very unpleasant odor of rancid butter. That is where it got its name from (as it smells of *butter*, it was named *butyric acid*).

Even with the purification challenge, the combined work of the R&D and process teams, coupled with the alignment and engagement of the industrial and commercial departments, enabled Elekeiroz to complete the project in six months, a time considered short for the general standards of the chemical industry.

### Potential markets

Focusing on the butyric acid potential markets, the Aroma project purpose was to expand Elekeiroz's product portfolio and its contribution margin through the commercialization of the new product in the domestic market, in view of the opportunity to replace imports.

To identify the opportunities, some studies on the global and Brazilian chemical industry were used, which allowed the identification of interesting segments to be prioritized. The prioritization recommendation came from an internal workshop to present the commercialization potential of the new product, which was then validated by a council, with indications of actual opportunities, which fed the pipeline of innovation projects.

If, at first, Elekeiroz identified the segments of flavors for the food industry and that of fragrances for the cosmetics industry, a new market emerged along the way: the animal feed market.

Whereas the flavor and fragrance segment accounts for 12% of the global butyric acid market, the share of animal feed is 61%, a difference that is even more important when considering Brazil's outstanding position in the production of proteins for human consumption.

In fact, Elekeiroz has not given up on fragrances – which would not make sense, consider-

ing that Brazil has one of the largest cosmetic markets, in addition to being one of the largest food producers in the world. Therefore, it has partnered with the main Brazilian industry of fragrances, a potential buyer also interested in joint developments.

The main application in animal feed occurs in the weaning of piglets, as butyric acid has the virtue of stabilizing the intestinal tract of the animals, in addition to opening their appetite. Thus, when the piglet is weaned, it continues eating and does not lose weight. If it does not lose weight, there is no productivity loss. In chicken production, the butyric acid is used to stimulate the animals' appetite.

Another interesting aspect is that the additive used in animal feeding, upon improving the intestinal microbiota, it reduces the need for antibiotics, which is a relevant sustainability appeal for the sector.

### Innovation for reinvention

The path to the development of the new product, which diversifies Elekeiroz's portfolio both in industrial terms and in its operating markets, is a direct result of the company's internal restructuring, which began in mid-2012.

Since its foundation in 1894, Elekeiroz has been a leading player in the launching of various chemicals, occupying an important position in the national chemical industry. In 2012, a new innovation cycle was launched in order to strengthen the company's positioning in the markets of high margins and growth, in order to increase its sustainability.

From the perception of this unfavorable scenario, the company's shareholders understood the need for an internal restructuring. The admission of a new CEO was accompanied by intense work of changing the culture and strategy, bringing innovation to a protagonist status.

The first major change was the creation of an Innovation and Engineering department, with a team exclusively dedicated to innovation projects. Thus, what used to be a product development laboratory, with a reduced team, became an important department of the company, focused on research and development of products and processes.

The starting point for this rearrangement was the understanding that innovation can only effectively have room in the organization if people can fully engage in innovative activities. When innovation "competes time" with everyday operations, it ends up losing most of the times.

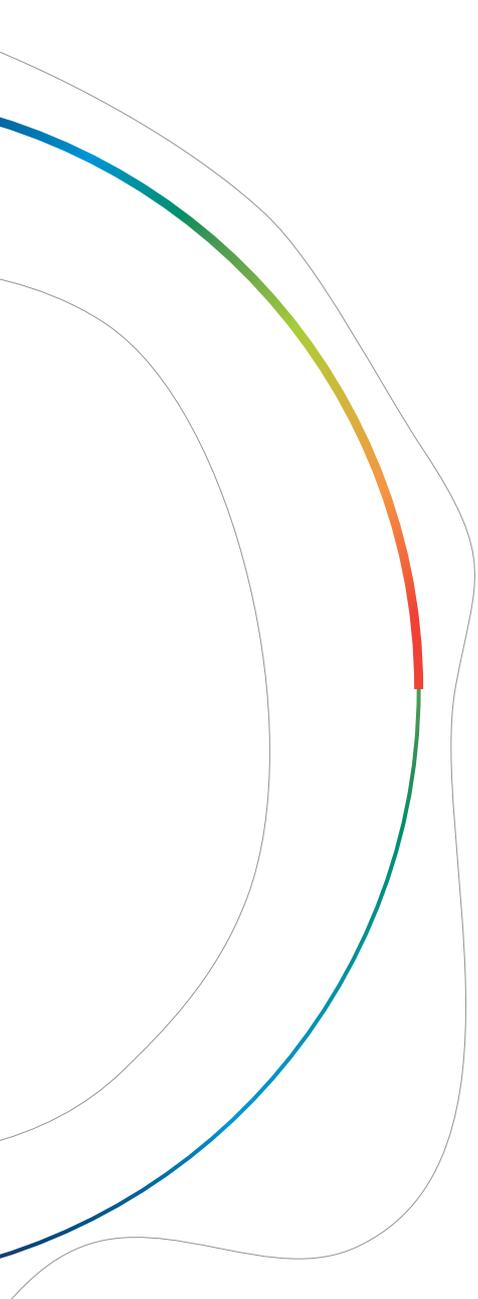
In this sense, the innovation team can be streamlined, but it must be dedicated, and the primary mission of producing innovations cannot conflict with other activities – which are always more urgent as they deliver results more quickly. Another important point in the restructuring was to



We can not say that we have already become a player in the market. But we are gradually increasing confidence in our product.

**Rafael Pellicciotta**  
Executive manager  
of innovation and  
engineering at  
Elekeiroz





design and implement an innovation management process, appropriate to the company and its new strategy.

In addition to “tidying up” and turning to Innovation, Elekeiroz identified the need to change its way of thinking, shifting the focus from the product to the market. This positioning and a thorough diagnosis of its processes were the guiding principles for redefining the company’s strategy.

After that, it was time to establish a pipeline of projects. At that time, Elekeiroz used two approaches, which were called *inside out* and *outside in*. The first, as the name suggests, was used to identify possible in-house improvement and development points. The second, in reverse, has a look at the environment outside the company, in search of new opportunities. The butyric acid project is the result of the *outside in*: the possibility of increasing the portfolio and domestically supplying a product only available through imports.

### First results

Elekeiroz already markets butyric acid in the domestic and international markets, and its customers are mainly made up of flavor and fragrance companies. However, as the animal feed market is expected to grow 10%, the company is focused on developing partners to serve that niche by 2020.

Although the production volume of the acid is much lower, when compared to the volumes of the products marketed today, the profitability is, on the other hand, much higher.

The company’s current effort is focused on the domestic market, for two reasons: first, because the sales force is prepared and positioned to operate in this market; second, because the company still considers itself at the preliminary stage of establishment in the domestic market. “We cannot say that we have already become a player in the market. But we are gradually increasing confidence in our product”, comments Rafael.



Still, in order to prepare for the entrance to the external international of animal feed, the company has looked for certifications considered requirements in some markets, like Kashrut: markets related to the Jewish community require kosher certification. Certification for chemical intermediaries is valid for all groups of Jewish communities, a certification that Elekeiroz obtained in July 2016.

GMP+ (Good Manufacturing Practices), for export of animal feed and GMP (Good Manufacturing Practices), for sale in the domestic animal feed market, certifications are under feasibility analysis.

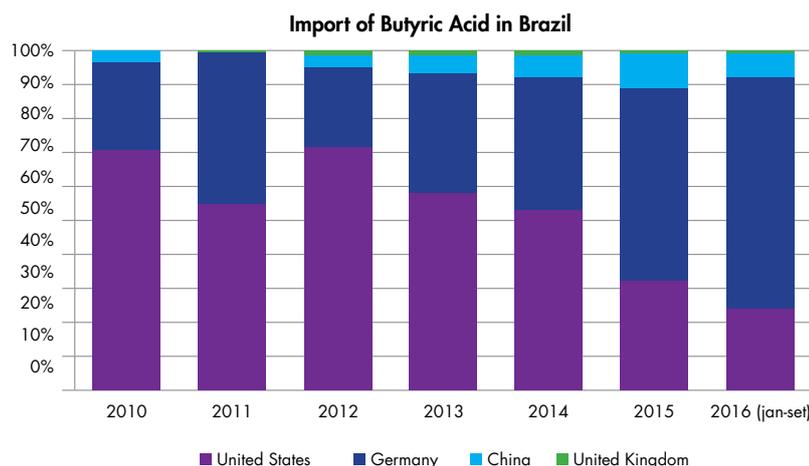
Regarding the domestic market, more important than sales margins and volumes is the establishment of commercial understandings for the development of new products, an opportunity identified immediately when establishing relations with the largest flavor industry in Brazil. "It does not want to just buy the product, it wants more. It wants to identify other opportunities, wants to buy other products, wants a contact, and wants to be able to buy reduced volumes to work in development. And it does not get that from external suppliers", explains Pellicciotta

### Exciting prospects

With the Aroma project, Elekeiroz confirms its search for portfolio diversification and starts to operate in a high-growth sector with more remunerative margins.

The prospects in the animal feed market, to which Elekeiroz has dedicated its efforts, are very promising. National companies in the pork and chicken protein sector systematically import butyric acid or animal feed additive made from butyric acid. In 2015 alone, imports surpassed USD 1.15 million.

Looking at this opportunity, the R&D team has sought to adapt production to the requirements of the animal feed market, which is interested in microbiological control – unlike



Source: AliceWeb, Federal Revenue Service's website

that of flavors and fragrances, for which the important thing is the smell of the product.

In the animal feed application, butyric acid is converted into a series of derivatives, the butyrates, which are used as additives. A future perspective for Elekeiroz is to provide not only the butyric acid, but also its derivatives, which may lead to the development of partnerships with other companies in the production chain.

### Market expansion and business repositioning

Although the innovation is far from being groundbreaking, Elekeiroz repositions the company within the chemical industry, placing it as the only supplier in Latin America of a raw material relevant to several segments of economic activity, in agriculture and in the flavors and fragrances industry.

Although the initial purpose of the project was to replace the import of butyric acid by producing it in the Brazilian territory, the product has potential markets in other regions of the world, such as Europe, North America and Asia.

The changes are far from few, despite produced by a streamlined, but dedicated team: a new product – and maybe a platform for derivative products –, new insertion in markets that are more rewarding and less subject to the volatility of commodity demand, a diversification of the customer base in Brazil and a new international insertion of the company.

What is not bad for a first cycle of innovation!





**embraco** POWER IN.  
CHANGE ON.

# WORLDWIDE INNOVATION IN COMPRESSORS FOR RESIDENTIAL REFRIGERATORS

- EMBRACO
- Joinville/SC
- Large-sized enterprise
- 11,000 Employees
- Product innovation
- MEI Agenda:  
Regulatory framework – PI,  
Global inclusion through innovation

*Embraco revolutionized the refrigerator market with the launch of Wisemotion, a new concept of hermetic compressor*

Focused on providing products with better energy efficiency and lower environmental impact, Embraco developed the world's first oil-free hermetic compressor for applications in residential refrigeration equipment.

The technology, called Wisemotion, also allows the compressor to automatically regulate its power, depending on the demand of the refrigerator. According to the size of the environment to be cooled and the amount of food, the compressor works with more or less refrigeration capacity, allowing for the reduction of over 20% in energy consumption when compared to the best-selling high energy efficiency refrigerators in the global market.

Wisemotion is also quieter and smaller than a compressor of equivalent capacity. Its reduced size saves internal space in the refrigerator, adding up to 20 liters in the equipment internal area.

An additional advantage comes from the production line: its handling on the assembly line is easier and, as it does not require the use of lubricant oil, it makes transportation and storage easier, benefiting the entire logistics chain.

The project originated numerous patents in several countries, demanded partnerships with other companies and universities and received several awards. In the market since 2014, the product is marketed worldwide, with China and the United States as the main markets served.



## Breaking paradigms

Born in Brazil in the 1970s, Embraco is one of the world's largest compressor manufacturers, with a production capacity of 40 million units per year, which represents approximately one fifth of the world market.

The company, currently present in more than 80 countries, has 11 business units and plants around the world (Brazil – 3, China – 2, Slovakia – 2, in addition to the United States, Italy, Mexico and Russia), to provide innovative solutions aiming at a better quality of life.

Therefore, the development team continuously seeks answers to some key questions: How can we make compressors differently? Where can we simplify? One of the researchers' answers to these questions was the creation of an oil-free compressor; the starting point for the Wisemotion project.

It took 10 years of development, over which more than 100 engineers and researchers were involved, researching and seeking knowledge around the world, to design a highly innovative product that disruptively changes the concept of compressors until then existent.

Six of the ten years of the project duration were carried out in a pilot line, built at the Joinville plant, exclusively for the development of the new compressor.

What is so different about this compressor compared to the others? The traditional compressors use rod-crank systems, in which the circular motion of the electric motor is converted into back and forth motion from the piston through an oil-lubricated bearing mechanism. This piston motion is responsible for the compression of the cooling fluid.

The Wisemotion concept is based on linear compressors: a motor directly drives the piston, eliminating the need for motion conversion and, consequently, the need for lubricating the bearings.

## Technical Details

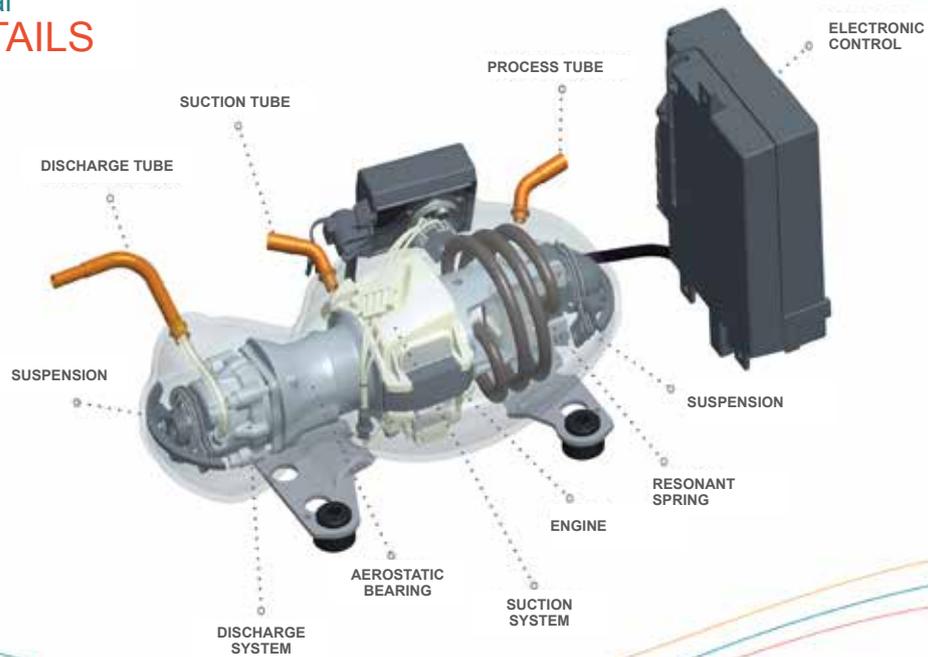
In addition to eliminating the oil, the development of the process has been translated into new prerequisites, such as reduction of compressor size and electric energy consumption, as well as the decrease of temperature oscillation inside the refrigerator. The result is an admirably innovative compressor, from its basic mechanical concept, to its manufacturing process, its architecture and its applications.

What are the benefits that Wisemotion provides to the manufacturer and the consumer?

The **compressor** is the "heart" of a refrigeration system. Its function is to pump the refrigerant that circulates throughout the system, sometimes in the liquid state, sometimes in the vapor state. In the process of cooling a refrigerator, for example, the compressor receives the vapor-like fluid from the evaporator and promotes the pumping of that vapor to the condenser, part of the system that re-liquefies the liquid, dissipating the heat absorbed in the evaporator.

## Technical DETAILS

## External view



### Oil-free

The entire productive chain of existing refrigerators must deal with special requirements to be able to work on compressors with oil. Therefore, the benefits of removing oil begin already in the production process itself, since it eliminates the need for all the logistics in which it is involved, from its acquisition, transportation and storage, to its introduction in the compressor and delivery to the customer.

The same goes for customers who buy the compressor without the oil and need to have their own logistics to put it in the compressor. Last, at the end of its life cycle, a compressor needs to be recycled – and the oil is not an easily recyclable product because if it is disposed of incorrectly, it can contaminate the soil and water. Therefore, eliminating it has advantages that go from the manufacture and assembly processes to the post-consumption.

In addition to the economy represented by the elimination of oil and the insertion operations in the manufacture and assembly processes, its absence also provides savings of refrigerant gas, due to the loss of gas functionality, which partially dissolves in contact with the oil. Without this oil, the loss is eliminated and thereby the amount of refrigerant is reduced.

For the refrigeration system manufacturer, the greatest benefit of an oil-free compressor is undoubtedly the greatest development flexibility – the positioning of the compressor is no longer required in the lower part of the refrigerator. “When the oil circulates in the system, it must be returned to the compressor by gravity. Therefore, it is best to place it as close and as low as possible to the bottom of the refrigerator. Without oil, the compressor can stay anywhere: top, bottom, beside, outside the kitchen; it may even be part of a distributed refrigeration system. There is no limit for the design”, explains Rinaldo Puff, fellow researcher at Embraco, a participant in the project team.

## Reduced Size

Being much smaller (about 100 mm lower) than other compressors, Wisemotion halves the consumption of raw material for its production, which results in lower cost and lower environmental impact. For the refrigerator manufacturer, the reduced size of the compressor converts to an approximately 20-liter magnification of the refrigerator's internal space, giving even more freedom of design. How about having another drawer and more shelves in your refrigerator?

## Minimum temperature variation

The more stable temperature inside the refrigerator cabinet provides the best preservation of food: the lower the temperature oscillation, the longer the storage time.

## Low frequency variation

In terms of oscillation frequency, Wisemotion is more stable than conventional compressors. This means it generates less noise and makes the refrigerators quieter. Say goodbye to the usual on and off noise of refrigerators.

## High energy efficiency

Wisemotion is also more efficient when compared to conventional compressors. The lower energy consumption is due to the presence of only one bearing – a huge advantage over traditional compressors, which have five oil-lubricated bearings. Energy efficiency is probably the biggest benefit of the innovation for the final consumer, also with effects on energy demand. Thanks to the use of Wisemotion, the energy savings achieved by cooling systems can reach 20% compared to the best-selling high-energy efficiency compressors on the global market.



## **The mission of preserving food**

A highly complex technological innovation such as that of Wisemotion, based on very well designed and developed scientific principles and research works, could only be achieved thanks to a research and development team, comprised of over 500 professionals, distributed across 47 laboratories (located in four continents), proof that the company has a real commitment to innovation and an internal management structure that regularly challenges its employees to anticipate trends and seek solutions, developing new technologies.

Adriano Mota, Product Promotion and Strategy Manager at Embraco, sums up this commitment well: "We are passionate about creating great experiences through innovation and what we do, and our mission is to provide innovative solutions for a better quality of life."

Embraco invests 3% to 4% of its annual revenue in R&D and uses an internal innovation management system, based on technological pillars.

In the Wisemotion project, for example, four of these pillars have been involved: technological innovation, pioneering, energy efficiency and sustainability. Each of them

### **Temperature Variation**





We are passionate about creating great experiences through innovation and what we do. Our mission is to provide innovative solutions for a better quality of life.

**Adriano Mota**  
Product promotion  
and strategy  
manager at Embraco



has teams dedicated to the generation of ideas – which are based on customer demands, market analysis, technological prospecting – and all have close interaction with universities and research centers (since 1982, Embraco has maintained partnerships with universities and research centers in Brazil and around the world, the main – and oldest – of which being with the Federal University of Santa Catarina – UFSC).

The projects flow follows the innovation funnel concept. A large number of ideas is generated and they are discussed internally and with the research centers. Then, each of them goes through a maturation process in which, with each new step, some are discarded, others are archived and the others, if validated as economically and technologically feasible, enter into a project cycle.

Embraco has been working for three years with a new business unit that has the responsibility of looking at everything that is beyond the core business of the company and could affect it somehow. Currently, the focus is on five promising markets: energy management, refrigeration, Internet of things, food preservation and recycling.

A third important element in the company's innovation structure – apart from the pillars and New Business – is competitive intelligence. Embraco constantly monitors patents, academic works, international and national publications and market analysis in search of opportunities, ideas, and technologies. This monitoring regularly produces insights for the development of pillars and new products.

Having a structured competitive intelligence process as part of the innovation management within the company has the purpose to reduce development time, reducing risks and mapping opportunities and threats within four main strands: a) food preservation technologies; b) refrigeration technologies; c) compression technologies; and d) subsystems (topics that competitors and science and technology institutions are researching and may, for example, replace plastic or metallic parts of equipment).

### **Patents, patents and more patents**

Embraco has, therefore, a very well structured highly favorable internal environment for innovation, with a robust and highly qualified research and development team, which implements a well-defined strategy.

One of the tangible results of this structured work is the high number of patents that the company holds. There are over 1700, distributed in the four continents. To get an idea, Embraco is one of the Brazilian private companies with the largest number of patents granted in the United States.

Patenting is a business strategy for Embraco, because, since its foundation, in 1971, the company has continuously been producing important developments in the compressor industry. The company also values the employees who participate in the projects that generate patents: at the headquarters, in Joinville, there is a large wall where inventors linked to projects with granted patents are honored with commemorative plaques. That is a lot of wall!



The first compressor patented by Embraco was On-Off, which works with single speed, regulated by means of an automatic on/off switch. "It is a great world market, in which we still work very intensely, but that will gradually migrate to more modern technologies", explains Rinaldo.

Another patented platform – 100% Embraco and 100% Brazilian – is the variable speed compressor system, the technology called Fullmotion, which reduces energy consumption by 30%, compared to the On-Off system. The product is a great pride for the company, both for its pioneering spirit and for directing the entire market for this type of technology, which "has been adding more and more electronics in a world that was practically only mechanical."

The next generation, Wisemotion, has already produced 80 patents, a significant number that shows Embraco's technological strength and the productivity of its R&D team. So the question remains: what will be the next step?

### **International Success**

Wisemotion was launched worldwide in 2014, when the manufacture of the new compressor started at Embraco's Mexican plant.

The option to manufacture in Mexico arises from the plant proximity with the United States, one of the main consuming markets for the product.

Since its launch – released in 14 languages – Embraco's oil-free compressor has already received a series of recognition, both inside and outside the country. Also in 2014, the year of its launch, it ranked first in the Aberje Award – Brazilian Association of Business Communication, in communication and international relations category. The following year, it was the highlight at the 15th Anpei Conference – National Association of Research and Development of Innovative Companies and in the refrigeration equipment category of China Refrigeration Expo Innovative Product, held in Shanghai. Also in 2015, Wisemotion ranked second in the III Brazil – Germany Innovation Award, in

the technological challenge category and third in the Stemmer Award for Innovation in Santa Catarina, in the Innovation Protagonist category.

Although the manufacture continues exclusively in Mexico – and the product is marketed worldwide –, the largest sales volume is concentrated in the Asian and North American markets (the company does not disclose exact figures of sales volume and number of customers).

According to Embraco, the success in Asia is linked to the local culture, which encourages customers to look for technological state-of-the-art products. “Our customer in the Asian market even places on the refrigerator door an indication that the product has Wisemotion, a compressor with innovative technology,” Rinaldo points out.

“In the United States, though, what sells more is the issue of energy efficiency and acoustic comfort, so much so that over there Wisemotion is used in niche markets, in refrigerators considered top of the line”, he adds. Wisemotion does not make the refrigerator expensive because the technology itself is not more expensive than that of other high-efficiency compressors. However, for the advantages of the product, it is used in high-performance refrigerators, usually sold at a higher price range.

Why is the product developed in Brazil, but not produced or marketed in Brazil?

The Brazilian market has not yet absorbed the technology, because there is no well-defined national energy efficiency policy, such as those existent and well-established in the countries that most consume the product today. “There is no demand today in the country for a product like Wisemotion, but when it arises, the product will surely bring many benefits to the national industry and the country’s energy efficiency, explains Rinaldo Puff.

### Everyone wins

The positive impact of Wisemotion outweighs commercial issues. For Embraco, technology has brought about the strengthening of mission, strategy and image, which translates

into the conquest of new markets and the strengthening of research fronts that have been open for more than 30 years, together with universities and research institutes. Graduate, masters and PhD students have had the opportunity to participate in the development of the product through these partnerships, in the country and abroad. “There are several scientific works related to the Wisemotion platform, made in agreements with partner institutions”, says Puff.

The fact that the product development was carried out in Brazil also contributed to reinforce the role of the Brazilian engineering team and the Embraco development center in Joinville, facing the global refrigeration industry.

In the group, Brazil is a reference in R&D, centralizing much of the development research for the whole world. Furthermore, the talents developed here serve as reference for the whole group. The latest case is that of Embraco’s former president, Roberto Campos, who since 2015 has been VP of Whirlpool Corporation, leading all global technology centers.

The new product also favors the possibility of more sustainable specifications, not only in terms of technology, but also with regard to product requirements. In this field, suppliers were highly impacted, as they also needed to innovate to adapt to the new specifications arising from the new technology.

On the market, Wisemotion offers the assembler the possibility of using a pioneering technology in domestic refrigeration, that meets the strict energy efficiency regulations of the most demanding markets in the world.

Speaking of domestic refrigeration, even though Wisemotion is already practically consolidated at this level, “Embraco is now studying new possibilities for technology”. The product is used to replace a traditional compressor, but following the same market rules. The idea now is to think where else the innovation could be employed and, if necessary, create a new market, still nonexistent uses. “It is like when the iPhone was created: it was necessary to create a value proposition, to create a need for the market”, explains Adriano Mota.

## It is possible

Much more than breaking paradigms in the refrigeration market, the Wisemotion project overturns the view that the industry in Brazil only innovates by means of the tropicalization of technologies, bringing products developed abroad to adapt them to the Brazilian scenario.

Embraco did exactly the opposite: all the development, from the creation of the idea, to the development of the pilot, to the tests, everything was done here. The Brazilian team is the heart of Embraco's R&D and uses a partnership with local universities and research centers to attract highly qualified personnel trained in the country.

Embraco's example is even more emblematic, considering the enormous technical capacity of the Brazilian team, to the point of creating such a sophisticated innovation, only absorbed in the foreign market, since the domestic market is not mature enough to understand its importance.

Embraco is therefore an inspiring example, as it proves that investing time and material and human resources in innovation – leveraging the existing opportunities in the local ecosystem and turning out to complement its strengths and fill its weaknesses – works.

This is another example that shows the global opportunities for Brazilian skills.



There is no demand today in the country for a product like Wisemotion, but when it arises, the product will surely bring many benefits to the national industry and the country's energy efficiency.

We have a lot to evolve in the Brazilian internal policies for energy efficiency demand, to trigger us to use this technology internally.

**Rinaldo Puff**

Fellow researcher  
at Embraco



LIVE

Home

Monitoring

Dashboard

Adições Meta

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PRÊMIO - BRASIL  
last hour

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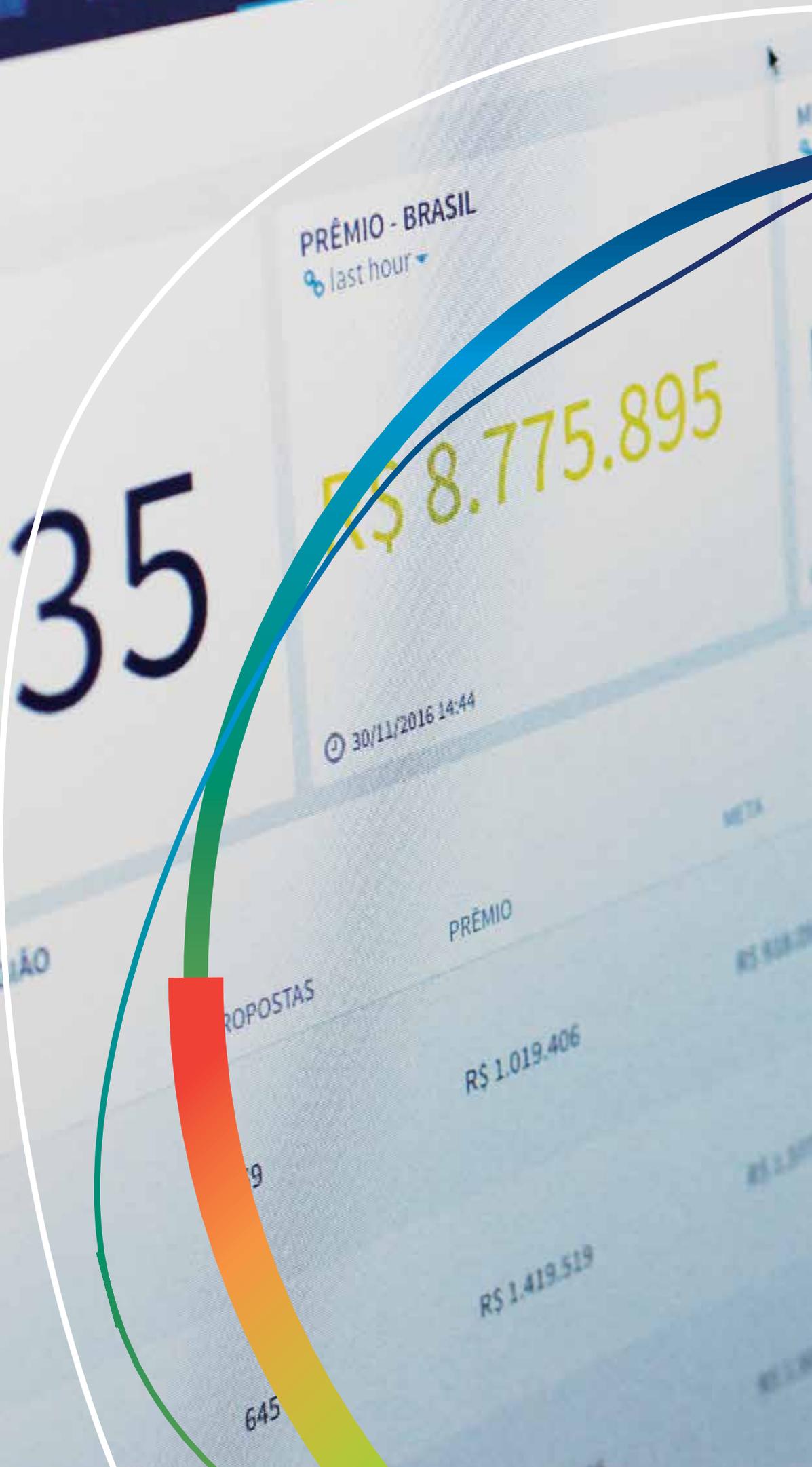
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INTELIE. 

# INTELLIGENT SOFTWARE FOR OIL DRILLING RIGS

- 
- INTELIE
  - Rio de Janeiro/RJ
  - Medium-sized enterprise
  - 30 Employees
  - Product innovation
  - MEI Agenda: Global inclusion through innovation

*Rio de Janeiro-based, Intelie creates a new generation of software that enables real-time data analysis to optimize drilling operations for oil wells*

Intelie's innovation project consists of the creation of a technological platform (software), the Intelie Live Solution for Oil & Gas, which enables the capture of data from oil drilling rigs sensors, the real-time processing of this data and availability of an Operational Intelligence environment with dashboards for variable monitoring of the operation, predictions of problems/behaviors, alerts and automations of actions. The platform enables the possibility of a much more agile and data-driven management of the operation, in real time.

The RTO (*Real-Time Operation*) platform Live Analytics uses machine learning and automatic data analysis to produce high-value information that helps in deciding where to drill oil wells.

The technological innovation lies in the flexibility offered: through the unique language Intelie Pipes, it is possible to customize solutions for each customer, creating new analysis or smart alerts and extending the language with new algorithms. From the interface point of view, the platform elaborates new visualizations, from a series of preexisting graphics or even creates totally new applications.

The tool was acquired by Petrobras, which was able to identify and solve potential problems in the wells in a precise and fast manner, thus reducing operating costs. The platform has also been marketed to other global oil companies.

## The challenge of the information age

With the increasing digitalization of business and the Internet of Things (IoT), data generation has grown exponentially, and we must deal with it in real time so that maximum value can be used.

It is possible to say that today the main assets of companies for the generation of value are human capital and data. It was from this observation that the founders of Intelie, Hubert Aureo Cerqueira Lima da Fonseca, Ricardo Gomes Clemente, Pedro Henriques dos Santos Teixeira and Jorge Luiz de Brito Falcão, electronic engineers and computer scientists – who were then studying Masters in Machine Learning and Processing of data at PUC – RJ –, designed the platform that gave rise to the company.

The platform enables the capture and processing of large volumes of data at high frequency (data flow), from several different sources, such as sensors, electronic platforms, social networks, transactions, etc.

“The biggest differential of our service is that we have been able to deal with complicated problems from both the computing and the oil world, and translate them into a simple customer interface. The simplified interface is almost an obsession within Intelie, something we treat with extreme concern, because we want to ensure that everyone who has to deal with the tool can handle it with ease”, summarizes Ricardo Clemente, who, in addition to being a founding partner, is Director at Intelie’s operations in Houston, United States.

The idea to create the company came in 2008, when Ricardo, Jorge Falcão and Pedro, who worked on a large Brazilian content portal, realized the need for a solution that could promptly identify technology failures and their causes.

Although the company had many tools for past data that generated reports on past events, it lacked a technology that provided real-time data both to help make timely decisions and to anticipate what might still happen. This is a strategic issue for any operation, as it can generate a lot of money or a lot of damage in a short time – as well as involving high security risks.

The desire to turn theoretical knowledge into practical applications existed since the Masters, and friends thought the challenge could be interesting. They presented the project to the employer at that time, who showed no interest. They then made the risky decision to leave the company to start their own business, later becoming suppliers to those who used to employ them.

Intelie started operating in 2009, incubated at PUC-RJ’s Gênesis Institute. The first solution created and sold to the portal using machine-learning technology was the IEM (Intelie Event Manager) system, which was able to correlate data and identify patterns to keep the operations staff always informed of failures that would compromise the business.

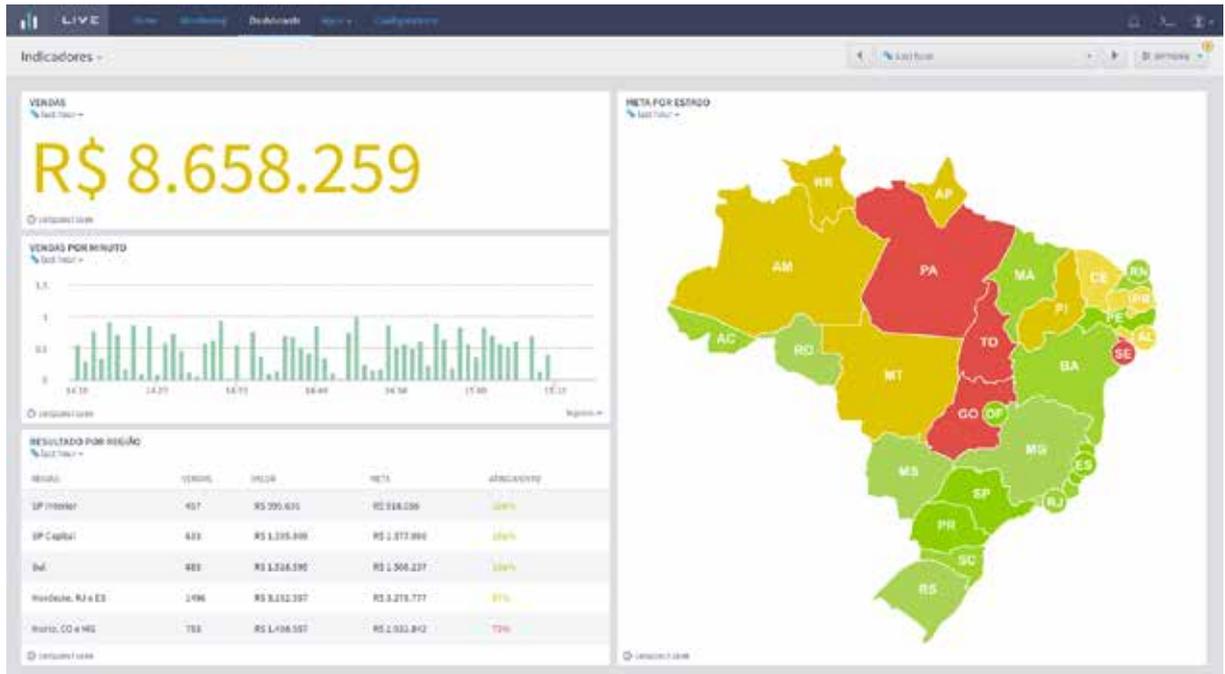


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**Ricardo Clemente**  
Founding partner and currently Director at Intelie’s operation in Houston/United States

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Since the amount of logs<sup>1</sup> produced in this company was gigantic, the technical staff needed to make searches and analyzes more easily with-in this sea of information. To solve this problem, Lognit emerged, with capacity to process more than three Terabytes of information per day, with a lower memory consumption than the competitors and within a controllable margin of error.

In parallel, the initial IEM solution evolved into a new version, Intelie Live, which also generates intelligence from data collected and processed by the Lognit tool.

The solution gained notoriety by helping to identify attacks and security issues in the on-line voting system of a famous Brazilian reality TV show.

With the success of the project and the efficiency of the solution, Intelie decided to publish an article on the case. Later, this article was cited by CERN, the European Organization for Nuclear Research, located in Meyrin, Geneva, highlighting Intelie's methodology and the architecture of the algorithm used as trends to be followed for the detection of unsupervised anomalies.

With the successful results for content sites, the Intelie team began to look for new niches to apply their solution. In e-commerce, a very dynamic operation, they started offering technology as a way to boost their business. "If we identify a large flow of people searching for the same product at the same location, the e-commerce manager can use this information to direct the on-line marketing actions of that product to the same location, increasing their visibility and sales, among several other intervention actions in the real-time operation, aimed at mitigating risks and / or maximizing opportunities", explains Ricardo.

<sup>1</sup> Logs are activity logs generated by computer programs.

Another important move, which became the third segment of Intelie's activity, was to seek financial companies, banks and insurance companies, which were then beginning to mobilize to increase their operations in the digital world. It was the moment when many e-commerce professionals migrated to the financial sector, and Intelie made its networking to also enter this nascent new market.

With the increase in the number of customers, Intelie naturally extended data analysis to other areas such as sales, marketing, logistics and finance.

### **Watershed**

After several works performed, Intelie took a decisive step towards its development as an information intelligence company, by accepting the challenge to construct for Petrobras an intelligent solution that gives meaning to the large volume of data produced by oil drills without, however, generating analysis or actions.

It was Petrobras itself that approached Intelie in 2012, as the tendency to apply machine learning and artificial intelligence in the world of oil and gas began to emerge.

The problem faced by the company was related to the development of models to define the weight of drilling fluid in salt and pre-salt regions. The physical models previously used in other types of wells did not work to size the weight of the fluid in the pre-salt wells. Intelie's proposal was to increase the portfolio of engineering problem solving techniques by adopting the Machine Learning approach as well as physical models.

The strategy worked, and the results were so positive that they were published at the OTC (Offshore Technology Conference) 2013, the industry's main technology congress.

The gains in efficiency in the planning process were so significant that, since then, Intelie has been working on Petrobras projects, intended for the development of solutions to complex oil engineering problems, using both physical modeling and Machine Learning and data integration, among the various subjects of drilling operation planning.

These initiatives were still taken without Intelie Live, since the solutions were focused on the planning phase, without the need for real time.

In 2015, projects involving real-time solutions actually began. First, the Petrobras' Research Center proposed the challenge, accepted by Intelie, of capturing and concentrating data from all probes and applying intelligence to improve operational performance and management. In other words, Petrobras wanted Intelie to make in the oil world what it had already been doing in other sectors.

"There was a clause in the contract that provided for a cutoff date for the solution to be working. Otherwise, we would lose the contract. We had four months to adapt our entire platform to capture data from probes sensors from nine different service companies (drillers). In these four months, we got to do five different probes. To get an idea, every one second<sup>2</sup>, 400 sensors in each probe send data", Hubert describes.

Petrobras works with several partners or suppliers of the drilling service, each of which has a contractual obligation to provide data on the drilling operation, such as pressure, depth, rotation.

The problem is that although there is a data integration standard in the oil and gas industry, each one provided the data with some variations and specification (unit of measure, frequency of update, treatment of outliers, for example), making the task of consolidating data availability for operation analysis complex, making it impossible to perform this analysis in real time.

In order to face these first difficulties, the team sought to understand the protocols and specifications of each service provider, creating a layer of data acquisition services that executes, in real time, several processes for

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<sup>2</sup> The production and analysis of large volumes of data offer new opportunities for understanding complex problems. The combination of data sources (e.g., through sensors) with increasing computational capacities and extremely powerful analytical models consists of a new field commonly known as Big data.

the treatment of this data available for analysis, improving the decision-making on the operation.

This was the first achievement, which allowed the use of the Intelie Live platform, internally called the RTO, to support decision-making in the drilling operation, in a much more timely and data-driven manner.

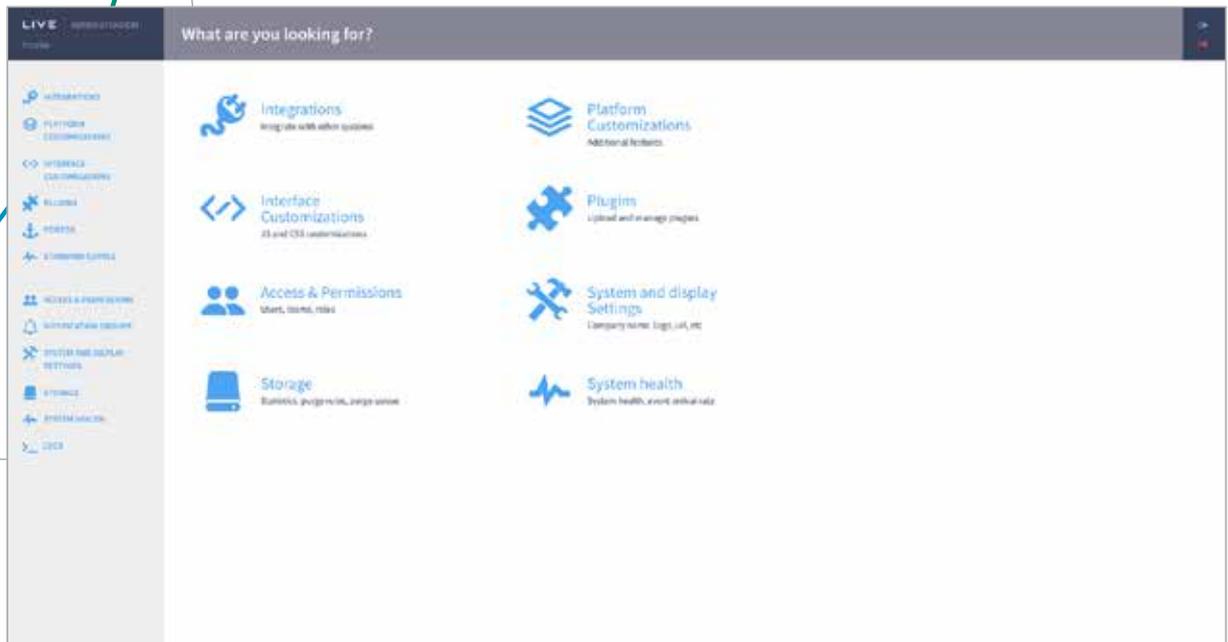
What Intelie brought about innovation was a flexible and extensible software platform. Flexible in the sense that the language used allows the client to create developments on it.

“It’s what we call ‘look how cool what I did’. It is what the client tells us when we visit him and he shows us some new report or quality control, created within the platform itself, through the use of our language and graphics library. It’s all very simple: he selects, drags with the mouse, inserts the logic he wants and generates the result, all with a lot of autonomy and in intuitive manner”, explains Ricardo.

According to Intelie, this flexibility, called the white box, is especially important in the oil and gas segment, where until then most of the solutions were closed – the so-called black boxes. Intelie has created an extensible platform in which the customer can develop and install a new algorithm. “Engineers, researchers and partners, such as universities, can create new analysis, streamlining the continuous evolution of the monitoring items of the operation”, concludes Hubert.

### How is the platform

In general, the Intelie Live Solution for Oil & Gas Companies is a flow analysis platform that helps companies turning data into results, and can act in the cloud or locally.



It can collect data from any source, from geology to BOP<sup>3</sup>, process this information in real time (filter, aggregate, correlate, enrich) and turn it into high-value, ready-to-use information.

Real-time data visualization, with an easy-to-use interface, gives the user the required insights to improve their operational intelligence. The system also provides continuous monitoring scenarios and predictive analytics capabilities that emit alerts with valuable information, to avoid problems and predict opportunities.

### The essence of business

Intelie has evolved a lot in its almost 10 years of existence. The company, which started as bootstrapping, now stands on its own revenue. In the beginning, in addition to seeking financial assistance through Finep's Prime, the partners decided to follow the rule they themselves called 50/50: while 50% of them worked to support the four of them, the other 50% worked on the product. The choice of each one's roles was very natural, since the partners have well defined profiles – the entrepreneur, the salesman, the nerd –, what complement each other. The jobs that helped to sustain the business were the most varied, from the creation of blogs to the development of any type of software.

The provision of services, as a way to contribute positively to the cash, is a practice that the company maintains to this day. What has changed are the now more complex and specialized types of services, that also serve to show value and open doors to sales of platform licenses.

The competitive essence of Intelie's business is to turn data into result. "The idea is to help companies think faster. By using data analysis, they can prevent failures and identify business opportunities, acquiring operational intelligence", says Clemente. For this, our team works in collaboration with the customer, to identify and understand the problem and then to solve it assertively.

This solution customization made the software project more flexible, to the extent that Intelie's actuation was diversifying to reach new segments.

### Success in the new market

The Intelie platform solved Petrobras' data governance and analytical challenges problems, enabling efficient consolidation of information from multiple service providers into a single point of access and automatic data logging, with consistent taxonomy assurance. Its flexibility and extensibility have also enabled the rapid development of customized solutions.

Petrobras, which started using the product in early 2016, recorded a saving of BRL 10 million, related to the replacement of software licensing by the Intelie's platform. This calculation does not include reducing the cost of drilling operations.



The idea is to help companies think faster. By using data analysis, they can prevent failures and identify business opportunities, acquiring operational intelligence.

**Ricardo Clemente**  
Founding partner  
and General  
manager of Intelie



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<sup>3</sup> BOP stands for Blowout Preventer, a special valve or mechanical device used to seal, control and monitor oil and gas wells, in order to prevent explosions.

**Finep's Prime** – First Innovative Company program – was launched in early 2009. It is intended to create favorable financial conditions so that a significant number of high value-added nascent companies can successfully consolidate the initial development phase of their enterprises.

Most of the nascent innovative enterprises present structural weaknesses and various development difficulties in their initial phase, because entrepreneurs and founders of companies deviate from the main focus of the business to dedicate themselves to parallel activities that guarantee their survival in the short term.

Prime supports the company in this critical phase of birth, enabling entrepreneurs to fully dedicate themselves to the development of original innovative products and processes and to the construction of a winning insertion strategy in the market.

Intelie's platform, in addition to helping develop the Libra wells – and saving 90% of the costs generated by the software previously used – allowed Petrobras:

- a. To ensure the delivery of data from service providers, in accordance with data standards;
- b. To monitor operational indicators, including predictions of some problems, allowing engineers and researchers to develop, with sufficient autonomy, evolutions and new monitoring and alerts dashboards;
- c. To enable integration with expert solutions; and
- d. Use Machine-Learning techniques along with classic Oil Engineering techniques to solve problems.

Petrobras' Chemical Engineer Roni Abensur Gandelman points out the advantages of integrating different specialized systems and the identification of real-time data transmission problems, such as wrong unit conversions as well as help in making the right and fast decisions. "Intelie software is very user-friendly, flexible and is a unique tool in the oil and gas industry," he summarizes.

In addition to the fact that the Intelie Live Solution for Oil & Gas Companies have become standard in Petrobras Decision Support Centers, the data is also delivered in real time to other complementary systems, which perform specific analysis of certain phenomenon to detect any problems.

One positive side effect was the emergence of business opportunities also with service providers – such as drilling companies, the so-called drillers. They also want to monitor their own operations – something Petrobras has been encouraging – since the procedure generates continuous improvement of the entire chain process.

### Recognition and future plans

Speaking of positive effects, throughout its trajectory, Intelie has conquered several important recognition for the consolidation of the business in addition to markets.

In 2011, the company participated in the Finep's Seed Forum, a strategic orientation program in which innovative companies, with high growth potential, undergo a six-week preparation with the team of investment specialists and partners and, at the end, present their value propositions to an audience of potential investors, such as investment funds, corporate investors and angel investors. Although the experience was important for the maturing of the team, the company opted to continue with equity.

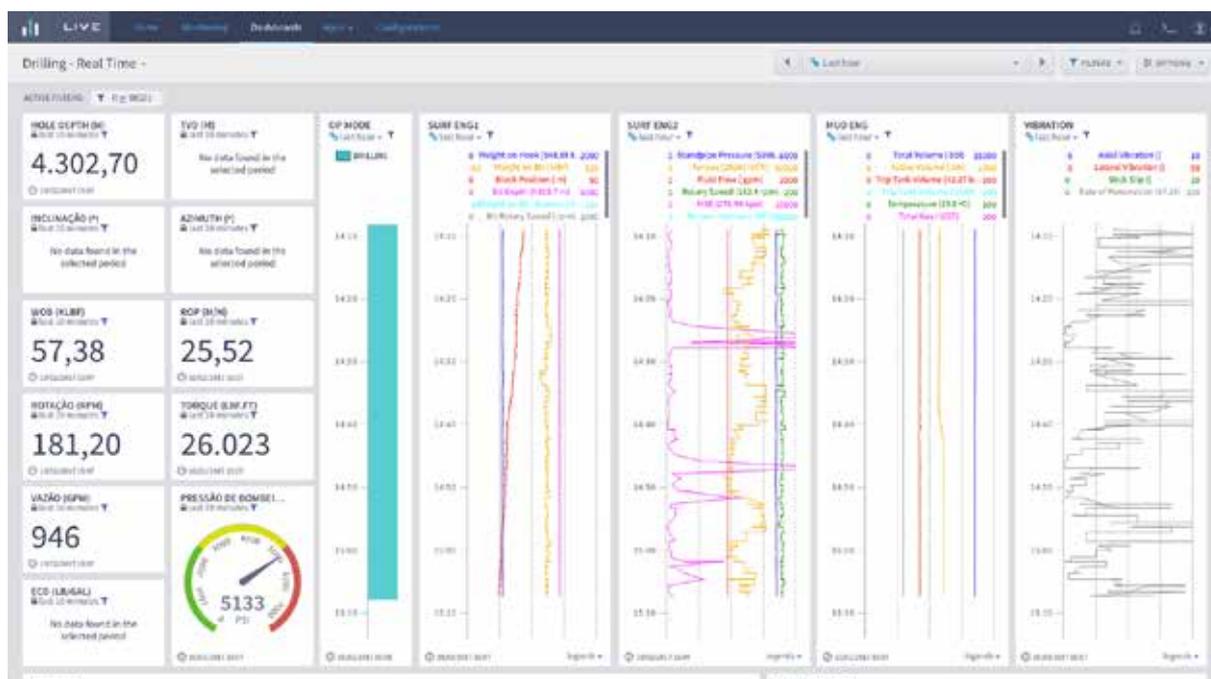
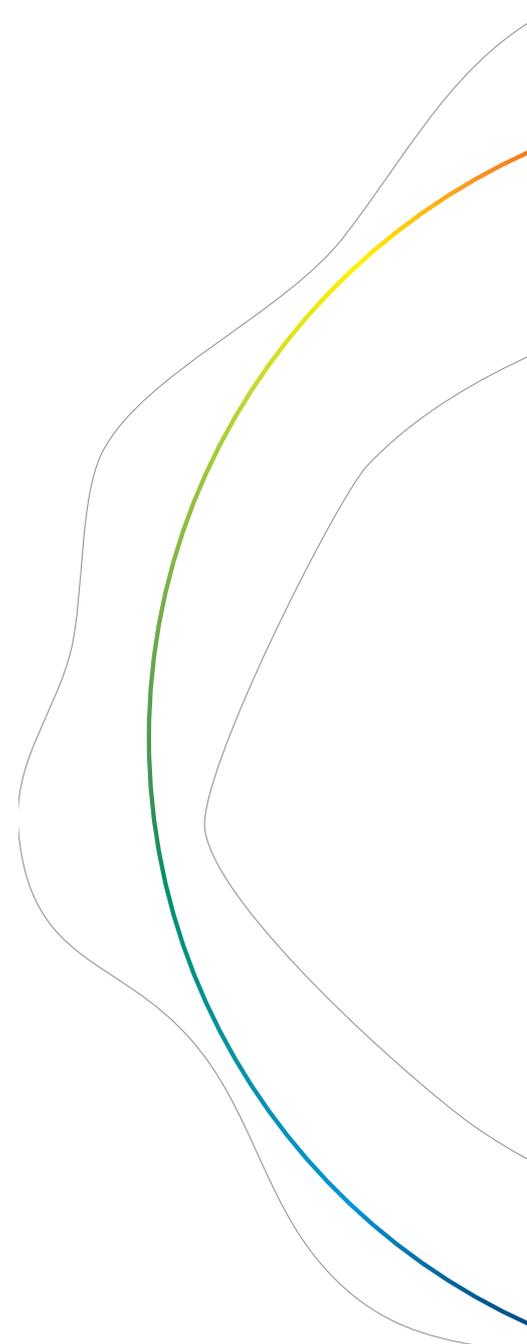
As early as 2013, Intelie participated in and won the Start It Up program, a startups contest conducted by TOTVS Venture. The mentor of the team during the competition, Lelio Souza Jr, a TOTVS executive, continued to support Intelie's young professionals over the years until, in 2016, he decided to invest in the company and became the fifth partner and CEO.

Graduated in Mechanical Engineering from the Federal University of Minas Gerais (UFMG), the executive, with experience at Accenture more than eight years ago, was at TOTVS, where he worked in the structuring of TOTVS Consulting and the Private unit, in addition to being the company's commercial director and service and relationship director. Lelio's executive profile complemented to that of the other partners and added both knowledge and networking, as well as greater credibility, to the business.

In 2015, Intelie was named Cool Vendor by Gartner, and signed up, with Endeavor's support, to participate in the MIT (Massachusetts Institute of Technology) G Lab Program, to which it was selected.

In this program, MIT sends graduates of its global MBA in entrepreneurship, to consult with startups from around the world, sharing the lessons learned in the course and assisting companies in their expansion processes. As part of this program, a company team is invited to attend a one-week entrepreneurship course at MIT before receiving the consultant delegation.

Companies participating in the program – approximately 20 per year – are carefully selected by an MIT team. During the process, the companies hosting students gain new insights and expertise in critical business areas, such as strategic growth, entry into new markets, pricing, marketing, benchmarks, fundraising, and financial strategies. In the case of Intelie, the program result was the preparation of a project to internationalize the company, in the oil and gas field.



International expansion then began in May 2016, when Intelie's office in Houston, Texas, opened. The location was a strategic choice recommended by MIT, because the American state concentrates countless giant companies and is considered the global center of the oil and gas sector.

Large international operators have already shown an interest in the product, and a global operator has already fired Intelie's services, which confirms the MIT recommendation. The company is very confident in its growth in the US market and, given the volume of leads, recently hired four Houston professionals to join the team.

### **Towards the dream of being a global company**

In this dynamic universe of the digital economy, Intelie has built its niche of action, based on the scientific skills of its core founders. It was in mathematics, information science, and computing that its partners and founders constructed approaches to a range of problems – and opportunities – that many companies have.

Intelie is proud to have started from scratch and succeeded in building a 100% national technology, with a team of young people that have graduated in the country and today compete, on an equal basis, with international competitors.



**DATA => RESULT**

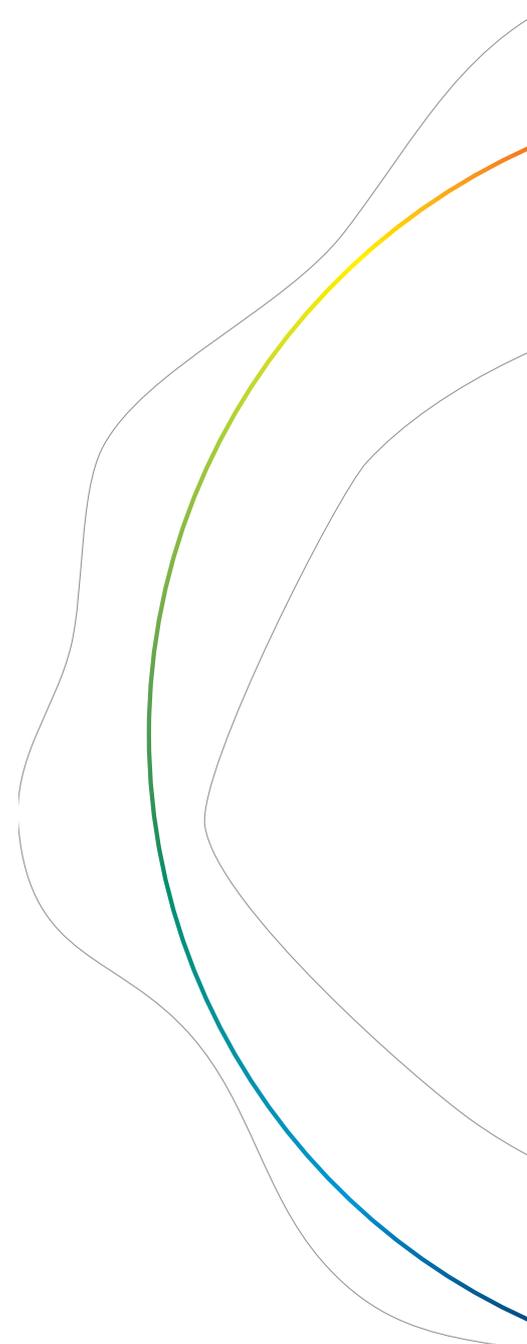
Transformamos dados em resultados  
por meio de tecnologia.

The company has had help, conquered by the competence and solidity of its business, from a number of important players in the domestic and global innovation ecosystem, notably MIT's G-Lab, Finep (an important subsidy line for the product development and improvement), Sebraetec (financing for patent), and the customers themselves, such as Petrobras, among other large companies. Now, Intelie is gearing up to launch itself in the international market and seek the accomplishment of the dream of being a global company.

In addition to projecting its global insertion in the oil and gas sector – with effective steps and already visible results – Intelie has technologies that enable a promising entry into the Industry 4.0 model.

The technologies that underpin the company's capabilities around Big Data, and the tools that enable its analysis can effectively contribute to various industrial and service sectors that are at the threshold of new industry standards.

It is interesting to note that the Brazilian innovation ecosystem already has the dynamism to promote the emergence of companies capable of playing important roles in the industrial model that should transform the production and consumption modes in Brazil and the rest of the world.







# LIVRE

Soluções em mobilidade



# INNOVATIVE KIT TURNS WHEELCHAIRS INTO MOTORIZED VEHICLES

- LIVRE
- São José dos Campos/SP
- Micro-sized enterprise
- 11 employees and 3 partners
- Product innovation
- MEI Agenda: Innovative SME

*Livre creates motorized kits, attachable to any wheelchair model, giving wheelchair users greater mobility autonomy*

## **Mobility = autonomy + freedom**

This is the equation that Livre, a startup of São José dos Campos/SP, proposed to put into practice, by creating a solution capable of increasing the freedom of people who depend on wheelchairs for their mobility.

KIT LIVRE – [Free Kit] an appropriate name, considering its purpose – is a motorized kit that can be attached to any model of manual wheelchair (regardless of brand, size or nationality), transforming it into an electric motorized tricycle, which significantly increases mobility, providing freedom and autonomy for the user.

Moving around on damaged sidewalks, going up and down slopes with ease, walking on sandy grounds and lawns, feeling much more active and interactive are unattainable situations in conventional wheelchairs, whether manual or motorized. KIT LIVRE's proposal is to allow the wheelchair user to perform all these movements safely, comfortably and – why not? – with fun.

Brazil has more than 4 million wheelchair users, and, every year, another 46 thousand people acquire some type of problem (resulting from spinal injuries, amputations and diseases), that reduce mobility and make them potential users of wheelchairs. When this unfortunately happens, people wonder how to rescue their freedom and self-esteem.

According to Júlio Oliveto, creator of KIT LIVRE and founding partner of the company, this is exactly the motivation for Livre's work: "To make wheelchair users the protagonist of their lives again".

The company offers several versions of KIT LIVRE, always aimed at outdoor use, including models specially adapted for extreme sports – some of the company's models have an average range of 25 kilometers, and can reach up to 40 km/h.

## **Family Entrepreneurship**

Sons and grandsons of entrepreneurs, twin brothers Júlio and Lúcio Oliveto, are the founding partners of Livre. Born in São José dos Campos, the brothers grew up watching the carrier company created by their grandfather, a former taxi driver, be successfully managed by their father.

Later on, they had the opportunity to accompany their father in a forklift rental business, the administration of which was delivered to the two when they came of age. According to the twins, "this practical training, resulting from learning from mistakes along the way, played an important role in the conception and conduct of the Livre".



KIT LIVRE's purpose is to make wheelchair users the protagonist of their lives again.

Júlio Oliveto  
Founding partner  
at Livre





At that time, the brothers, already graduated at high school level as industrial computer technicians, entered university. While Lucio chose the course of Administration, Julio went for Mechatronics Engineering. And it was exactly at the end of the engineering course that Julio's involvement with the universe of mobility solutions for people with disabilities began.

In his end of course paper – usually an exercise without technological challenges or practical application –, Julio chose to develop an equipment capable of climbing stairs autonomously: "But I did not want it to be a robot or something connected to the industry. That was when I decided to do a stair-climbing wheel chair", he says. Although today this is a relatively common device in public places, at the time (2007), was still little known in Brazil.

Even managing the family business, the brothers, at the end of college, proceeded to post-graduate studies. Lúcio in Logistics and then Financial Controller, and Júlio, a master's degree in Mechanical Engineering, at Unesp. KIT LIVRE was born as a result of this project. Contrary to what may be supposed at first, the motivation to continue working with wheelchairs met his personal desire to contribute to society – Júlio is not a wheelchair user, and does not have any friends or family members who are.

It took three years of dedication to the masters and to the forklift business, and many sleepless nights, until the first prototype of the motorized kit was ready, in 2011. Thanks to the good results of the project, teachers suggested that this would be a product with strong marketing opportunities.



According to Júlio, the idea took him by surprise. “When I entered the master’s degree, it was not the business vision, but the technological vision to develop a product that interested me and challenged me. Once the product was ready, I understood that it could be a business for which there was a market”, says Júlio.

The next step was to file a patent with INPI, in 2012, through the Unesp Agency for Innovation – Livre has a 33% stake in the patent and a licensing agreement, which guarantees manufacturing exclusivity.

After the patent application, the search began for companies interested in licensing the product, through participation in fairs in the sector. Although this type of approach was initially ineffective – since no company was interested in it – the new product attracted the attention of the target audience in a very positive way.

### **Persistence is the soul of the business**

Júlio admits that “in the beginning, I took it more to the emotional side than to the business side; I cared more about the social appeal and could not get any company interested because it did not show the potential market. Not even my brother believed in the business”.

With this insight, a new presentation model was structured and, in 2013, the twins began attending entrepreneurship events. The first was the I2P – Idea to Product, held at the Federal University of Juiz de Fora – UFJF.

During the three-day event, in which the project reached the final stage, came the confirmation that the motorized kit really had potential, but that it was necessary to structure a good business model.

The next contest, already with a business model at hand, was the Santander Entrepreneurship Award 2013, in which the project was among the 15 finalists (out of a total of 16,000 subscribers), but did not get the award. The frustration with the result, coupled with his brother's disbelief, encouraged Júlio to attend several other contests in 2014. "I wanted to prove to Lúcio that it was worth it", he says.

Success came with persistence. At the same Santander Entrepreneurship Award, held the following year, (2014), KIT LIVRE ranked as one of the four winners. In addition to the prize – a contribution of BRL 100 thousand – Julio won his brother as a partner and together they founded Livre.

Much of the amount received was invested in the production of the first batch of 10 kits – up to that point they only had three prototypes, two of which were sold to customers in São Paulo and Rio de Janeiro. The rest of the money was used to participate in Reatech – International Fair for Rehabilitation, Inclusion and Accessibility Technologies, in April 2015, in São Paulo.

Livre took all kits to the fair and made them available for test drives, which drew the attention of the 50,000+ visitors from all over Brazil. The strategy proved to be efficient: they were able to identify business partners in several states and, with the feedback received from the people who tested the equipment, made adjustments and improvements in the product, which includes its great differential: the possibility of customization.

### Marketing and customization as business strengths

Livre's main purpose is to find solutions that allow the disabled person to improve their self-esteem and be seen in a new and more positive way by society. It is a business with social impact, that reaches a very specific niche, and that is why it is necessary to meet the client. Thus, the company understands that is the relationship with the consumer, both pre-and post-sale, is fundamental. According to Júlio, social media (Facebook





and Instagram) have proven to be the strongest and most impacted channels to reach their target audience.

Another interesting strategy to attract clients and give credibility to Livre's product is the use of ambassadors: athletes and public figures, wheelchair users, including Paralympic athletes who were part of the Brazilian team in Rio 2016 Games and adapted surfers. These are people who use the KIT LIVRE and stand out among the company's target audience.

A third important aspect of marketing strategy concerns Livre Drives, events where the company invites wheelchair users to meet and test their equipment. Livre also participates in all events related to accessibility, always focused on getting closer to the public, consolidating its network of relationships and increasing the visibility of its solution.

But marketing can only work on a product recognized by its audience. In order to earn it and retain it, the kit needs to be adapted to the specific needs of each customer – each wheelchair user has their own biotype and there are different types of deficiencies.

Early in the development of the product, the team identified that it was necessary to ensure the universality of the application, that is, the kits should be adaptable to all users and to any wheelchair model. Thus, customization became a strength and an important competitive differential, which turned Livre into a "mobility solutions" provider, with customized service for each customer.

Nowadays the company is able to serve from people with reduced mobility and with tetraplegia (without the hands movements), to people with motor deficiencies, due to vascular accident or other type of cerebral alteration that compromises the movements of limbs.

Within this universe of reasons that lead to the necessity of the wheelchair, each person has their peculiarities. As Lúcio says, “even if we compare two individuals who suffered the same injury, one of them may have more strength in the right hand and the other one in the left, or the opening of the arms may be different, for example”.

With that in mind, the whole kit was designed, so that it could be adapted to each customer. The equipment has two brakes on the base model, one on each handle.

If the person has injury on one side, it is possible to put a double brake on the other. The handles can also be adapted: they are smaller for those with reduced mobility in the hands. There are also versions for people who do not have mobility in the arms and who can drive the equipment with the feet, kits with brakes in the feet and accelerators in the hands. The possibilities are virtually endless.

The equipment is split: it has a front part, where the controls and the motorization are found, and a second part, the universal support, installed in the chair. This support has telescopic adjustment, which allows adjustments of width and depth, and its installation is made by means of two support points in the wheelchair. The Kit attaches at a point in front of the support.

All the equipment is produced in a modular way, and this is how it is possible to attend any type of chair – 80% of the equipment is standard and the remaining 20% correspond to adaptations unique to each user. An important characteristic of the customization is the possibility of variation in the power and the autonomy of the battery that feeds the equipment.

For the manufacture of the kits, Livre outsources the machining of metal parts and carries out the adaptation and assembly projects at its own factory in São José dos Campos / SP.

Since the secret of customization lies in the modularity of the kits, this is precisely the aspect contemplated in a second patent – this one held by Livre –, submitted to the Patent Cooperation Treaty, which is currently under evaluation, so that the company later determines which countries it will be filed with.



Customization has become a strength and an important differential for the business. It is Kit Livre that adapts itself to the user, not the users who adapts themselves to Kit Livre.

Júlio Oliveto  
Founding partner  
at Livre



## Sales success

KIT LIVRE has been on the market since July 2015. Between June of that year and December 2016, 300 kits were sold in 22 Brazilian states, plus the Federal District, in addition to occasional sales in the USA, Australia, Germany and Argentina. Today, from the total sales made, 90% are direct, through internal sellers, and 10% through commercial partnerships, which include wheelchair manufacturers, orthopedic product sellers and retail sites (e-commerce Casas Bahia, Ponto Frio and Extra).

In addition to manufacturing the Kits (the front part that attaches to the chair), Livre supplies special sports wheels for the chairs, – which improve damping, reduce impact and provide greater stability and comfort to the user – as well as resells exclusive accessories with its brand, such as handles and differentiated lanterns.

Since the kits are highly customizable, there is no stock of finished products, since all production is made to order only.

With an internal team of eleven people, in addition to the partners (Production Engineer Eduardo Matsumoto joined the brothers Júlio and Lúcio in the corporation, in 2016), Livre has today the capacity to produce 20 to 25 kits per month, with the manufacture of each kit taking an average of 15 hours. Livre also offers customized technical assistance: customers send the product through the Post Office, maintenance is carried out inside the company and the product goes back to its owner, also by the Post Office.

Focusing on classes B, C and D, Livre kits currently cost BRL 5 thousand to BRL 12 thousand. The price range is due to variations in power and battery life of the different models sold. Just for comparison, since the purposes are very distinct, a traditional motorized wheelchair costs around BRL 7.5 thousand.

Wheelchairs, provided by SUS, cost on average BRL 1 thousand – BRL 1.5 thousand; for chairs with more reinforced structures (monoblock type), prices range from BRL 3.5 thousand to BRL 5 thousand in national models, and may reach BRL 12 thousand in imported models.

In addition to financial results, which indicate market acceptance, the project has been recognized through several awards. In 2015, Livre was one of the winners of the Fiesp's 7<sup>th</sup> Startup Acceleration Contest, in addition to also winning the FedEx Contest for Small Businesses.

In the following year, the company was one of those awarded with mentoring from Endeavor – through Braskem Labs – also being a finalist at the 100 Open Startups Brasil, at the Sustainable Brands Innovation Open 2016 – an event promoted by Report Sustainability and by ProjectHub, which integrates the Sustainable Brands Rio 2016 program, bringing together companies and leaders interested in transforming business by using sustainability. Livre was also a finalist in the 2016 Creative Business Cup global competition held in Copenhagen.

In the same year, the company won the Brazilian stage of The Venture, a startups competition, held by Chivas Regal, with mission is to discover and help potential social businesses. Thanks to the prize, Livre will represent Brazil at the global stage of the event in July 2017 in Los Angeles, United States, in which it will compete for a fund of USD 750 thousand.

### **A noble purpose turning into a successful business**

With so many positive results, the focus now is on the future, and Livre's entire planning focuses on expanding business. After a period of investing its own resources and obtaining return through the sale of the kits, the company got, at the end of 2016, an angel investment, through a Social Impact Investment Fund. In addition to the capital contribution – which will be applied in marketing, team qualification, purchase of inputs and components, cash flow and R&D – this contribution has helped the company in its internal structuring process and in the definition of longer term strategic planning.

Since the second half of 2016, Livre has been carrying out, with the assistance of Sebrae and SENAI, the mapping of its processes for the implementation of an ERP, that allows to optimize production control, optimizing manufacturing time, inventory and costs. The post-sales system is also being restructured so that it is better defined, focusing on customer loyalty.

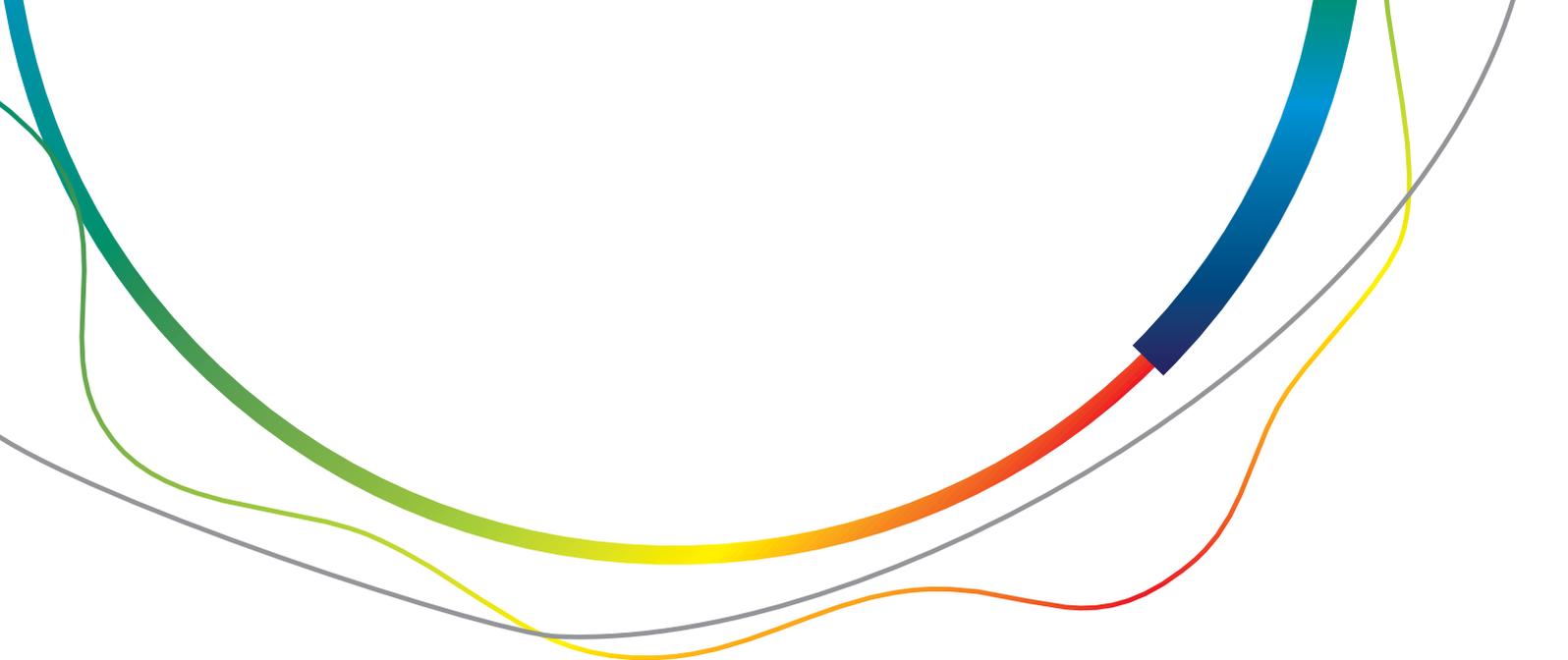
Also in the plans is the creation of Livre's first physical store, which will host both the sale and after-sales of the products – that will serve as a pilot to define the growth model, either through the creation of other stores in other states, or through franchises.

The expansion also aims for the foreign market. For this purpose, Livre participates in ICV Global (a partnership between FGV and Apex Brasil), with the aim of structuring the company for export and internationalization still in 2017, supported by the filing of the patent via PCT.

The patent encompasses all the equipment that compose the kit and is the exclusive property of Livre. The application is under prior analysis, to define in which countries it will be filed with. The idea is to prioritize South American countries and the US, where the company has a partner that has been conducting a market survey among healthcare plans, aiming to serve war veterans.

Julio is categorical about the importance of the patent as determinant in the success of the business: "We understand that, beyond the protection of intellectual property, it is fundamental for the business to seek the strengthening of the brand and to work on its main differential, which is the customization of the equipment". After all, customer satisfaction is what drives Livre.





The fact that each kit is unique brings buyers closer to the Livre team, who have endless inspiring stories to tell. Júlio's and the company's experience shows that the equipment changes not only the lives of those who use the kit, but of all other people who live with the disabled.

A good example is the case of a father who gifted his daughter, who suffers from paralysis, describing the emotion he felt when she went out alone to visit a friend. "He told us it was late afternoon. She attached the kit to the chair, lit the flashlight, and left with the light flashing. He accompanied her with his eyes until the light disappeared and became emotional, because he could never imagine living a moment like that", says Júlio. Another customer defined very well what the kit represents for him: "I could not walk, now I can run!"

The greater autonomy and the change of life perspective positively affect the self-esteem of all the users. Testimonials such as these represent an added incentive to work, and the pride in bringing so many transformations into people's lives drives Livre to dream higher and higher. The biggest dream? To become a world reference in assistive technology. Does anyone doubt these boys?



## Announcing Industry 4.0

One of MEI's agendas concerns industry 4.0, considered vital for Brazil: to be able to manufacture completely differentiated products, for different audiences, on bases that are now handcrafted.

That is the question that Americans and Europeans are answering today, through advanced manufacturing, used for production that combines large scale with extreme differentiation. Livre's case therefore announces well beyond the nobility of the product itself, a very interesting challenge that all of us Brazilians will have to reflect on – especially the Brazilian industry.





L'ORÉAL  
BRASIL

## SUNSCREEN DEVELOPED FOR THE BRAZILIAN SKIN

- L'ORÉAL
- Rio de Janeiro/RJ
- Large-sized enterprise
- 2700 Employees
- Product innovation
- MEI Agenda: Regulatory framework

*L'Oréal R&D Center in Brazil develops high SPF sunscreen, which has in its formula a raw material developed by NASA*

### Alliance between protection and comfort

Vinícius de Moraes, in his *Receita de Mulher*, already said: "(...) the skin must be fresh on the hands, arms, back and face". The poet's recipe has everything to do with the attributes of fresh skin sensation all day long and high protection against the harmful effects of the sun, brought by Anthelios Airlicium SPF 70, product of the La Roche Posay brand, developed by L'Oréal's researchers team at its R&D Center in Rio de Janeiro – the company's only in Latin America.

According to statistics data from the Skin Cancer Prevention Campaigns, promoted by the Brazilian Society of Dermatology, about 9% of our population are affected by some type of skin pre-cancer or cancer, with the most important cause for its development being exposure to ultraviolet rays, emitted by the sun, which also contributes to skin aging.

In order to meet these two consumer concerns – aesthetics and health – L'Oréal launched Airlicium with SPF 70. In terms of health, its high SPF protects the skin from the sun's effects against aging and against the onset of skin cancer.

In terms of aesthetics and well-being, two aspects are important: the first concerns the presence of Airlicium, a raw material that has the incredible ability to absorb 10 times its weight in sebum – that is, no glossy skin. The second is that the product was released in both tinted and colorless versions. Although both offer the same protection, the tinted version has the advantage of hiding the imperfections of the skin – vain people appreciate it.



### Innovation with local look

The product development, started in 2012, was based on the Brazil's particularities, with insights that came from consumers themselves and dermatologists, as well as the company's innovation and marketing team.

Surveys conducted by L'Oréal (U&A Skincare 2014) has shown that one of the biggest concerns – especially for women – is premature aging, even more than skin cancer. Therefore, wearing sunscreen daily on the face to prevent wrinkles is a common habit for Brazilian women, which contributes to the country occupying the second place in the world ranking of consumption of photoprotection products.

The discomfort with the oiliness is almost unanimous. Our high temperatures and the humidity of the air increase the sebum production and the sweat secretion, causing excessive brightness, increase of the pores and sensation of dirty skin.

In fact, Brazilian skin is oilier than some from other countries, to the point that 74% of women admit to having oily skin in summer and 47% in winter (QT Beauty Strategies, 2016), even if dermatological studies show that only 50% effectively have this characteristic.

But it is the perception that counts for L'Oréal and for its strategy of meeting the demands of the market: "The female consumer wants a product that protects her skin and, at the same time, keeps her skin clean throughout the day. She does not want that sticky skin feeling", explains Marina Espósito, the researcher behind the project.

The issue of perception was confirmed in conversations with dermatologists. "We heard that our products were not very adapted to the Brazilian reality, and there were better options for oily skin in the country," says Marina. The opinion of specialist doctors is extremely important for L'Oréal.

Two of its most representative brands in the country, Vichy and La Roche Posay, have pharmacies as sales channels, and Brazilians consult a dermatologist twice a year, on average. That is, if the consumer listens to the dermatologist, we must also listen to them.

Another important aspect of the Brazilian reality is the high index of ultraviolet rays – the famous UV – that affect the Brazilian territory. In Rio de Janeiro, the average UV rate in summer is 12, while in Paris the index is 7, in the same season.

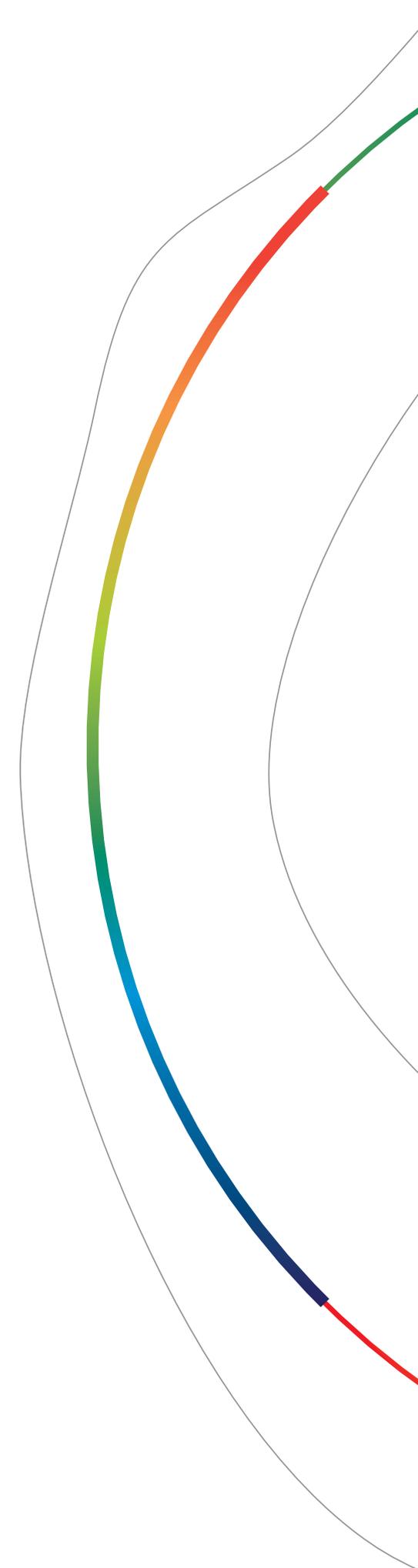
As these rays are the main cause of skin cancer, Brazilians really need to use sunscreen daily. This concern has been popularized with awareness campaigns over the years, so that today the search for protection factors above 50 has been growing.

To ensure that protection is effective, the product must be applied correctly, and this is greatly influenced by how easily it can be applied. This information was absorbed by the development team as a requirement for the product consistency, which should allow a simple and pleasant application without leaving the skin oily.

The conclusion of the project team is simple to summarize, even if difficult to achieve: to please the Brazilian consumer, it would be necessary to innovate, combining high protection and dry texture.

It was then necessary to create a product with a high sun protection factor (e.g., SPF 70), which combined rapid drying, gloss and oiliness control throughout the day, matte effect (effect of leaving the skin completely dull) and the feeling of clean skin. Quite a technological challenge!

This is because formulas with high SPF are oily, and raw materials that give dry touch are usually post-added to the formulas, which ultimately destabilize them. As if this challenge were not enough, the L'Oréal team decided to add another one: to include in its formula a new raw material: Airlicium.



### But what is Airlicium after all?

Originally developed by NASA to capture interstellar dust, Airlicium is the raw material that gives L'Oréal's innovative product what the company called "clean touch".

Chemically speaking, Airlicium belongs to the family of gel silicas (the same kind of material that fills those sachets that come inside coats and bags to keep them from absorbing moisture), but has unique and very different properties from classical silica. Although the material had already been studied at L'Oréal globally since 2011, the use of the product in cosmetics had not yet been applied.



What then led the team to choose the product? The researchers relied on three main attributes. The main characteristic was Airlicium's very high porosity, which makes it extremely light and gives it the ability to absorb 10 times its weight in oil, a property that applies to the sebum produced by the skin throughout the day. In second comes its high hydrophobicity, which is the ability to repel water, important for the product to accelerate the moisture evaporation from the skin, preventing sweat from remaining on the face.

Airlicium's third key characteristic is the small size of its particles, which thus generate an optical effect through the reflection of light – which in the cosmetic environment is called the matte effect, an opaque, dull finish that pleases a lot the Brazilian women. In the tinted version, the effect is even more accentuated, and the product covers the imperfections of the skin, as if it were a makeup.

This means that Airlicium is the key for the sunscreen, which bears its name, to meet all consumer requirements: oiliness control, dry touch and light and clean skin feeling, all day long.

Anthelios Airlicium SPF 70 is also the first La Roche Posay sunscreen that has a fragrance. Consumer surveys have shown that, unlike what is seen in other parts of the world, fragrance is important at the time of purchase decision in Brazil, because it is closely associated with the perception of cleanliness.

### Innovation in Brazil for Brazilians

A very important point of the innovation project developed by the L'Oréal team, in the R&D center implanted in the country, is its focus on the Brazilian consumer.

L'Oréal's Brazilian R&D Center, the works of which began in 2008, with five researchers, now counts on a team of 117 people, working on several fronts.



At first, the focus was on products for hair treatment, which has always been the priority for Brazil, one of the largest markets for this type of product in the world. However, over time, new research fronts have been added on skin protection, hygiene (focused on deodorants), and advanced research. Thus, a multidisciplinary research structure was built.

### Why Brazil?

Because of diversity of ethnicities and miscegenation. "L'Oréal has a classification of hair types ranging from 1 to 8, depending on the curling degree of the hair. And in Brazil all eight types are found – the Country is one of the few countries where you can find from the smoothest hair to the curliest hair.

This obviously has repercussions on different uses, a diversity of routines that have to do with this diversity of hair", explains Cristina Garcia, scientific director at L'Oréal Brazil.

Likewise, there is a very large variation of skin types in the country. "Today Brazil represents, from its population biological point of view, as well as the behavioral profile, a very great wealth, so that we can work, inspire and respond to these characteristics".

A product developed, for example, in Brazil may be a product that will also solve a problem of South Asian women, or a woman in the United States. So, it has a very great wealth, a potential for innovation, not only for Brazil itself, which is already a very large market, but also for the world", Cristina adds.

The association of the biological and behavioral profile was very clear in the Airlicium project, the first great success of L'Oréal's Brazilian research and innovation team. According to Marina, this success was the result of the existence of a research and innovation center in Brazil. "It came from consumer research, for Brazilians' skin characterization, by the innovation team, which identified the real need of dermatologists and the consumers".

### Strategic Research and Innovation

The Brazilian R&D Center is one of six research and innovation hubs created by L'Oréal in the world – the only one in Latin America. This type of work model is part of the company's new global strategy, to decentralize its Research and Development area, seeking to meet the needs and profiles of local consumers. "We went from a model where there was a product or a formula that met a global consumer's need for a more specific focus, for a particular local need," explains Cristina Garcia.

Already well known worldwide as a major innovator in the cosmetics sector, with an important budget in research, development and innovation, L'Oréal seeks, with this new strategy, to ensure that the philosophy of innovation is present in the organization around the world.



Today Brazil represents, from its population biological point of view, as well as the behavioral profile, a very great wealth, so that we can work, inspire and respond to these characteristics.

**Cristina Garcia**  
Scientific director  
at L'Oréal Brasil





Thus, R&D activities, previously centralized in France and with strong performance in the United States and Japan, were spread across other regions of the world – Brazil, China and India – considered representative of a certain consumer behavior, relevant to research and innovation.

This way, L'Oréal's R&D has become a multi-polar organization, responsible not only for identifying needs locally and for developing products for these needs, but also for promoting communication between its centers, creating a network of research and innovation. L'Oréal thus fulfills the objective of fostering new initiatives and technologies that can be tested not only in one locality, but also in other populations.

At L'Oréal, research and innovation work through two mechanisms: push and pull. The first, push, is the search for technologies that can be used to meet the specific needs of consumers. The second, pull, seeks to detect and predict new insights, new consumer needs, to inspire disruptive innovations.

The division of research areas follows this approach. There are applied research areas, defined by product categories (skin protection, makeup, hygiene, hair); development areas (also defined by product categories); in addition to the Advanced Research area, which studies topics such as the synthesis of the main active ingredients with the potential to compose or transform into some product, by increasing the knowledge about the world's skin and hair.

These are more exploratory, riskier and longer-term projects, often carried out in partnership with universities.

In general, the path of L'Oréal's great innovations starts in Advanced Research, goes through applied research, until finally reaches a viable product.



This is admittedly a long road, but with highly promising results. This is the case of Anthelios Airlicium FPS70, which began in the advanced research, the raw material of which was studied to identify potential applications, going through applied research and finally reaching the development area, where the product was developed and tested, to be launched in the market, and become the basis of innovation, represented by the Anthelios Airlicium FPS70. The total product development period was approximately four years.

### Being where the consumer is

Regardless of the time it takes to develop, no innovation is successful if it is not well accepted by the consumer. That is why being where the consumer is has become the L'Oréal's *modus operandi*. "Our industry, the cosmetic market, deals with dreams, with aspirations. We need to be sure to capture those needs well; we need to have the sensitivity, not only to detect something purely technical, but also to know what the consumer expects from a sensory point of view", Marina explains.

Therefore, although most of the guidelines for innovation come from the connection with the company's business department, there is a very relevant area within L'Oréal's R&D, which seeks to understand the needs of the consumer in each location. Designated by the acronym CMI (Consumer & Market Insights), the area has a team whose mission is to prospect new innovation opportunities, focused on the consumer and their needs, identifying the differential they are looking for and bringing this knowledge to development teams, so that they can work on secure bases.

This is how the research and innovation structure in the country today remains extremely sensitive to all market signals, not only in Brazil, but also globally, thanks to the well-established connection between the various hubs. "A trend that happens in China gets here quickly; something that happens here can reach the United States – this interconnection is very important to us", Marina explains.

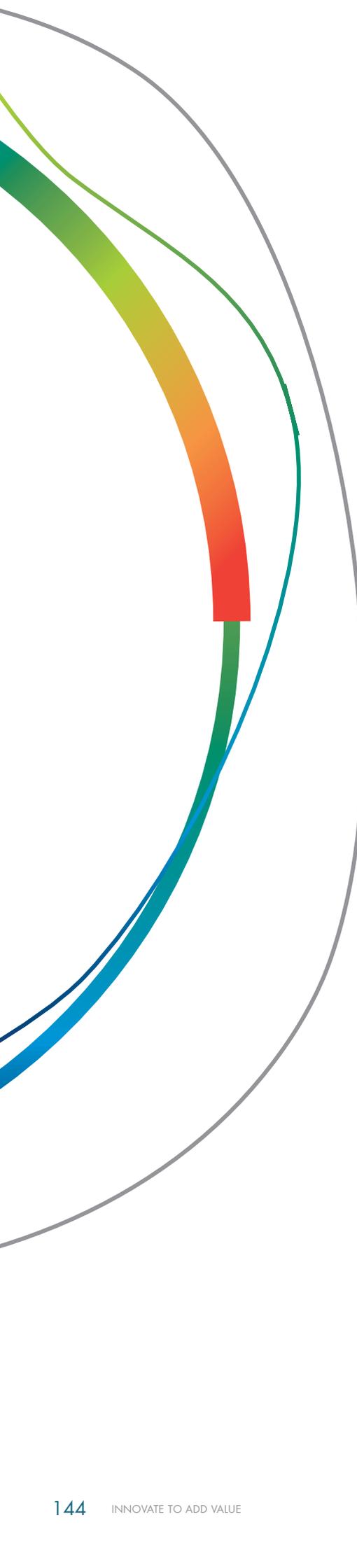
In summary, there needs to be a strong interaction between capturing consumer insights, formulating and evaluating the product. This process is fundamental, so that one can be sure that the product will be developed from a need, and the new formulation will effectively meet this consumer's need. "If all three areas are really well coordinated and actually complete a project, that's the guarantee that we have a winning product", concludes Cristina Garcia.



Our industry, the cosmetic market, deals with dreams, with aspirations. We need to be sure to capture those needs well; we need to have the sensitivity, not only to detect something purely technical, but also to know what the consumer expects from a sensory point of view.

**Marina Espósito**  
Researcher behind  
the project





## Consumers satisfied: proven success

Anthelios Airlicium FPS70 is a good example of this. The development process, which began in 2011 with research with Airlicium in the Advanced Research department in France, was brought to Brazil in 2013, when the local team identified its suitability for the Brazilian market for clean touch products.

It took one year to develop a formula with good stability, plus one year to carry out all the required physical, chemical and biological tests and almost another year to scale up, i.e., take the product from the laboratory to the production industrial scale. Several challenges were overcome until the market launch, in September 2015.

Soon after the launch, the products reached a share of 2.3% of the dermocosmetics market. One year later, the share increased to 5.2% in the color version and 3.4% in the colorless version.

According to data from IMS-PMB, which outlines the complete commercial statistical profile of pharmaceutical products in Brazil, in the last quarter of 2016 the tinted version became the best-selling protector (in number of units and in value) in the solar-dermocosmetics market and the best-selling overall dermocosmetics product (which considers all skin care products – not just sunscreens).

Also, according to the same study, the tinted version also became the most-recommended sunscreen by dermatologists, with both products accounting for more than half (53%) of the growth of the dermocosmetics market in 2016.

However, more than market data, the best thermometer and the best proof of the product and its development project success are the use test results with the consumers. In the tinted version:

- 80% of them stated that the product controls the oiliness of the skin
- 91% perceived attenuation of skin imperfections
- 91% evidenced the clean and fresh skin feeling

In the colorless version:

- 86% felt the skin less oily, day after day
- 91% stated that the product resists perspiration
- 91% said the product fragrance is pleasant



## National pride

For the L'Oréal Brasil team, the success of the Anthelios Airlicium FPS70 has an even more special flavor, since it helped to legitimize the research center before the matrix.

Anthelios is the first L'Oréal sunscreen for the specific need for high protection (SPF 70) and oily skin, the first high-protection sunscreen to use Airlicium. The technological challenges faced during its development contributed to the team being recognized worldwide by L'Oréal. "We are increasingly taking on the title of innovators", Cristina says, proudly.

Proof of this is that a new research and innovation center is being built at Ilha do Fundão, near the Technological Park of the Federal University of Rio de Janeiro – UFRJ. The center will regroup the entire staff of 117 people and will be a workplace quite appropriate for the research and innovation activities. The highly functional, modern and sustainable building will be opened in 2017. "It will certainly be a great moment in the company structure and a showcase for L'Oréal Brasil to show everything it does in the country in terms of innovation", celebrates Marina.

## Innovate for Brazil and inspire the world

Another important indicator, which proves the competence of L'Oréal's Brazilian team in innovation, is the filing of several patents, made in Brazil, in 2016. In the specific case of Airlicium, in addition to the exclusive agreement with the supplier for use in cosmetics, the company holds 20 patents related to the raw material and its products.

By establishing an innovation center, L'Oréal's focus is to innovate for Brazil and to inspire the world. The company intends to work with local ecosystems, such as universities, STIs and suppliers, to generate great innovations of global potential, but which are acknowledged to be Brazilian, and nourish the innovation cycle, strengthening the entire chain and fostering the development of the country.



MAHLE

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**MAHLE**

# FUEL FILTER DEVELOPED IN BRAZIL IS A WORLDWIDE INNOVATION

- 
- MAHLE
  - Mogi-Guaçu/SP
  - Large-sized enterprise
  - 7,800 Employees
  - Product innovation
  - MEI Agenda: Regulatory Regulatory framework – Law of Goodness (Lei do Bem)

*New product, developed and launched by MAHLE do Brasil, separates water from diesel with greater efficiency, during its lifespan, presenting economic and environmental advantages*

The separation of water from diesel is a critical requirement for modern commercial vehicle engines. The presence of water can cause premature wear and corrosion of the fuel injection system components, in addition to providing microbiological growth, causing obstruction in the filters.

To ensure this separation efficiently, MAHLE has created “Blindagua” – a high-performance filter that water from diesel three times more, compared to its competitors, ensuring greater protection of the fuel injection system components and other filters, required for the operation of the engine.

Developed at the Research Center in Brazil, “Blindagua” is the first water separator, mounted on the MAHLE chassis, worldwide. The Brazilian innovation of the German company, with global performance, incorporates technological performance differentials, highly valued by truckers, fleet owners, mechanics, distributors and dealers.

## **Strategy, systemic vision and technology**

These were the three foundations that, in an integrated manner, led MAHLE to develop a dual-stage water separator filter. The initial motivation of the project came from the global planning, which identified in its strategic map the need for strengthening and greater participation of the brand in the commercial vehicle market. Therefore, all the Research Centers of the company in the world, including Brazil, were asked to dedicate themselves to projects capable of generating solutions for this segment.

The option to work in the segment of water separation was based on the biofuel theme: the trend towards more intensive use of biofuels was identified globally, making possible the development of new technologies linked to the subject. Based on this vision, in 2008 MAHLE defined an initial team of three people for the study of biodiesel and diesel – and their impact on the water separation function.

During the initial four years (2008-2012), the team visualized the contour conditions of the system in which the product was to be developed, to truly meet the needs of all customers – direct and indirect.

For this, the work was divided into three main fronts: a) basic fundamentals research, comparing the actual field conditions to the laboratory, the biodiesel/diesel ratio and its effect on the water separation function, together with the reading of scientific publications on the theme; b) product study, mapping existing solutions in the market and their performance in actual field and laboratory conditions, including verification of published patents on the subject, looking for where there was still room for new concepts; and c) consultations with direct and indirect

customers, to understand the needs of all those involved in the commercialization and use of filters.

As a result, it was possible to identify the main problems faced by the customer in the use of the product – which would lead him to change brand – and which contour conditions were changing.

In this case, the higher biodiesel content requires a piece with greater efficiency of water separation from diesel. There then needed to be verified which opportunities the team would have to launch a new product that really represented an innovation.

In this research context, the project team interacted with research institutes and universities, with the purpose of obtaining technological partnerships and accelerating studies. The Federal University of Itajubá – Unifei – served as a partner to measure the water droplet size in diesel, with high-speed camera. Thanks to this study, it became possible to understand that the standard for laboratory testing recommended a milder condition than that which actually existed in the field. The INT (National Institute of Technology), in Rio de Janeiro, served as a partner to understand the effects of increasing percentage of biodiesel in diesel and microbiological growth in fuels. In this way, it was possible to understand that biodiesel really had contour changes in the application of the filters, and new concepts had to be developed.

### **Customer contributes to achieving innovation**

In 2012, with the completion of the contour conditions analysis stage, the development process of the product actually began. In this ideation stage, several concepts were generated, and the prototypes production was also developed, being tested and validated with direct and indirect customers.

This interaction brought important insights throughout the development and validated the approaches proposed by the MAHLE team, also contributing to directing adjustments.





Constant dialog was maintained with all the customers involved in the downstream chain: from mechanics to counter attendants in stores selling filters – indirect customers who play a prominent role in the commercialization of any product of a technical nature, such as automotive filters.

This communication is both positive and challenging as, in addition to helping identify problems and opportunities, it broadens and makes more complex the solution definitions to everyone's satisfaction.

For the end customer, who uses the filter in his truck, the key point would be to ensure high efficiency in filtration, in order to ensure greater protection of the fuel injection system and, consequently, lower maintenance cost.

Another demand from the end customer was to solve the problem of transparent reservoir break during filter change. In the traditional solution, this element needs to be assembled and disassembled with a special tool, which often causes the transparent reservoir to break, and a new part has to be purchased.

If the breakage occurs during a trip, in addition to the cost of changing the part, the truck driver will have to bear the cost of being stopped with the cargo. That is, a loss of thousands of Reais. Thereby, the product concept was modified, so that the transparent reservoir became welded to the filter, avoiding the necessity of assembly and disassembly during maintenance, thus reducing the possibility of breakage.

For the parts distributor who sells the filter to the end customer, the main focus was to reduce inventory: it was necessary to keep 22 reference numbers stocked to ensure minimum market coverage for replacement.

In an attempt to remedy this problem, MAHLE worked with the concept of multiple applications. Thanks to this methodology, a part was developed to meet several reference numbers. In this way, 7 reference numbers were developed to cover the 22 previous numbers, for the same coverage of applications.

As the distributor needs a minimum number of parts per reference number in stock, reducing the amount of reference numbers required for market coverage has allowed a reduction in the total number of parts in stock.

For auto parts distributors, the need was to facilitate disposal. "We visited dealerships that had two or three rooms full of filters for disposal", recalls Felipe Ferrari, product development engineer at MAHLE. As the traditional part was metallic, it would be necessary to open the part and separate the metal from other materials for the disposal.

MAHLE has solved this demand through breakthrough innovation: "Blind-agua" is the first water separator without any metal components, which eliminates the need to separate materials prior to disposal.

Once the prototype was validated, the investment was made for the production line and, finally, a new validation – now for the filter, produced on an industrial scale. The development team tracked all phases: installation of the first parts, training, sales presentation to train the distributors and guidance for technical assistance, until the product finally reaches the market, in 2015.

## Blindagua's differential: water separation during the filter entire lifespan

To ensure maximum performance of the product during the filter lifespan, the concept of water separation by stages was used. The mechanical principle is the same: the fuel enters the filter and theoretically separates the contaminant and water. The difference is that the filters available until then had only one stage, that is, the contaminants and the water are – or would be – separated at the same time.

Why does the traditional product lose its efficiency? Two phenomena explain this loss of filtration capacity. The first is the difficulty of separating water from biodiesel, because it chemically binds more to water than normal diesel. Therefore, the higher the percentage of biodiesel in diesel, the more difficult the separation process becomes. The second phenomenon is the presence of contaminants. In the single stage, these contaminants cover the filter, reducing filtration performance.

How to solve this problem?

The solution was to develop MAHLE's filter with two stages, with water and contaminants being separated at different times.

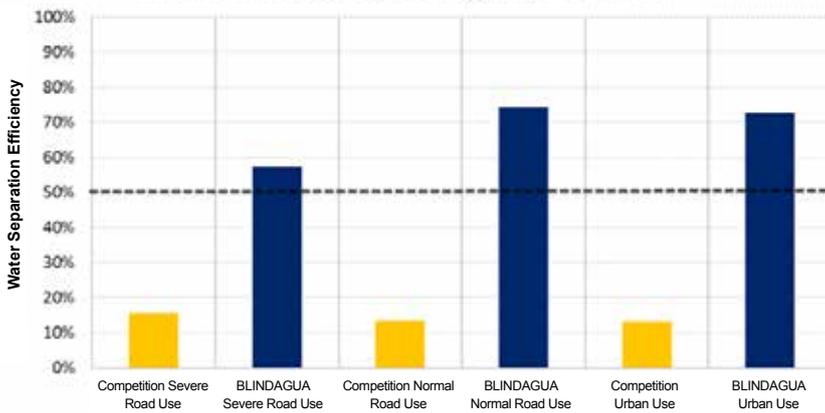
In the first stage, the contaminant is retained, and the water present in the diesel is coalesced. That is, the water droplets, small and chemically bound to diesel and biodiesel, have their size increased as they pass through the filtering element.

In the second stage, without the presence of contaminants and with much larger water droplets, the water is separated and directed to the bottom of the filter. "We performed a concept test of the product in a sugarcane combine, a continuous high-demand machine exposed to environment with much dirt. We noticed that this dirt affected the performance of traditional parts".

After 416 hours, the "Blindagua" filter still maintained 85% water separation efficiency, whereas the competing product had less than 15% water separation efficiency at 300 hours, causing engine components to suffer greater wear, resulting in higher maintenance costs", says Ferrari.



## Water Separation Efficiency after 30,000km



## Structure dedicated to innovation

The path taken throughout the project, from the four years of study and ideation to the launch of the product, is closely linked to the system that structures innovation in the company.

Of German origin, MAHLE has 77,000 employees around the world, with 170 production units, 940 customers and a turnover of around € 12 billion.

In Brazil, MAHLE has a turnover of BRL 2.2 billion, 7,800 employees and four production plants, in addition to the

Technological Center in Jundiaí (SP), where 317 people work in research, development and innovation.

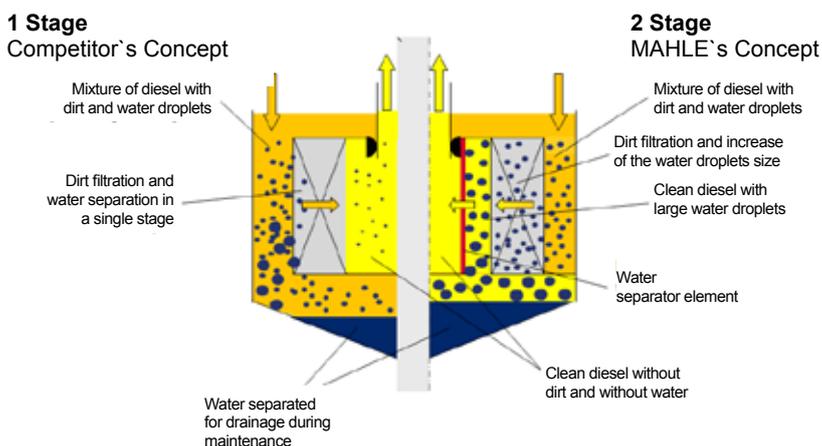
In addition to the Brazilian, MAHLE has 15 other technology centers around the world, each one focused on a specialty, representing around two thousand employees, who work with intense synergy and communication.

At the Technological Center in Jundiaí the flagship is the engine components system, which includes piston, ring, camshaft, connecting rod, plain bearing, sleeve, etc., where 70% of the budget is concentrated, which reserves 18% for Engine Filtration and Peripherals.

To justify the investment made in the Technological Center, keeping the equipment updated and in regular use, MAHLE makes a significant sale of technological services.

The filtration team is comprised of 25 people, divided between those working on development projects and those dedicated to testing, simulation and support areas services.

MAHLE's innovation structure is always guided by alignment with the company's strategy, starting point for the emergence of ideas. The systematization mechanism of ideas is a fundamental element in the innovation management. "In 2016, 160 new ideas were collected in Brazil. That same year, 36 projects were developed and 6 new products were launched on the market", explains Samantha Uehara, innovation engineer at MAHLE.



In order to work on this classification, innovation teams rely heavily on the competitive intelligence area, which monitors different publications, including competitors' patents, automotive news channels, market analysis and other sources of information that may influence strategy and products in development.

Fábio Moreira, research and development manager, points out, however, that the company determines to work and

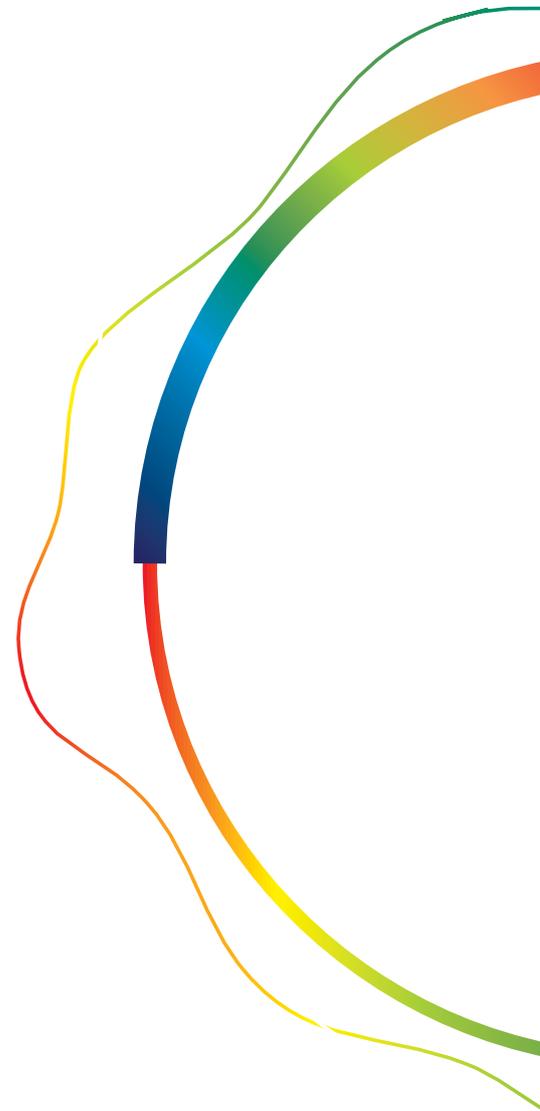
invest in both types of idea. "There is a clear division in our R&D investments: a percentage goes to businesses that bring profitability in the short- and medium-term, whereas there is a budget dedicated to pre-developments that may generate breakthrough innovations".

In the case of the water separation filter project, there were ideas similar to the usual filtration methods, and there were breakthrough ideas. Conceptual prototypes were then prepared to evaluate each concept, defining those that would be eliminated and those that would have the greatest potential. Out of these, some were put on hold, for an opportune moment, and others moved forward: some focusing on the short-term, others focusing on the long-term. "Within the same project, we often have two or three different products that have already matured, because they come from a natural selection of four or five ideas matured during the research phase", explains Fernando Yoshino.

What is, then, the course of the idea until it becomes a project?

In addition to specific demands, which can originate from the headquarters in Germany, there is a system for collecting these ideas through the Intranet, where any employee can contribute suggestions for the improvement of any of the products in the portfolio or for the creation of new products.

There are also ideas that come from external inventors, who get in contact with the company's Innovation department. These ideas are then directed to specific evaluators, with knowledge on the theme and the fundamental concept.





There is a clear division in our R&D investments. A percentage goes to businesses that bring profitability in the short- and medium-term and there is a budget dedicated to pre-developments, that may generate breakthrough innovations.

**Fábio Moreira**  
Research and development manager at MAHLE



Each product type has an innovation coordinator, who evaluates whether the idea is relevant or not and, if so, directs it to a specialist to conduct further evaluation. If the idea moves on to the next stage, it is then taken to an innovation committee, where it is evaluated by other product specialists around the world. There is then a global meeting to assess the feasibility of opening a project related to that idea.

### First steps

The water separation filter was launched in November 2015, with the aim of gaining space in the Brazilian market, the current fleet of which is more than 4.5 million trucks.

The product was first presented to the aftermarket, where great acceptance was crucial for the Brazilian team to convince MAHLE that the product could be launched worldwide.

The average sales in Brazil today is around 6,000 spare parts per month, and the product is in the validation phase in several automakers, so that the vehicles already leave the factory with the new filter.

In 2016, exports to Mercosul began, and in the same year, “Blindagua” was launched at the Frankfurt Auto Parts Fair, formalizing it as a global launch by MAHLE. There are studies already being conducted, aimed at exports to Mexico, South Africa, Colombia, Russia, Poland, USA and China.

### Internal challenge, global success

Without a doubt, besides the market success, the best result for the Brazilian MAHLE is to have gained global recognition as a technological leader. “MAHLE saw that we had competence and asked us to build an additional solution for the corporation. This has put our technical group as a reference within the organization as a whole”, celebrates Fernando Yoshino.

“Sometimes the challenge is not just technical; so you need to have a lot of skill in that process. If there is no resilience, learning with failures and persistence, innovation cannot be achieved”, summarizes Fernando.

The result is the promotion of the Brazilian team to a condition of equal dialog with the other R&D teams. An important maturation for the local team, who became the global leader for the product, leading a group now composed of Germans, Chinese and Americans. This new group is now undertaking feasibility studies to start production at the units in Europe, China and the United States and for the development of new products for the “Blindagua” line.

## Industrial Property and Partnerships

Generating industrial property through patents is also important for the innovation department. "We seek, whenever possible, to generate intellectual property. We have 141 active patents in the different business units here in Brazil, and an average of 20 annual applications", says Samantha.

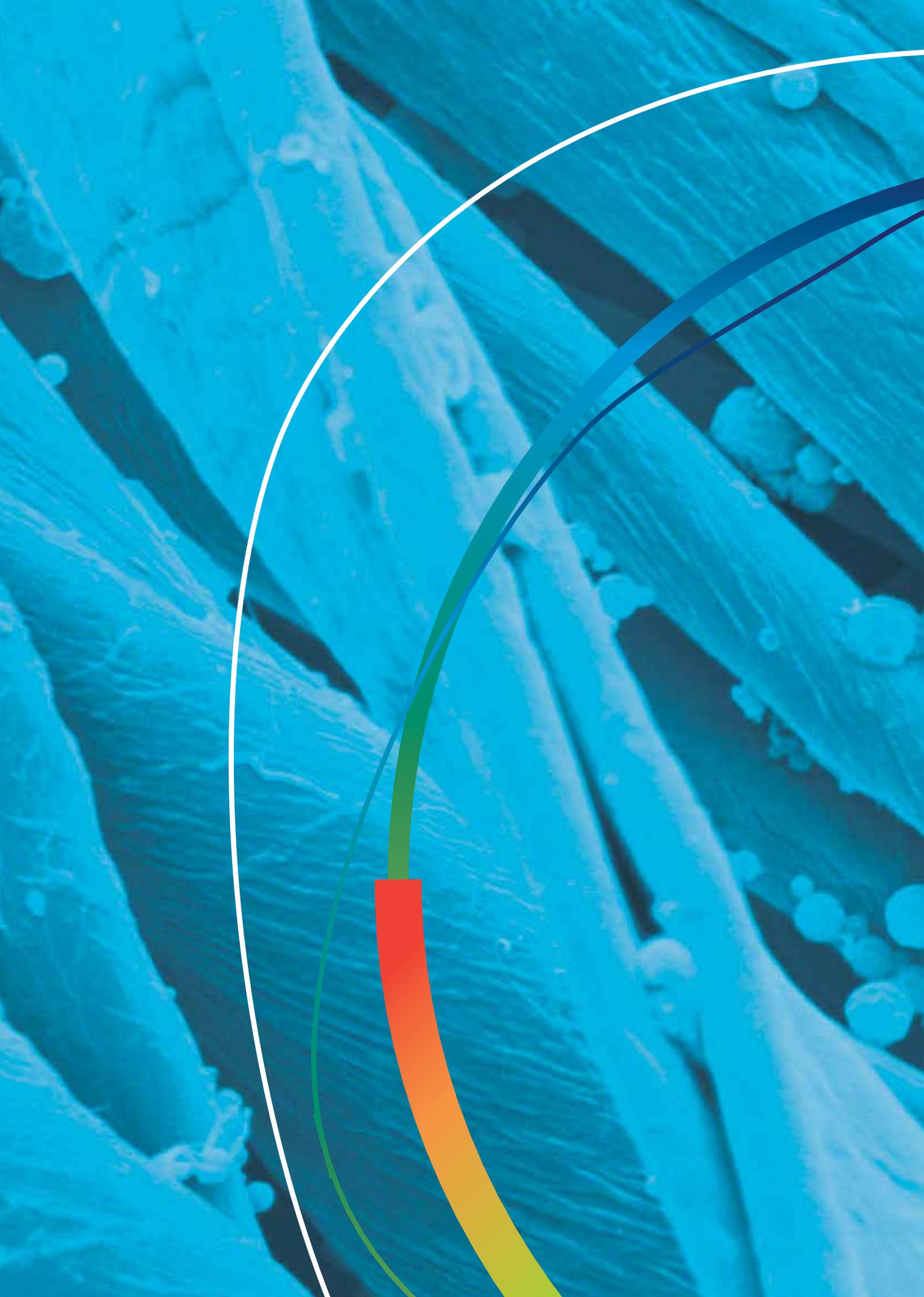
The Blindagua project, for example, generated two patents, already filed. The company vows to file the patents first in Brazil, and then send them to the international phases, through the PCT (Patent Cooperation Treaty). As a result, MAHLE became the first in number of patents, in the automotive area, in Brazil, to be sent to the PCT, ranking second among private companies.

For previous searches, the MAHLE researchers can count on the support of the Innovation department. For the writing of patents, MAHLE counts on the collaboration of an external office.

Partnering is also another important aspect for innovation at MAHLE. The company has several projects, developed in collaboration with universities and institutes of science and technology, with suppliers, and with other companies in the automotive area, to promote technology.

Samantha clarifies that "this is crucial, because it is difficult to innovate alone. It takes a good dose of humbleness, knowing who is better than you, and learning from them too".







**nanovetores**  
INOVANDO NATURALMENTE

## NANOTECHNOLOGY TO REVOLUTIONIZE CLOTHING

- NANOVIETORES
- Florianópolis/SC
- Medium-sized enterprise
- 41 Employees
- Product innovation
- MEI Agenda:  
Regulatory framework  
– nanotechnology,  
Innovation financing

*Brazilian company, specialized in nanotechnology, brings to Brazil the concept of textile cosmetics*

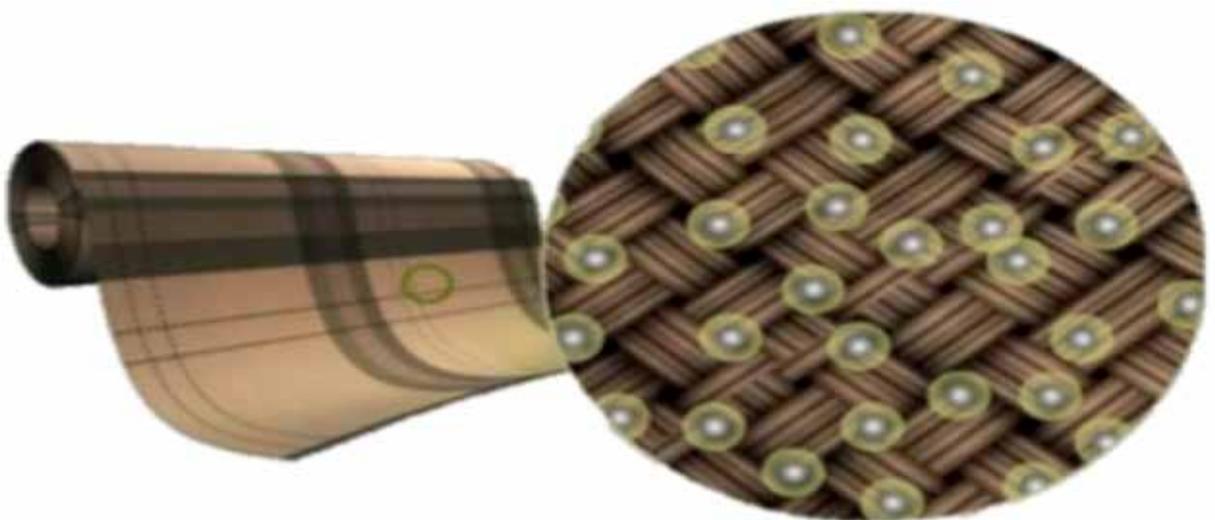
What about wearing a pair of pants that helps reduce cellulite, a shirt that has a moisturizing effect or even clothes with repellent, to protect against *Aedes aegypti*?

This is exactly what Nanovetores makes possible with its textile cosmetics technology, also known as smart textiles that receive a treatment that inserts nanoencapsulated active ingredients into the yarn weave, so that they are released during use.

The nanoencapsulation of active ingredients is the specialty of the Santa Catarina-based Nanovetores, which developed a technology that allows controlled release, through different triggers. These triggers are the great differential of the technological platform developed by the company, as they allow the active ingredient to reach maximum effectiveness in its target. Another important differential is that Nanovetores encapsulating systems only use natural, biodegradable raw materials, and the entire production process is carried out in aqueous medium.

Nanovetores works in the B2B model and its main customers belong to the cosmetic, veterinary, (compounding) pharmaceutical segments – and, more recently, to the textile segment, attracted by the concept of textile cosmetics, brought to Brazil by the company.

Operating in the market since 2008, Nanovetores is today one of the main Brazilian companies in the nanotechnology segment. Between 2013 and 2015, it stood out as one of the small- and medium-sized enterprises that grew the most in the period – a whopping 658%.



## Synergies in the marriage of science to business

Nanovetores was founded by the couple Betina Giehl Zanetti Ramos, a pharmaceutical with PhD in Chemistry, and Ricardo Henrique Ramos, bachelor of administration. These are skills that have been combined and completed in a successful marriage between science and business.

Since graduation, Betina has been involved in research related to encapsulation systems. Her doctorate in chemistry, carried out in co-supervision in France, covered the subject of polymer synthesis in aqueous medium, by means of encapsulates.

By then, Betina's goal was to follow an academic trajectory, but her work drew the attention of the pharmaceutical and cosmetic markets.

During her post-doctorate at the Federal University of Santa Catarina (UFSC), the same school where she had taken her degree and master's degree, she began attending fairs and congresses to identify the state of the art in the country. At that time, all the technology of encapsulated systems arrived via import and she saw there a promising niche: to develop this type of technology domestically.

The company was established in 2008 with the initial purpose, in Betina's words, to "investigate whether the full potential of nanotechnology that was seen in scientific articles would work with industrial product". Incubated in Tecnópolis, the Technological Park of Florianópolis, Nanovetores, right in the beginning, counted on first economic subsidy, through Pappe/Fapesc (Finep), a federal program executed in partnership with the states.

The first research was conducted by Betina herself and another postdoctoral friend, Andrea Seccon, who until today is part of the Nanovetores' team. With experience in compounding pharmacy, Andrea knew exactly the role that the product they intended to develop would have to play.

Betina explains that the major technological challenge for nanoencapsulation is the nature of nanoparticles, which varies a lot according to a number of chemical parameters.

It is a very complex process, involving pressure, temperature and humidity, which makes scale transposition a critical factor. "Sometimes you come across interesting results on the bench, but when transposing to 5 kg, it does not work. So imagine to produce a ton. It is extremely challenging", she explains.

In the first two years of the company, research was devoted almost exclusively to this transposition of scale to ensure that it would be possible to work with technology on an industrial scale.

This phase was extremely challenging, as is the case in all companies with promising results, but that are still far from having overcome the technological and commercial challenges of production and sales on

*Launched in 2004, the Program for Research Support in Business (Pappe) of the Foundation for Research and Innovation Support of the State of Santa Catarina (Fapesc), funded by Finep, promotes research and development in companies from the state of Santa Catarina, favoring their proximity with research institutions, in order to generate and implement innovations with high added value through scientific and technological knowledge.*

a sustainable economic scale, whether in terms of income, whether in terms of economic sustainability.

The eventual delay in overcoming the challenges associated with this phase characterizes what is called the “death valley”: despite the pot of gold that exists on the other side, the company has no resources to overcome the difficulties and achieve it.

The first encapsulation systems developed underwent clinical trials, to evaluate the effectiveness of the active ingredients with the transposition of scale. “We were very excited when the results started to appear, which were very good. That, of course, was motivating us. We were doing more, creating the line of products that would enter into portfolio”, says Betina.

In 2010, the project was completed, the initial part of safety and effectiveness was already validated and the company was already able to produce nanoencapsulated items on an industrial scale. A commercial stage then began, with participation in fairs and events, aiming at presenting the products to the market, with proven effectiveness and safety, giving visibility to the business and developing a chain of distributors.

In 2011, just three years after its establishment, the company received its first award, ranking first in the Stemmer Award for Innovation in Santa Catarina, which recognizes efforts and results achieved by people, institutions and companies that have stood out in promoting the use of scientific and technological knowledge in the practice of innovation.

The following year, Nanovetores ranked second at the incubated companies category, in the National Award for Innovative Entrepreneurship, promoted by Anprotec, in partnership with Sebrae. Also in 2012, thanks to the contribution of the visibility achieved with the awards, Nanovetores received investment from Criatec – fund that relies on resources from BNDES – and became a joint-stock company, a requirement of the program. Since then, the company has been receiving more support through a grant, including another Pappe program project and a second Criatec phase in 2014.

The business has been growing quickly, and the company now has a team of 41 employees, eight of whom are fully dedicated to research and development.

In 2016, the company ranked second in the Deloitte/Exame ranking of small and medium-sized enterprises that grow the most in the country. It was also granted the awards of the best incubated company in Brazil in 2014 and best graduated company in Brazil in 2016 – both granted by Anprotec.

It is important to emphasize that, in 20 years of the awards, Nanovetores was the only one to win these two Anprotec awards. Continuing its success trajectory, the company opened its first office outside Brazil in 2015, in the United States.

## Why using nanotechnology in cosmetics?

The proposal is to increase effectiveness. Working with nanoencapsulated active ingredients, in addition to preventing them from being oxidized or suffering other chemical reactions with the environment before reaching the skin, allows to control and improve skin permeation, so that the active ingredient only acts when it reaches its specific target.

Thereby, it is possible to increase the effectiveness by up to 5 times and reduce the dosage of the product by up to 10 times when compared to the same cosmetics in the conventional way.

But what are these active ingredients? Any active substance applied in cosmetics such as a vitamin C-based product for the treatment of eye wrinkles, a nail antifungal agent or even an anti-cellulite agent that needs to act only when it reaches a certain layer of skin.

Specific permeation and controlled release of the active ingredients are obtained by means of the so-called triggers, which are nothing more than the means by which the capsules are opened. Nanovetores uses five triggers in its products: temperature, humidity, friction, pH and enzymatic. Each active ingredient and its means of application require a specific type of trigger, determined jointly by the company and customer teams.

This concept of triggers is a conceptual innovation of Nanovetores and one of its most important differentials. The other is on the company's technological platform, which uses only natural raw materials and water-based systems, an important aspect given the wide range of applicability in the cosmetics segment.

## How did cosmetics end up in fabrics

Textile cosmetics were already a reality in Europe, when the Nanovetores' team decided to invest in the development of technology in the domestic market. The motivation was to bring to the Brazilian textile segment, which has been suffering a lot from imports and competition, a different way of adding value to its products.

The company's strategy was to partner with Malwee, which was also interested in the innovation, so that the teams could work in synergy in the development of new products. Thus, whereas the textile company sought opportunities and application trends, Nanovetores was responsible for transporting its technological platform into the fabrics.

The first technological approach was to insert nanocapsules of moisturizers active ingredients and anti-cellulite active ingredients directly into the yarn weave. The application is made during the industrial process of treating the fabric – in the so-called padding stage, in which the fabric passes through a bath, where the dispersed capsules are compressed by rollers to ensure uniformity of the impregnation. The durability of the capsules action on the tissue is 20 washes, twice as many as that of similar products marketed in Europe.



As the active ingredient release occurs slowly and continuously in a fabric with moisturizer nanoparticles, it is as if a new layer of the product were applied to the skin every two or three hours.

**Betina Giehl  
Zanetti Ramos**  
Technical director and  
Founder of Nanovetores



What is the advantage of having a moisturizer or an anti-cellulite in the fabric, compared to the conventional application directly to the skin? In the fabric, the release of the active ingredient, which normally occurs by friction or enzymatic trigger (through skin enzymes that can break the capsule and release the active ingredient) is gradual, as the capsules closest to the surface migrate to the skin, which increases the effectiveness time of the product.

Whereas the conventional moisturizers lose effectiveness shortly after application, because all the active ingredient is consumed quickly. “As the active ingredient release occurs slowly and continuously in a fabric with moisturizer nanoparticles, it is as if a new layer of the product were applied to the skin every two or three hours”, explains Betina.

Another application that recently gained strength – due to the epidemics of diseases transmitted by the *Aedes aegypti* mosquito – is the use of nanocapsules with repellent, applied to clothing for pregnant women and children.

The curious thing is that when this technology was developed by Nanovetores, its application was designed for clothing used in fishing, camping and other outdoor sports and activities in nature. The public health issue came later, greatly expanding potential markets.

The company uses both citronella and icaridin, recommended by the WHO to act in the prophylaxis of vector-borne diseases such as dengue fever, yellow fever, Zika and Chikungunya. The encapsulation allowed to reduce by four times the content of active ingredient, compared to products of topical use, maintaining the same effectiveness.

### **Business based on customer need**

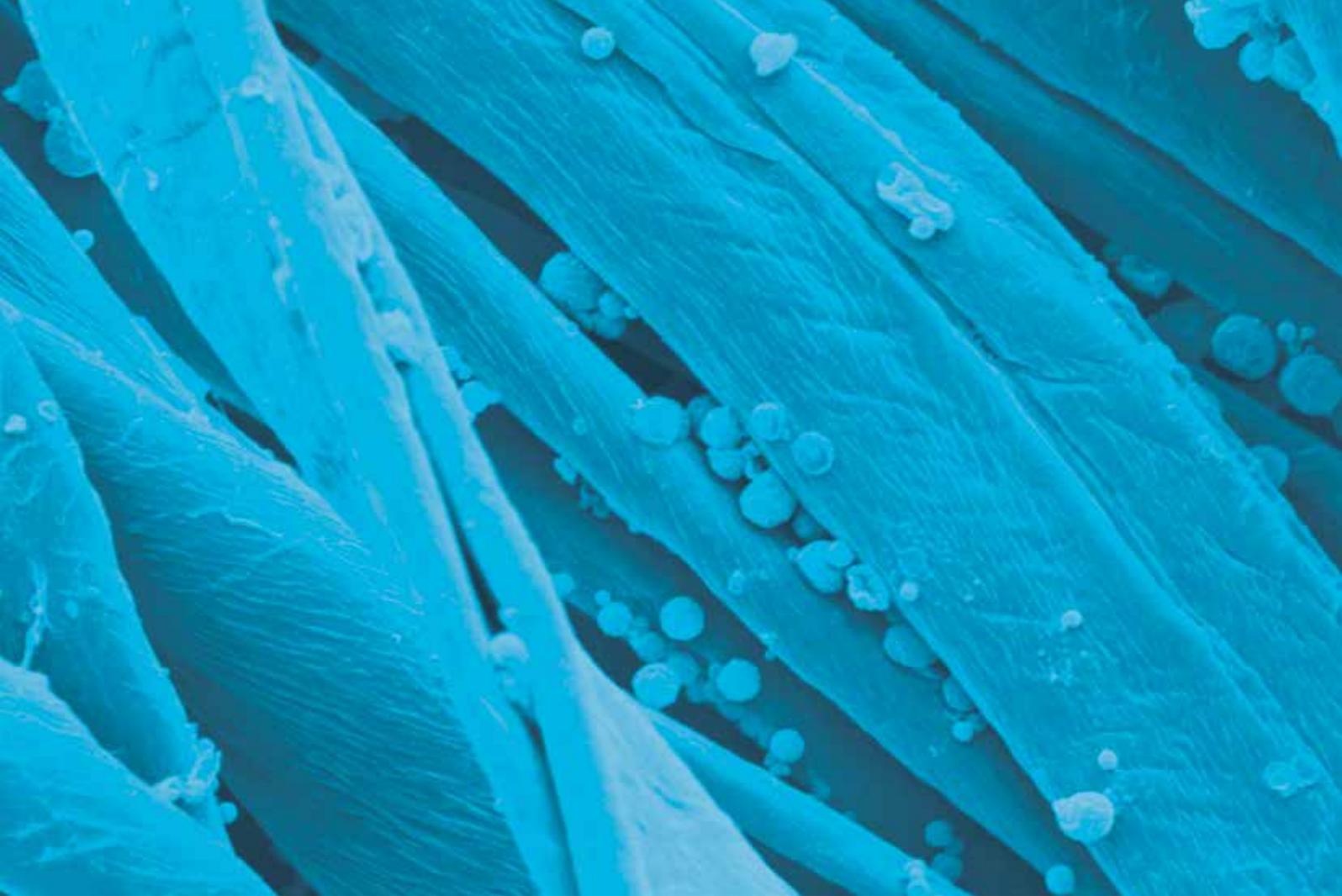
The business model is business-to-business (B2B), and today Nanovetores has an impressive 1,500 active customers. The product portfolio mainly serves the cosmetic segment, followed by textiles. Next comes the dentist, where the company’s products seek dental whitening, desensitizers and other oral care products.

The services are provided both through direct sales and through a network of distributors in Brazil and abroad, which reaches 26 countries.

Customers range from multinational giants to micro- and small- businesses, including all of the country’s compounding pharmacies. The whole production is concentrated in Florianópolis (SC) in a new plant, inaugurated when the company ceased to be incubated in 2015.

In Nanovetores’ sales strategy, each manager has its own portfolio of customers, with which they work both the maintenance and the conquest of new projects. This way, it is possible to efficiently monitor all customers, guaranteeing replacement, repurchase and offer of new products.

In spite of having a very diverse customer base, Nanovetores’ service is highly customized, because it is necessary to understand each customer’s need before choosing, among the many solutions offered by the company, which one best fits with certain application. “We have several encapsulating systems, some more compatible with hydrophilic active



ingredients; others with hydrophobic active ingredients. Some that release within a few hours of application; others that take much longer to release, and so on. Therefore, we first need to understand the reason why the customer wants to encapsulate the product and, based on the application characteristics, the best system is chosen”, details Betina.

Thus, the same active ingredient can be applied to both a cosmetic product and a textile, only changing the encapsulation characteristic: whereas in textiles, the capsules are required to be anchored to the fabric, in the cosmetics, they must have affinity for the skin.

The R&D team works integrated with the production team. In the R&D laboratory, prototyping is performed on small equipment to evaluate product choice, stability and effectiveness, before transposing to industrial scale.

To carry out more complex characterizations, which require more expensive and sophisticated equipment, Nanovetores has a partnership with UFSC. For clinical trials, in vitro tests, and other analyses which require certification, the company hires specialized service providers.

It is because of this stage of testing, in which stability, product shelf life and effectiveness are verified, that the contact with each customer can vary from eight months to more than two years, depending on the complexity of the project.

For the textile market, the cycles tend to be shorter, but this depends on the agility of the customer, as it may be necessary to make machinery purchases, process adjustments, etc.

In the case of cosmetics, the cycles tend to be longer. "In general, the larger the company, the longer the cycle. The same goes for multinationals, because it is necessary to validate the raw material in all the places where the multinational operates. So it is a very careful work, which can reach two years of testing, documentation, analysis", explains Ricardo.

The diversity of the customers' profile means that Nanovetores has a differentiated price policy linked to volumes in addition to a differentiated portfolio.

However, obviously there is also a commercial strategy taken into account in the pricing process. In the case of key customers with the potential to generate positive impact on technology and the brand, the priority is business rather than cost.

Speaking of financial issues, how is the price of a product with nanotechnology for the end consumer? Although the Nanovetores team assists in quantifying the cost increment in the production chain, the price difference is related to the customer's positioning and strategy.

In general, including a Nanovetores' active ingredient in the chain does not generate a high cost increase, but it does add value to the product, whether from the point of view of the benefit itself, whether from the marketing point of view, by incorporating an innovative feature. In the case of fabric with moisturizer, for example, the price increase, compared to the traditional clothing, ranges from 20% to 30%.



For a technology business like Nanovetores, market intelligence is crucial. In the company, the R&D and Marketing team are responsible for monitoring the market and the means of scientific dissemination, in search of new opportunities and trends that can increase the portfolio.

When it comes to the market, Nanovetores' option to protect itself from competition is the industrial secrecy and intellectual property. The first concerns the way the company effectively chooses to protect its process and products. There is a confidentiality policy, which involves all employees and customers.

In terms of patents, Nanovetores has filed nine so far, made to protect the market, "more to prevent another company from preventing us from doing something we already do than to prevent someone from having access to it and from being able to reproduce our product", says Ricardo.

### **Rising market and strategy to overcome the crisis**

The first textile product using Nanovetores technology was launched on the market in 2013. It is the Malwee leggings pants with moisturizing action. In 2015 the company released a new leggings, this time with anti-cellulite properties, which had successful sales.

Other important customers in the textile segment today are garments, companies of different sizes, which produce repellent clothing for pregnant women, babies and children. This niche had a boom in 2016, due to concern about cases of microcephaly, linked to the Zyka virus. The textile segment accounts for 10% of Nanovetores' revenues, and the company's plan is to increase this share by five times in 2017, targeting precisely this repellent market.

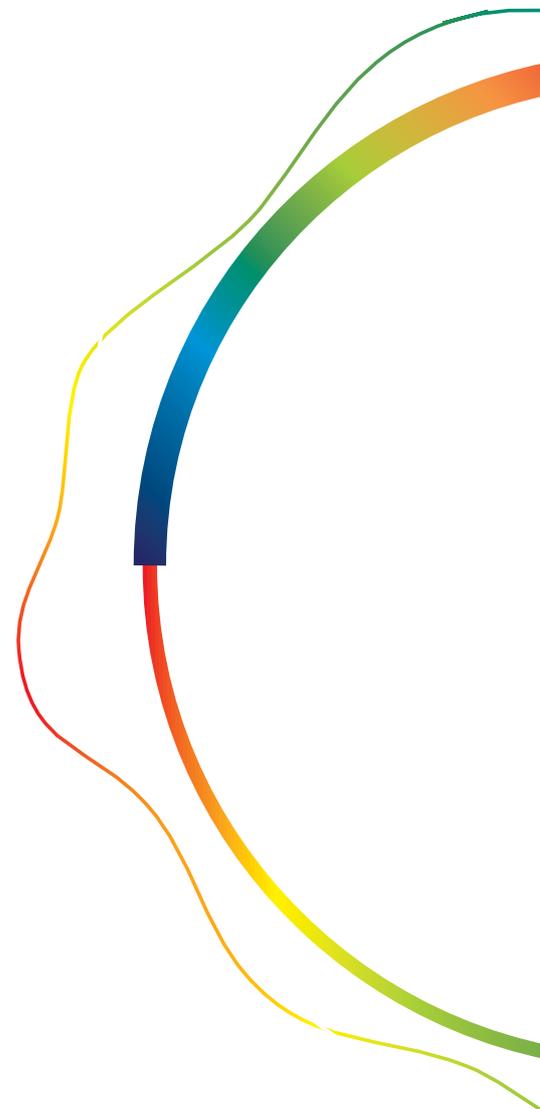
The company believes that even at a political and economic time of many uncertainties – such as the one the country has been going through since 2016 – innovation can make a difference for business. "Our talk with the customer is this, to show that we can help them in this differentiation. Investing in something different, in a new technology, may be exactly the chance to show something that draws attention", says Ricardo.

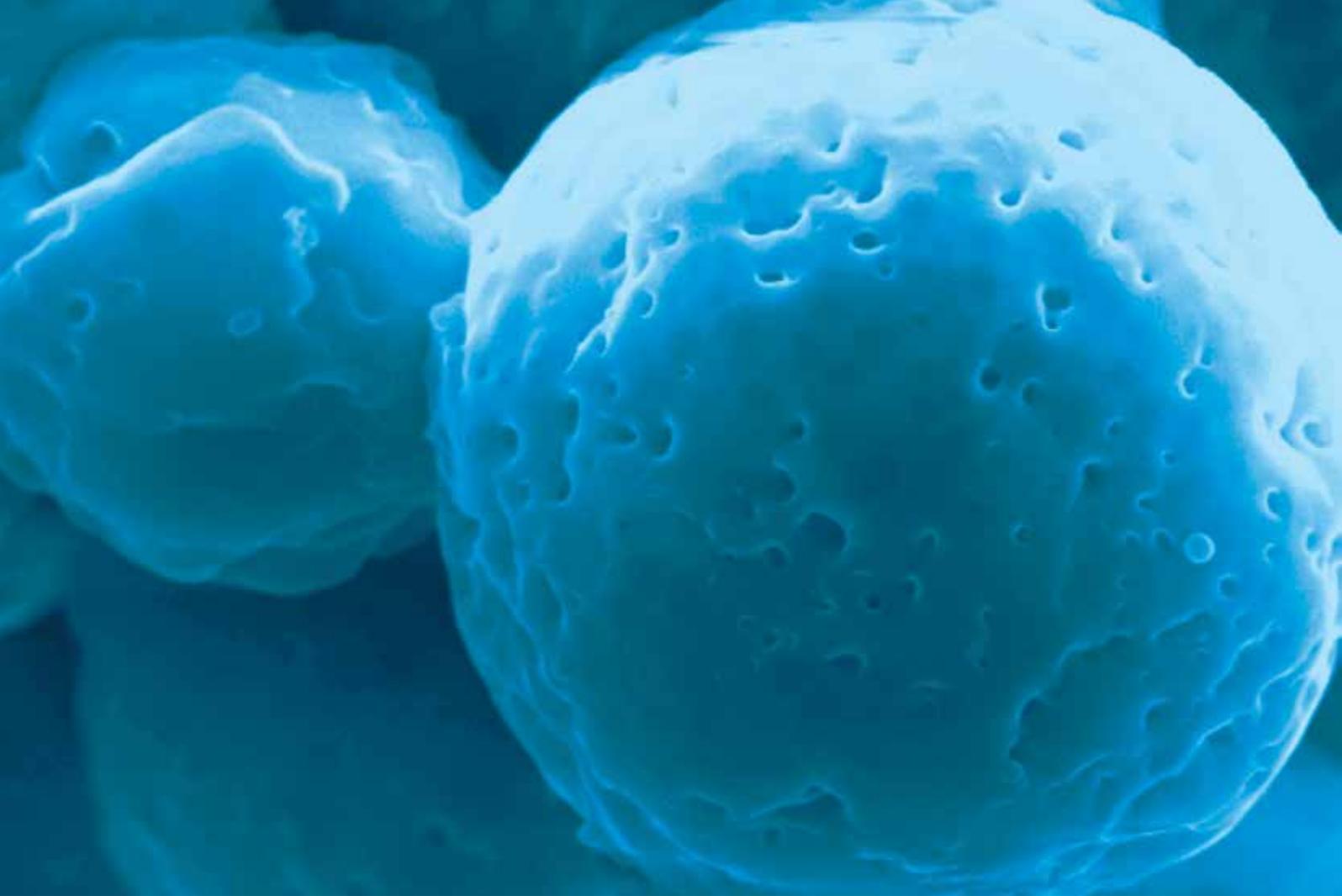
This strategy has proven to be successful. The number of customers rose from 640 in 2015 to more than 1,200 in 2016. In this atypical year, the company was forced, in the midst of the crisis, to search for new fronts, new customers. "We capture many customers, often with the small average ticket, but with good margin. Our expectation is that, in the post-crisis resumption, with those customers that are already in our portfolio, we will be able to boost the business", explains Betina.

The numbers are already impressive, but Nanovetores has bigger ambitions.

### **Future prospects**

In order to advance further in the textile segment, Nanovetores is working on a project, in collaboration with SENAI, so that the functionalization of the fabrics does not occur in the weave, as currently, but inside the thread, with the capsules impregnating the microfilaments that compose it.





Unlike applications such as moisturizing and anti-cellulitis, which need to migrate to the skin to perform their function, the idea in this case is that the particle can remain in the fabric rather than migrate to the skin, ensuring that the release is extremely slow.

The increase in effectiveness in both cases is enormous. As each yarn is formed by at least 20 filaments, the contact surface is greatly increased.

In addition, the functionalization approach of yarns should expand the range of customers with the entry of spinning industries, as currently Nanovetores' textile audience is concentrated on weaving and clothing.

In this way, the company starts to attend to all the links of the textile chain, from the small confection, which treats the fabric through padding, to the great producer of synthetic threads – or even the one who wants to buy the yarn and has a benefit to weave.

Parallel to the work with the fabrics, Nanovetores begins a major project for the development of a new platform of preservatives, based on nanotechnology.

The project was granted the investment of BRL 11 million through a bidding process for the Chemical Industry Development and Innovation Plan (Padiq), a joint initiative of BNDES and Finep, which is intended to support projects that contemplate the technological development and investment in the manufacture of chemicals.

Among the future plans, there is also the prospect of opening a unit in Switzerland, supported by the Swiss government, reinforcing the company's international presence. The percentage of exports is still low, around 5 to 10%, but the spread in these countries is a good indication of technology acceptance in different markets.

### **Support that consolidates innovation**

Born as a startup egressing from the academic world, the company's meteoric rise in both turnover and customer numbers is certainly the result of the skills of a strong, well-trained team and a well-designed and customer-focused business strategy.

However, Nanovetores' trajectory of success has been guided by the financial support and awards received, which helped to create and consolidate the business. "When you work with innovation, with a new product, a new company, a new technology such as nanotechnology, in order to consolidate the business and win customers, it is necessary, in addition to financial support, that the company be recognized, have the backing of solid, reputable entities", says Ricardo.

In addition, that was the role that awards and investments have played for Nanovetores, a company that still has a lot to offer for nanotechnology and for the country.





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# Biovech



**Larvicida Biológico**  
Não polui, não deixa resíduos  
e não agride o meio ambiente.

**PROTEÇÃO CONTRA A DENGUE**  
Eficaz no combate às larvas  
de *Aedes aegypti*



Conteúdo  
**500 mL**

**Ação Preventiva:**  
*Biovech age sobre as larvas  
dos mosquitos e ataca o  
problema antes que você  
e sua família corram riscos*



**CUIDADO! PERIGOSO SE INGERIDO, INALADO OU ABSORVIDO PELA PELE!**

ANTES DE USAR LEIA COM ATENÇÃO AS INSTRUÇÕES DO RÓTULO.  
AGITE BEM ANTES DE USAR!



NEOVECH

# Citronela Nanovech



**Odorizante de ambientes**  
à base de óleo essencial de citronela



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contra mosquitos e pernilongos



**O ÚNICO COM NANOCITRONELA®**  
Contém nanocápsulas de citronela  
Produto à base d'água / Sem álcool

250 ml

# NEOVECH®

# BIOTECHNOLOGY: PLATFORM FOR INNOVATIONS IN DIFFERENT SEGMENTS

- NEOVECH
- Porto Alegre/RS
- Small-sized enterprise
- 6 Employees
- Product innovation
- MEI Agenda: Innovative SME, Innovation financing

*Neovech places on the shelves of the retail chains a larvicide, of biotechnological origin, that fights vectors transmitting diseases*

Neovech, a startup from Rio Grande do Sul dedicated to the development of biotechnology-based solutions, created a biological larvicide, Biovech, harmless to humans, animals and plants, but highly effective against *Aedes aegypti* and other mosquito larvae. Its formulation contains protein crystals, produced by *Bacillus thuringiensis israelensis* (Bti), which cause larval mortality after ingestion.

The use of Bti for larvicidal action is not unprecedented – it is in fact widely used in agriculture. But Neovech’s product is the first to be made available with formulation and concentration that allows the domestic use and the free sale.

Available in the market since December 2015, the product is now marketed in large retail chains, all over the country.

## A little history: the trajectory of a scientist with many interests

Can a scientist with many interests be also a successful entrepreneur?

A scientist’s profile usually includes a passion for discoveries, which often takes him away from the routines that dominate business life: suppliers and customers, stabilized production processes, well-defined products and packaging. It is rare for both profiles to fit into one person, who, sooner or later, will have to choose one of the roles.

But Neovech, established around its founder, Fernando Kreutz, has been demonstrating that it is possible to reconcile researcher profile – involved with far-reaching scientific challenges – and the determined entrepreneur profile. If the scientific challenges involve oncological therapies, to which the researcher and his company have dedicated themselves for more than 20 years, the entrepreneurial challenges in a prosaic biological larvicide, called Biovech, embody a challenge of another nature: the conquest of the market.

Neovech’s and FK’s founder is a physician who obtained a doctorate in biotechnology from the University of Alberta (Canada) in 1997, with research involving the fields of diagnosis and therapy. It was during his experience in Canada that Fernando met a then unusual figure in Brazil: the company incubated at the university, in close integration with strictly academic research works.





Back in Brazil, inspired by this experience and grounded in his new scientific skills, the new doctor decided on the entrepreneurial experience in his area of activity: biotechnology linked to human health – more precisely, oncological treatments (or vaccines). That was when he was able to apply for an incubation promoted by the Science and Technology Foundation (Cientec), linked to the Secretariat of Economic Development, Science and Technology of Rio Grande do Sul.

The birth of the company was, as usually happens in Brazilian startups, very “Franciscan”: “In the beginning, in 2000, it was a desk, a computer and the researcher”, in the words of the founder himself.

But shortly thereafter, FK was able to attract investors, who provided the company with a modest amount – at least for the investment patterns in companies at this embryonic stage, which depend exclusively on a head and their knowledge. The contribution, of approximately BRL 2 million (restated amount), was made by RSTec, an investment fund managed by CRP, with resources – among others – from Sebrae.

The contribution made, although it may seem substantial, is certainly a modest amount when one thinks of the world of biotechnology and human health, where the development of solutions involves long deadlines and considerable expenditure. How to solve

then this problem so well known to all entrepreneurs in the world of biotechnology?

The solution found was inspired by the model the new entrepreneur had met in Alberta, Canada: building relationships with centers equipped with research infrastructure, facilities and equipment that could be shared.

The entrepreneurial scientist spirit led him to submit public funding proposals for his research. The result was the award in three different subsidy projects, with amounts totaling BRL 5 million.

These resources were invested in projects developed in public research institutions, including the Hospital das Clínicas in Porto Alegre, where clinical studies (phases 1 and 2) were carried out.

When FK implemented its model in the early 2000s, there was still no legal basis in Brazil for private technology initiatives to be carried out in a public environment. Fernando therefore considers himself a forerunner of these initiatives, which later thrived under the Innovation Act (created in 2004) and the new institutional environment, which has facilitated – or at least has not stopped – this kind of development of scientific knowledge, originating from universities and the results of their research.

### Cutting-edge scientific knowledge and a platform for multiple solutions

The resources coming from the subsidy applications were added to those of the investors, which allowed the formation of a dedicated team, with well-trained researchers in biotechnology-centered knowledge areas, focused primarily on human health.

But biotechnology is a very wide field of knowledge and of a transversal nature – that is, the same principles can be useful in multiple applications, whether in human or animal health, whether even in applications in the vegetable, industrial and even environmental areas.

The transversal nature of the scientific basis of modern biotechnology allows knowledge to inspire new applications in nearby or remote fields. This is where the history of Neovech and its innovative product, the biotechnological larvicide Biovech, begins.

One of the greatest challenges of biotechnology for human health comes from the very long intervals for any commercial success to be achieved, because, regardless of the technological solution developed, the product is only the end of one stage, followed by other long and costly stages.

The biotechnological product or solution needs to undergo demanding, time and resource consuming tests, which is why few startups have succeeded anywhere in the world to independently market a product they have developed in its entirety.

The truth is that, almost always, the testing stages have to be carried out by companies with large amounts of financial resources and with the capacity to deal with complex regulatory requirements required by the surveillance agencies (National Health Surveillance Agency [Anvisa] in Brazil, or Food and Drugs Administration [FDA] in the USA).



In the course of innovative biotechnology companies, it is common for some very encouraging initial results to stimulate the interest of investors, attracted by promises that – realistic or not – tend to take much longer than planned to be achieved. This is the world of biotechnology, especially in the area of innovative products for human health.

The solution that many companies find to survive – when results start to take time and investors' patience is giving the first signs of exhaustion – is the provision of technology services to other companies and to research organizations. This is one way of ensuring survival until the desired commercial results are achieved with innovation or major innovations.

It was in this context that Neovech, a company derived from FK, emerged. In the usual words of this world of new technology, Neovech is a spin-out of FK.

Unlike the typical path of obtaining additional resources through the provision of services, FK found in its internal universe of scientific and technological competencies the knowledge base required to create a commercial product capable of ensuring faster results less dependent on time consuming testing and expensive regulatory certification.

### **The larvicide**

When, in 2004, FK participated in a project in partnership with the Oswaldo Cruz Foundation in Rio de Janeiro – one of the main and most traditional Brazilian research institutions in the area of human health – part of the knowledge resulting from this project – later interrupted – remained in the FK and developed into permanent activity, involving from the cultivation of the bacterium until its possible uses.

Several other projects were developed by FK around the same theme, always with the support of public resources from subsidy, including the project called "Production and Development of a Biological Larvicidal Powder" to combat the mosquito transmitting dengue fever and a grant from the Human Resources Program in Strategic Areas (CNPq's RHAE) for the industrial scale development of Biovech production.

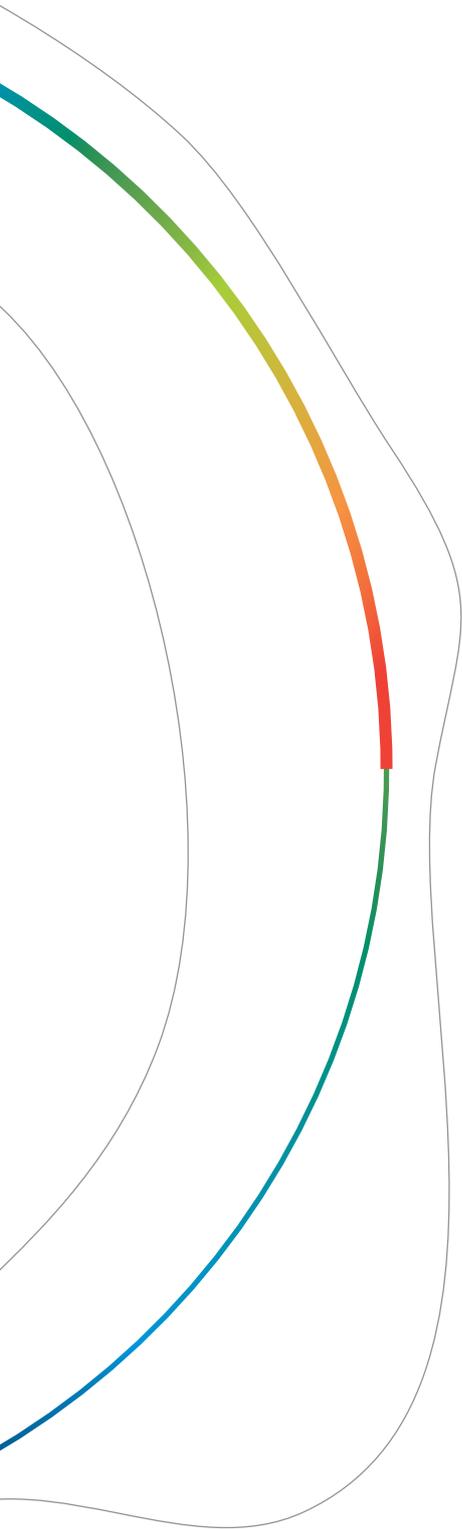
Each of these projects represented a new opportunity to master basic science and technologies related to the production of the bacterium and its possible formulations. And the problems involved in the commercial formulation of a product, which needs to maintain its functionalities in real field conditions, are neither trivial nor few.

In fact, the product must stay on the shelf at the point of sale and then at the consumer's home, in conditions of effective use, for a long period.

In this sense, the accumulated knowledge throughout FK's life was decisive in facing these challenges and responding to all these market demands.

Ten years went by so that this activity would gain an opportunity for commercial development and become a real business. In search of new businesses that could value the existing knowledge in the company and the technical capacities of the research team, the team envisioned the opportunity to develop a product capable of combating the reproduction of mosquitoes transmitting important diseases such as dengue and Zika.





Upon identifying the problem of the high prevalence of *Aedes aegypti* in residences, the FK research team, after analyzing the existing methods of combating mosquitoes, identified several alternatives.

The first of them, a mechanical one, was translated into an attempt to eliminate any possible water deposit – quite a difficult task and doomed to failure, since a remaining deposit is sufficient for the mosquitoes to reproduce. Although there are chemical agents to combat mosquitoes or their larvae, they have only residual effects.

In turn, Biovech's operation mechanism is based on the action of a bacillus (*Bacillus thuringiensis israelensis* – Bti), known for a long time, as summarized by Fernando Kreutz: "This bacterium, this bacillus, when it grows under stress, it sporulates and the bacterium becomes a spore. When this occurs, it produces a protein, called *Cry*. If the larva ingests this protein, it ends up dying, because this protein has a very interesting molecular system: it attaches to the cell membrane and ends up creating a pore inside that cell. So the larval gut cell gets a hole, liquid enters in it and it dies".

However, knowledge of the principle, although important, is not in itself sufficient to ensure the business creation. For this, it is necessary to create a viable commercial product, and this depends on other conditions and requirements.

The specification that the company built in its internal process of ideation came from a domestic product – because it is in the households that the mosquito lives and reproduces.

In the company's view, conventional methods of combating vectors are unfortunately of low adherence and therefore deficient and ineffective. Therefore, in Neovech's view, it would be necessary to create a truly effective tool that would translate into a commercial product by using the known action principle of the bacteria.



The second specification required that the product be easy to apply, comfortable, avoiding the recommended and little practiced operations to combat all standing water, existing in any dwelling. The third and final specification involved avoiding regulations and lengthy approvals of public health organizations – adopted for pharmaceuticals, for example. It was in order to face each of these challenges that the company mobilized the accumulated knowledge and experience of its team of researchers and professionals.

### The corporate model of FK and Neovech

FK has a group of 18 partners, with different equity holdings. The original corporation has already raised many resources and attracted many investments, whether from funds or individuals.

But despite having developed different projects in biotechnology, its results are in very different stages of maturity and proximity of the market.

When the commercial larvicide project was decided, a special vehicle was also created to house its development: Neovech. It is a standalone company with no formal ties to FK, although 12 of its partners form part of the parent company, which has six other partners.

These are two important links between FK and Neovech, led by its resilient chief scientist and founder.

The first link relates to the right of FK's partners to participate in any undertaking, set up from the parent company. It seems reasonable that the founders and partners of the original company, which has, from the outset, the greatest risks, may have the right – moral but not corporate – to participate in derivative business, allegedly of minor risks.

The second link is related to the licensing agreements of the technologies originating from FK, which gain autonomy in autonomous enterprises. The derivative company commercially develops the technology received, paying royalties to the original corporation. With this, the parent company obtains resources to continue its original development, while maintaining its focus; whereas the derived company benefits from the possession (or use) of a technological asset developed and suitable for commercial exploitation. It is, therefore, a winning combination, a win-win solution.

### Neovech's ecosystem and institutional environment for innovation

The ecosystem for innovation is, metaphorically, a half-full, half-empty glass: meaning that any observer is able to emphasize its virtues or evidence its ills without being challenged by it.

Neovech has had, over its history and milestones of its development, several opportunities to prove both faces of the Brazilian innovation system. Its founder, with medical-scientific graduation and advanced studies abroad, was able to dedicate himself to the founding of a company and found his first shelter in the public space of promotion of emerging companies.



When this bacillus grows under stress, it sporulates and the bacterium becomes a spore. When this occurs, it produces a protein, called Cry. If the larva ingests this protein, it ends up dying, because this protein has a very interesting molecular system: it attaches to the cell membrane and ends up creating a pore inside that cell. So the larval gut cell gets a hole, liquid enters in it and it dies.

**Fernando Kreutz**  
Founder of  
Neovech





It was also in a public initiative that found, in the RSTec fund, the first capitals that allowed him to transform a dreamy and visionary project into a company with resources, to realize their most daring aspirations.

Public resources were also present in the projects supported by the subsidy announcements and the Human Resources Program in Strategic Areas, belonging to the two main federal agencies supporting scientific and technological research (Finep and CNPq).

In fact, the support of public bodies and private investors is balanced in the company – 48% to 52%. But with one important difference: public funds are non-refundable.

It was possibly in the regulatory area that Neovech found the empty side of its glass. There was no standard in Brazil and its regulatory agency that could accommodate the innovative product developed by the company, which then had to develop along with Anvisa the norm that allowed the commercialization of its product. A process that took time and resources.

In spite of this difficulty, Neovech found its way to commercial development, starting from a mature knowledge that the company incorporated to its collection and masters in a very rigorous way, which allows an innovative approach to its use.

The success seems clear and translates into the product commercial penetration, which is now found in several of the major retail chains, and in the millionaire and increasing evolution of revenues. Not bad for a startup, which can be considered a side branch of a more ambitious trajectory of science that is breaking through promising and extremely challenging frontiers around the world.

### **Successful debut**

Biovech's commercialization began in December 2015, and the product is now available in large retail chains in the Northeast, Southeast and South regions of the country. Neovech invested in an intense marketing initiative and set up a network of representatives, which serves all regions of Brazil.

The results are impressive! In its first year of life, Neovech had revenues of BRL 2 million, resulting from the sale of 82 thousand units of the product, driven mainly by the dengue, Zyka and Chikungunya epidemics.

The growth prospects are positive, considering the continuity of the incidence of such diseases and, more recently, outbreaks of yellow fever, the urban vector of which is also *Aedes aegypti*. The company is also working to start exporting to Latin America (Guatemala, Peru, Ecuador, Paraguay, Colombia, Chile and Argentina), as well as South Africa and the United States.

### Other innovative products and next steps

The grandiose dreams of biotechnology for human health and the cancer vaccine have not been abandoned, and FK's work continues. But Fernando, his research team, his external collaborators and his associates know that this path is usually long. If they are not discouraged, they will not fail to continue their search for more stable sources of income, which will ensure Neovech's permanence and growth.

In addition to the larvicide, Neovech launched an insect repellent product, developed from citronella, nanoformulated to provide a more effective and prolonged action. Nanovech, the commercial name of the product, serves the public who seek natural solutions that do not use chemicals in their formulation and use natural essences.

A third innovative product is an environment-based flavoring, which uses nanotechnology to preserve fragrances and extend their period of action. The fragrances used in

the Khala product line undergo a nanoemulsion process, which protects them and expands their time of action. The use of nanotechnology in the Khala product line allows the aromatic notes to be of superior quality.

Neovech's innovative effort does not stop at these two products. The company also has in its portfolio a nanotechnology-based body repellent that can be used in infants from six months of age.

Neovech also has a concern with the culture of intellectual property, such as its parent company, FK, which has filed a total of 17 patents. Neovech, meanwhile, has filed a patent in 2016, which is awaiting review by the United States Patent and Trademark Office (USPTO).

### Science and market

It is curious that the startup, originally created to develop innovative solutions for the area of human health, has found, in a well-known body, its first source of commercial revenues.

Afterwards, from a commercial vision built with retail experience, the company has found, in its technology collection, new products to reinforce its strategy to expand the base of its business.

Who says that a bold and ambitious scientist cannot become an entrepreneur with a successful business and business strategy? That is what FK and Neovech did – an innovation from the bank to the shelf. With a more favorable business environment, the Brazilian innovation ecosystem could multiply these successes.





NEXXTO

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# QUALITY, RELIABILITY, SAFETY: WELCOME TO THE WORLD OF INTERNET OF THINGS

- NEXXTO
- São Paulo/SP
- Small-sized enterprise
- 20 Employees
- Product innovation
- MEI Agenda:  
Innovative SME,  
Innovation financing

*Nexxto is a pioneer in the country in the development of Internet of Things solutions for the retail*

Nexxto uses IoT (Internet of Things) as a tool to reliably and efficiently manage environments and goods. Small battery-powered sensors communicate with the cloud<sup>1</sup>, informing temperature and humidity of the storage environments, which allows the configuration of variation alerts, the issuance of periodical reports and the real-time monitoring of the variables measurement, 24 hours a day, 7 days a week.

All this information is available to the customers, who can access it whenever they want, through the internet. The system also sends alerts, via SMS and e-mail, if anomalies of temperature or humidity (breaches of the preset limits) are identified.

The solution won 23 customers over in just six months. A success that is not new for Nexxto: founded in 2010 (named RFIDEAS) by former students of the Polytechnic School of USP, RFIDEAS rapidly rose from startup to small business, bringing to market simple and efficient alternatives to automation and optimization of asset and product management processes.

With a business focused on Internet of Things applications since its conception – aiming to reduce losses and increase quality, reliability and safety for companies of all sizes and industries – Nexxto established in 2016 as a goal for the next four years to become the largest IoT products and solutions company in Latin America.

## **Simplifying is necessary**

The National Health Surveillance Agency – Anvisa, like other regional agencies for health surveillance, has a number of standards, which require that establishments dealing with food or medicines, from industry to retail, record the temperature and humidity of all stored perishable products. These controls are also essential to ensure the quality and reliability of the products, as well as reducing disposal and replacement costs.

As a rule, this work of collecting and recording data is done at the expense of very laborious and costly methods, which require the manual filling of spreadsheets, in paper or electronic media.

It is not possible to guarantee 100% reliability, since data can be lost over time and, in the overwhelming majority of cases, it is not (or cannot be) used to generate useful information for decision making.

<sup>1</sup> The principle of so-called cloud computing is the storage of data using computers and servers connected through the Internet. The process makes it possible to access information from anywhere, anytime, without having to install programs or files on the access device.

Thinking about solving this problem, Nexxto created a solution that uses the connectivity, through typical concepts and technologies of IoT, to simplify and optimize the entire process.

### How does this entire process work?

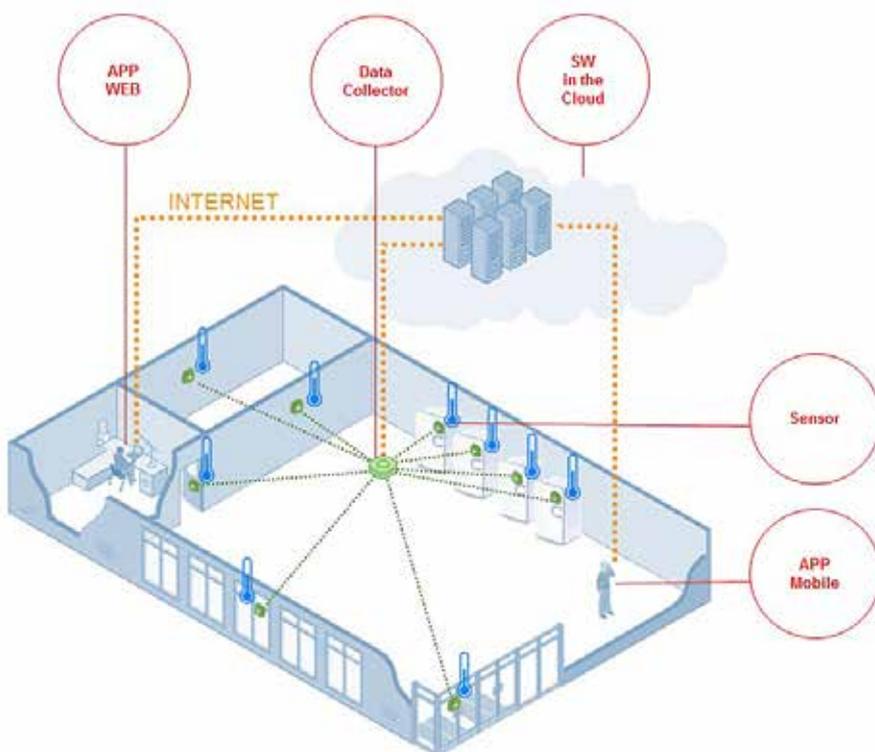
Wireless sensors, developed by Nexxto, are installed in environments and equipment and measure temperature and humidity 24 hours a day.

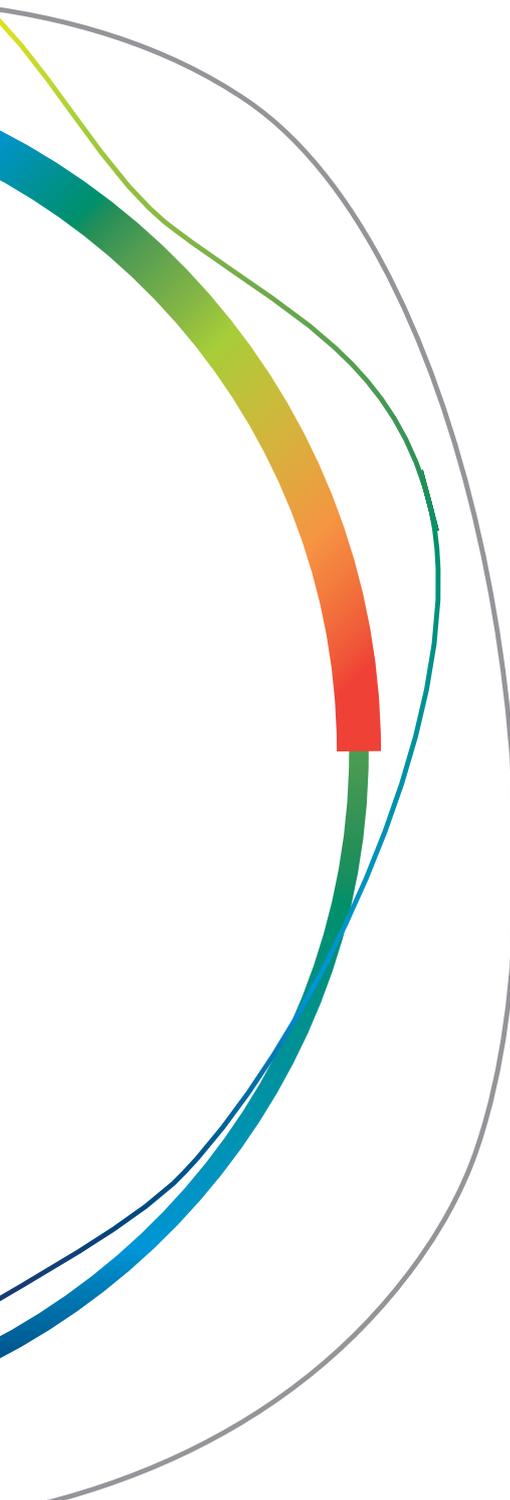
The collected data is then sent, in real time, to a device called gateway, which can read dozens of sensors at the same time, at a distance of up to 50 meters.

It is this device that then sends all the information to the cloud, from where the user can access it through a smartphone, tablet or computer, anytime and anywhere, and thus check the operation of freezers, refrigerators, air conditioners, in addition to monitoring failure in the electricity supply.

The system also allows the creation of collection intervals (if uninterrupted monitoring is not required), the generation of variable graphs over time, the creation of alarms for when temperature or humidity is out of the specified ranges and automatically send alerts via SMS or e-mail to one or more people.

Allied to this functionality – which allows the assurance of the effective compliance with the desired parameters and the identification of possible failures – the system creates reports in the standards required by regulatory agencies, keeping the data history safe.





In the case of companies that have several branches or points of sale, the system collects the information in a single place, a single platform, which makes it possible to monitor all these points at the same time, in a practical and simple manner.

### **Method and discipline to go from dream to business**

Although Nexxto is still a very young company, the monitoring solution via IoT is not the first to be made available on the market. In fact, the Nexxto solution is a second solution, intended for what the company calls automated real-time management, an idea that was the starting point for the business.

In the words of Antonio Rossini, founder and CEO, “Nexxto’s mission is to connect people to things that matter to them, anywhere, anytime”. A connection that can be made in many environments and in a smart way.

It was in 2010 when the newly-graduate engineers Antonio Rossini and Lucas Almeida created the RFIDEAS, a name inspired by the technology originally chosen as the heart of the business: RFID stands for Radio Frequency Identification (RFIDEAS is nothing more than the junction of the acronym RFID with the word ‘ideas’).

The first product was developed with the purpose of being a tool for tracking, controlling and managing IT equipment for Data Processing Centers (the so-called data centers), where thousands of expensive equipment – many of which are portable – are installed, which increases the challenge of controlling these assets.

The choice of this first niche is due to the graduation of the partners – Lucas is an electronics engineer and Antonio is a telecommunications engineer – and was fueled by a long and structured process, which is reflected today in the success of Nexxto.



Friends since graduation, it was during their studies at the Polytechnic School of the University of São Paulo that Lucas and Antonio had the initiative to unite, to turn into reality the desire of both to have their own business.

As a first step, they decided to make a commitment to meet periodically to discuss business possibilities. During this period, Antonio worked in a large telecommunications company, while Lucas was in a medium-sized IT company that had begun as a startup – a further stimulus for the entrepreneurial aspirations of the two young students.

“The idea that drove us”, says Antonio, “was dissatisfaction and discontent with the fact of Brazil being only a consumer of imported technologies, when we were sure that the country has the capacity to develop quality technology, with the competitiveness to fight with the international market”.

With this in mind, engineers began to enumerate all the ideas they considered to be transformable into business. With an initial list of 25 ideas, they made a sort of ranking, based on three main criteria: passion, technology and market. “We wanted something that would awaken a passion for work, have a technological component and a clear value proposition, a defined market,” explains Lucas. As it turns out, there was already a method in the process; which explains much of the success of Nexxto.

There were three months until the choice of RFID and another ten months maturing the project, defining what and how they would do it, researching the applications and opportunities for the technology, including cases outside the country, until they decided on the tracking of data processing centers assets.

“We knew that it was a market that was growing at an explosive pace due to the digital demand. More servers, more switches, more connection, broadband Internet coming to people’s homes. Of course, the demand for data center services would not decrease”, says Antonio.

“Also, we already had some knowledge on technology and, regarding capital, we saw that we could put money out of our own pocket and start a business from scratch, unlike, for instance, something that would demand specific people, intensive investment on R&D and a lot of capital, to reach the final consumer”, he adds.

The method also filtered the opportunities for the capital availability and the known difficulties to find investors in the initial stages of the ventures.

The next step was to design the business plan. Throughout this work, Lucas and Antonio had their first contact with Cietec – Center for Innovation, Entrepreneurship and Technology, managing entity of the Incubator of Technological-based Companies of São Paulo, located at the Institute of Nuclear Research (Ipen / USP), which had an open application process to incorporate new companies.

Realizing that the attempt to enter Cietec would be a way to validate their business plan, the young entrepreneurs submitted the project and were approved in October 2010. Over the three phases of the selection



The idea that drove us was dissatisfaction and discontent about Brazil being only a consumer of imported software, when we were sure that the country has the capacity to develop quality technology, with the competitiveness to fight with the international market.

**Antonio Rossini**  
Founder and CEO  
at Nexxto



*The Center for Innovation, Entrepreneurship and Technology - Cietec is a private, non-profit civil association established with the mission of promoting Innovative Entrepreneurship, encouraging the transformation of knowledge into value-added products and services for the market.*

*Throughout its 16 years of existence, Cietec has developed methodologies and expertise in the selection and monitoring of nascent technology-based companies, translated into the systematization of incubation processes, creation and management of innovation habitats and the promotion of activities and support to technological, marketing and administrative management of startups.*

process, the project and the planning were approved with praise. "From then on, we would leave work around 6 or 7 p.m. and go straight to Cietec, where we would only leave at three in the morning, every day", recalls Lucas.

With product and business on paper, it was time to incorporate people who had complementary technical knowledge. It was necessary to make up a team, comprised of specialists in hardware and software development, who had the necessary expertise to carry out the project. Through the incubator, the duo met the Research Program for Innovation in Small Business – Fapesp's Pipe, which supports the execution of technological research in micro-, small- and medium-sized enterprises in the state of São Paulo, to which they submitted a Phase 1 research proposal (intended to technical-scientific feasibility analysis). The proposal was approved, and RFIDEAS received the contribution of BRL 125 thousand.

In January 2011, Matheus Costa, an electrical engineer graduated from Unicamp and software developer, who had been Lucas' co-worker, joined the company and took over the company's R&D department. It was at this moment that all the partners decided to give up their other jobs and dedicate themselves exclusively to RFIDEAS.

That same year, the three partners decided to join their economies and go to the United States to attend an RFID world fair, where they would meet the state of the art and the functioning of the market. "We could confirm that what was being done there, we could do better here", says Antonio. In the luggage, in addition to knowledge, they brought some equipment, such as samples to aid in the developments.

Also during the development phase, an incubator's technology consultant suggested that the company introduce its prototype to Alog Datacenters do Brasil (now Equinix Company), the world's largest data center platform.

According to Antonio and Lucas, this was a watershed for RFIDEAS, as it resulted in partnership, aiming at the preparation and testing of a pilot to automate the management of Alog's assets. "The manager thought it was worth betting on our idea, because he had a huge problem to solve, without any tools to help him", says Antonio.

In this process, RFIDEAS was able to broaden its knowledge on asset management and related issues and thereby adapt and optimize its product to the market.

There were several interactions, until achieving a solution that satisfied all the client's needs. The experience was important to realize that "the success of an innovation in a startup requires you to get on with the work and build your path along the journey", says Lucas.

Alog was the first client to be won over, two years after the founding of RFIDEAS, a defining moment for young entrepreneurs. “It was one of the happiest days of my life because we closed a cycle. After you tell everyone that you were going to bet on that business, leaving your job and everyone saying this would be crazy, after one year just spending money – it was a personal achievement for each one of us”, recalls Antonio.

### Speed record

Named Artis, the product works by attaching tags (which look like labels) with the RFID sensors to the IT equipment, which are then registered to the system.

RFID technology allows the remote reading of tags, wirelessly and with great agility. In a few seconds, it is possible to identify all the equipment in an environment, which allows to monitor each one of them throughout its life cycle, and to determine, point by point, where it has been. It is also possible to set an alarm, which notifies the improper entry or exit of equipment at a location.

Artis is therefore an efficient and simplified alternative to asset management, allowing to abandon the time-consuming and costly inventory that companies need to carry out on a regular basis.

These were the characteristics that led Alog to adopt it in several data centers throughout the country, giving RFIDEAS a very fast business growth. As a consequence, still in 2012, the company became prominent in Cietec, for obtaining the graduation in the shortest incubation time of the Center’s history. Graduation occurs when the company reaches the stage where it is ready to access the market with its technology.

The following year, in January 2013, the company had its proposal for the Pipe-Fapesp’s Phase 2 (which consists of the project development) approved, receiving a second round of investments (approximately BRL 500 thousand). In the same year, RFIDEAS was elected one of the 20 most innovative companies in IT solutions by the ITS – Institute of Software Technology.

Also in 2013, the company participated in **Desafio Brasil**, promoted by Fundação Getúlio Vargas. Competing with more than 1,000 companies, RFIDEAS was elected the second best startup in Brazil in 2013 and the first in the IT segment.

As a reward, the company received consulting hours with SP Ventures (a Brazilian venture capital manager, which invests in technology-based projects with high growth potential), which included four months of coaching, with the purpose of preparing the business to receive investment, capable of enabling its growth.

In early 2014, the partners participated in a two-week immersion in Silicon Valley, California, to meet Brazilian startups established at the technology entrepreneur mecca around the world.

It was at that moment that they realized the data center market was limited, and the company’s growth would depend on the development of other solutions.

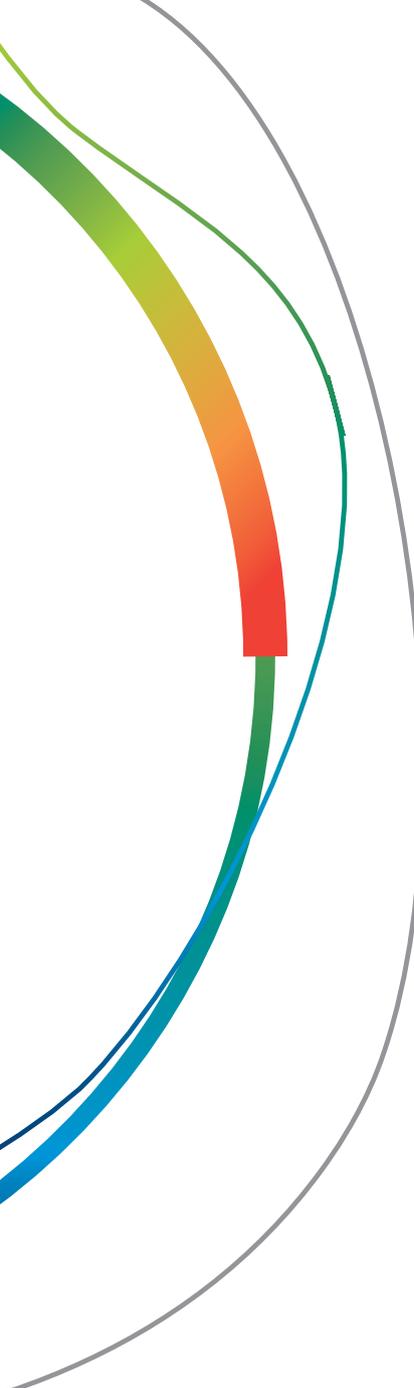


The success of an innovation in a startup requires you to get on and build your path along the journey.

**Lucas Almeida**

Founder and Director of marketing and sales at Nexxt





That was when the Internet of Things was beginning to be talked about, a technology that drew the attention of the RFIDEAS team, causing the partners to return from Silicon Valley with the purpose of actually developing an IoT platform, with 100% domestic technology.

The idea was to move from a solution that exclusively offered registration and tracking to a larger one, that sensed and monitored, in real time, something that could be expanded to other markets, in addition to data centers.

Research into new markets capable of durably sustaining the company growth has led to the identification of food and drug markets as potential customers for temperature and humidity control and monitoring services. For the development of the new product, the company presented the project to investors and got, in 2015, a first round of investments, consolidated in contribution with SP Ventures.

In the same year, the brand RFIDEAS was replaced with the brand Nexxto, expanding the company's operation scope and positioning it as an IoT solution provider. The name Nexxto comes from the junction of the words "Next to", which reflects the mission of bringing people closer to things that matter to them, anywhere, anytime. As is the case with Nexxto sensors.

### **A business with differential**

In Nexxto's history, an outstanding factor is the ease with which the company deals with changes. Whether in business or in the product, optimizations and adaptations are always welcome, perceived as challenges for the strengthening of the company.

This vision is also present in the innovation process within the company, the systematization of which includes taking the product for validation by the customer, before it is ready. This strategy is reflected positively in the evolution of products and in the relationship with the customer, considered a key part of the business model.



The company also maintains a digital marketing team, dedicated to generate relevant content for the retail and draw the attention of potential customers.

After the awareness phase, the next step is to deliver content that demonstrates the company's experience, tied to successful experiences.

In the next stage, when the customer finally decides to use the IoT solution, Nexxto offers consulting services to define a customized project, as well as a demonstration of the expected return due to the use of the new tool.

Once the solution is purchased, the customer pays for the setup, which includes installing the sensors, deploying the system and training the team. From there on, the customer pays a monthly fee for system maintenance, which includes updates and upgrades (such as those resulting from changes in Health Surveillance Agency requirements, for example)

The company maintains a "proactive behavior in customer relationships". Nexxto has an internal "Customer Success" department, the function of which is to be aligned with the customers' expectations, to ensure that they are 100% satisfied. It is important to emphasize that the compensation of the Customer Success team is tied to the customer's satisfaction.

The target audience was defined after a market study, which analyzed the entire value chain of products that require controlled temperatures and humidity: refrigerators, butchers, frozen, logistical transport chain, retail, restaurants.

As a result of this study, Nexxto has identified that the chain elements work with the delivery to the end consumer are the ones most likely to purchase the type of technology that the solution offers.

Thus, customers today belong to three segments of the retail chain: drugstores and perfumeries; supermarkets and wholesalers; and food services, especially restaurant chains of Japanese food, healthy food and fast food.

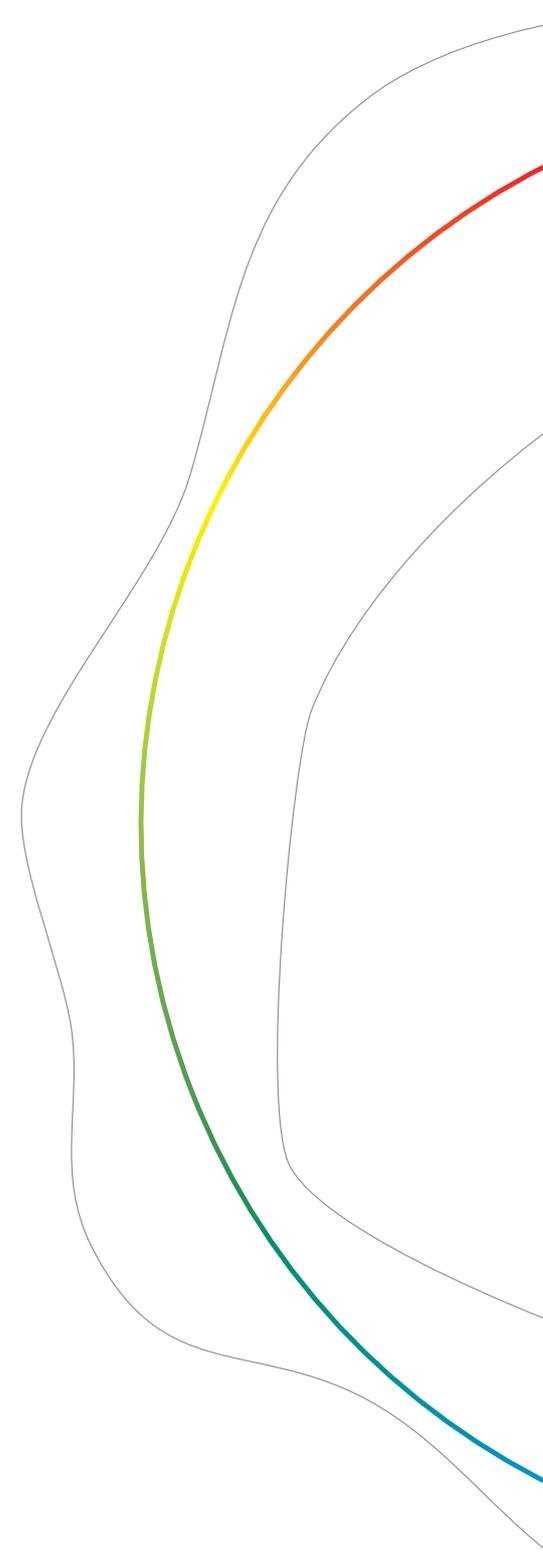
The main differentials of the solution are simplicity and low cost, precisely the parameters defined as fundamental at the beginning of the project.

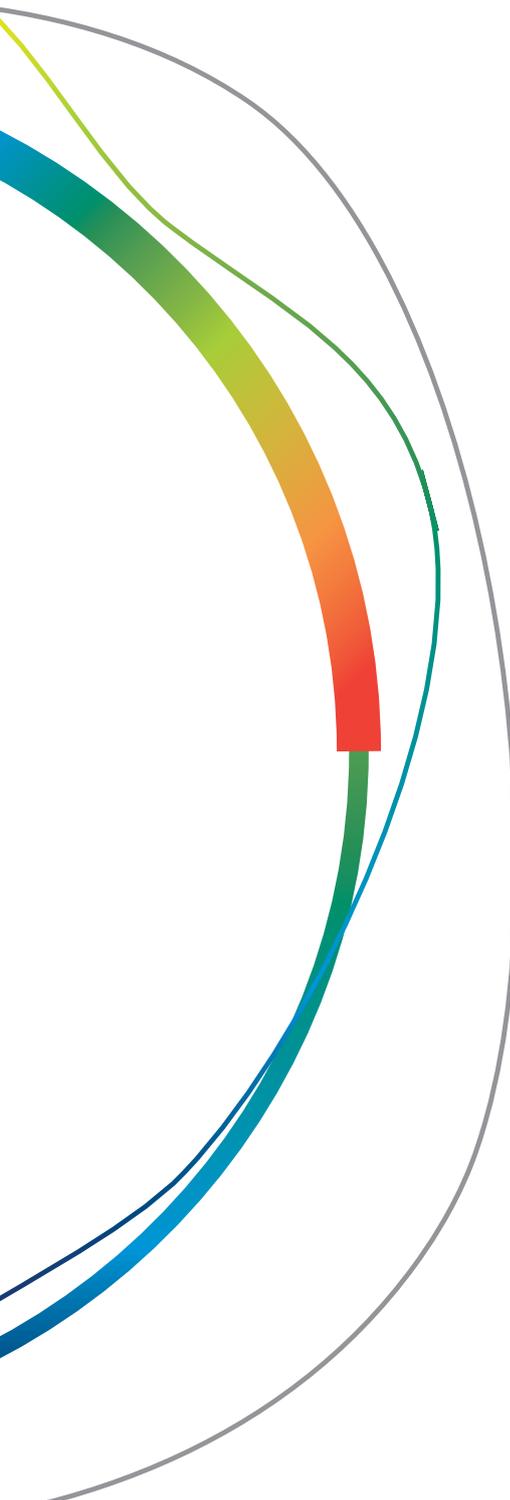
The ease of installation and use puts Nexxto ahead of competitors: the system is plug & play, that is, as soon as it is installed, the product is ready for use. In addition, the cost is also lower, a differential that Nexxto credits to its integration (the company is responsible for both the production of the equipment and the development of the software).

### **Promising start**

Launched in August 2016, Nexxto's humidity and temperature solution has a diversified portfolio of customers, ranging from large food and drug supply chains that operate throughout Brazil – more than ten – to smaller customers, such as snack bars and steak boutiques.

The potential market for the solution defined by Nexxto for its business is very significant: considering only the 300 largest retailers in the three segments in which the company operates today (drugstores and per-





fumeries, supermarkets and wholesalers, and food service), Nexxto estimates that the market is BRL 250 million. A share of this market represents a good prospect of growth for who, in 2016, earned BRL 2.3 million.

In addition to having won customers over quickly, the IoT solution for retail has also brought other results. Nexxto has partnered with Stefanini, one of the most important global providers of technology-based business solutions, to work together to develop differentiated offerings for the IT, Telecommunications, Finance, Industry and Retail markets. In addition, the Nexxto project was one of 10 selected by Accenture to accelerate the introduction of technology to retail.

### Well-defined goal

The trajectory of commercial success and the recognition of Nexxto do not stop there: in 2016, the company was elected the third most promising startup in Brazil by the movement **100 Open Startups** and, in 2017, won the award of small business with higher turnover at the APAS Show fair, the world's largest retail event. Acknowledgments of the utmost importance for who aspires to go ever further.

Currently accounting for over 150,000 equipment managed by its three products, Nexxto has been working to become the largest IoT products and solutions company in Latin America by 2020.

Along the way, one of its strengths is to use the same IoT platform model for other applications. "Today, in addition to the applications for temperature and humidity assets, we have also developed the platform to identify any type of variable. This is a great competitive advantage compared to other solutions in the market, usually limited to a specific application", explains Antonio. Partnerships with Stefanini and Accenture are bets of the company, in order to expand the reach of the business.

Another bet for the future is the use of the data collected by the IoT platform to develop an intelligence that allows to identify trends in equipment malfunctions and to plan preventive maintenance. It's another way to avoid waste and reduce costs.

## State innovation ecosystems

Since its founding, Nexxto has a young and talented team. Today there are 20 people, most of them graduated from the main state universities of São Paulo (USP, Unesp and Unicamp), 40% of them with masters, doctorates or some other type of postgraduate degree.

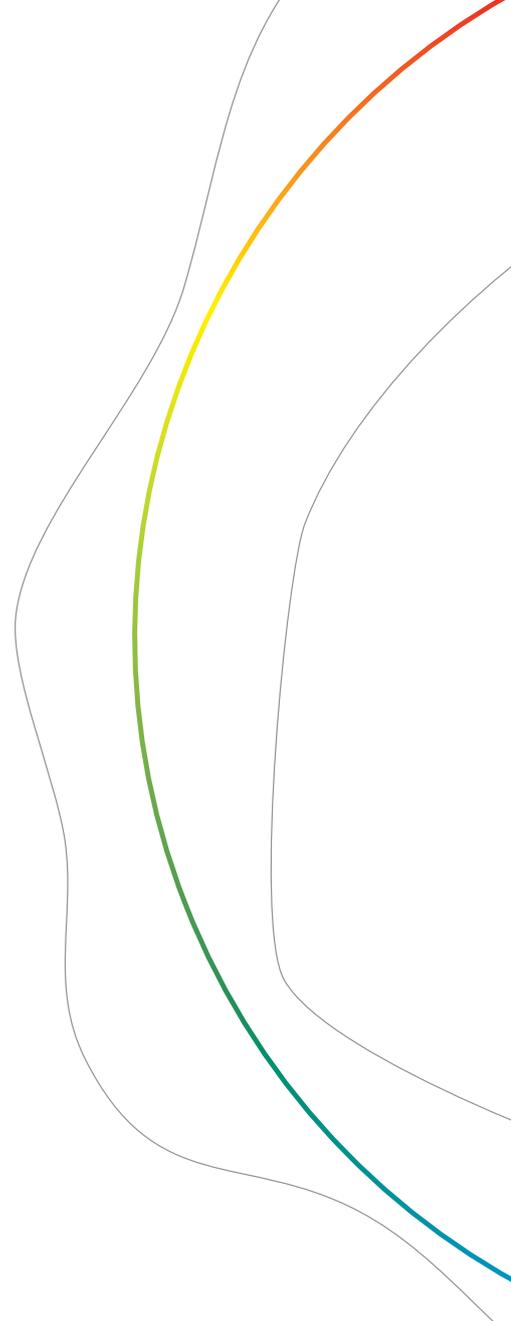
The youth of the Nexxto team – coupled with daring and entrepreneurship – was tempered by the presence of Jose Kleber da Cunha Pinto, a retired professor at the Polytechnic School (USP), a senior scientist with great knowledge on technology, and an enthusiastic collaborator of the project.

Their collaboration can be classified as mentoring, which has helped the research project and business enterprise to gain scientific consistency and foundation by exploiting all the opportunities offered by technology.

Advisor to Lucas at graduation, José Kleber played a prominent role in Fapesp's projects and the trip to the United States, maintaining a relationship very close to that of counselor – both in scientific and technological terms as well as personal.

According to Nexxto's partners, the high education level of the students of the public universities of São Paulo, the support received at Cietec, the financial assistance received from Fapesp, through Pipes, and the investment contribution made by the São Paulo Investment Fund (SP Ventures) have added up and contributed, in a decisive way, so that the São Paulo ecosystem of innovation is a decisive element of the success of the company.

This interpretation stimulates important reflection on innovation ecosystems in the Brazilian states and their role in effectively supporting the birth and establishment of small enterprises, whose business involves innovations with a high technological component.







**preamar**   
GESTÃO COSTEIRA

# SOFTWARE OPTIMIZES SHIP OPERATIONS IN PORTS

- PREAMAR
- Salvador/BA
- Micro-sized enterprise
- 8 Employees
- Product/process innovation
- MEI Agenda: Innovative SME

*The Bahia-based startup Preamar develops a precision meteorological and ocean information system, which allows to eliminate the uncertainties of the port sector, bringing more efficiency and safety*

## **Oceanography allied to computing**

A port management software, which allows to evaluate in advance the risks of each operation of entry and exit of vessels in ports and shipyards, through oceanographic forecasts (current, tide, wave, density) and meteorological forecasts (wind, precipitation and visibility): This is the solution developed by Preamar, a startup based in Salvador – and which has as partners four oceanographers, graduated from the Federal University of Bahia (UFBA).

The system relies on past public domain data (nautical charts, tide tables, meteorological forecasts) to simulate and predict, through mathematical equations, the behavior of the oceans and estuaries, assisting in the planning and decision making of public and private managers.

Preamar's technology differential is to transform complex environmental information into fast-understanding and intuitive data for each user, even if the user does not have advanced modeling and/or oceanography knowledge.

Unlike other weather and ocean information systems, Preamar's *Sistema de Observação e Modelagem Costeira – SOMC* (Coastal Modeling and Observation System) is highly accurate and provides port-specific information. The software is also highly customizable – the user determines which and how information will be presented.

In addition to the modeling, the system has sensors and instruments installed in the port, allowing not only for real-time parameters to be provided, but also for forecasts of up to five days, with precision of minutes and meters.

This type of information is extremely important so that it is possible to carry out maneuvers of ships in the ports, in compliance with the strict norms of the Port Authority, regarding weather and sea for moorings. The more accurate the information, the greater the efficiency and safety of port operations.

## Read and interpret the sky and the sea

The port sector has several players, each of them with needs and interests that can be conflicting. The two main players are, on the one hand, the practitioner, whose priority is safety – which often represents a high economic cost for ship owners – and, on the other hand, the private port, whose main interest is the efficiency of activities – which, in practice, means more ships loaded/unloaded per period.

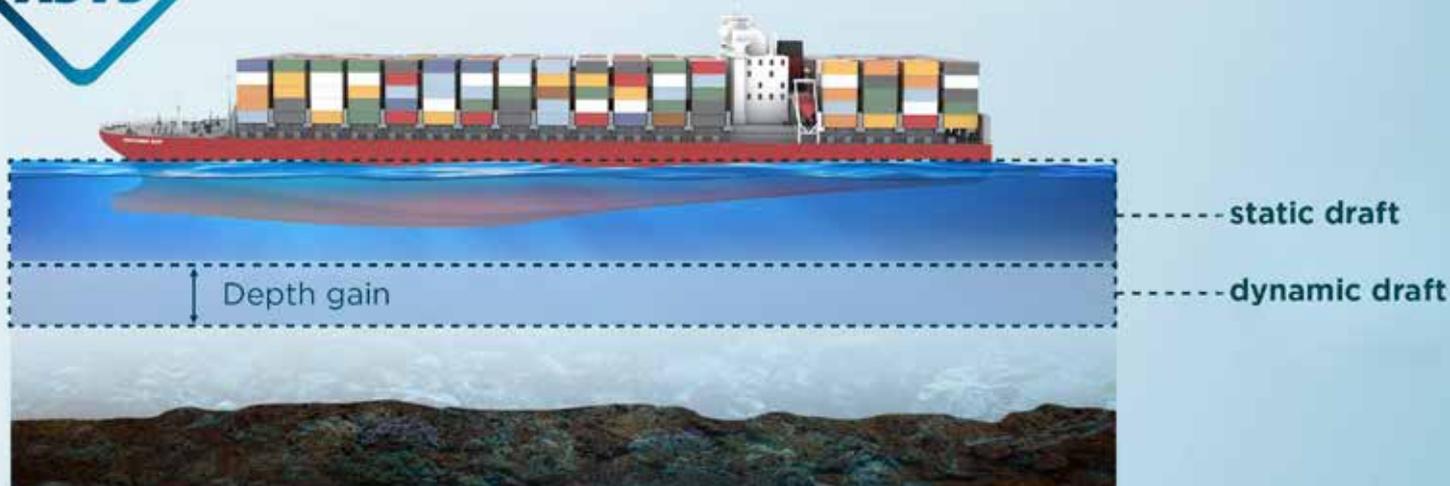
The SOMC design meets these two interests at the same time: ensuring operations with greater efficiency and safety. SOMC is a software that integrates two modules: one for observation and one for forecasting.

The observation module consists of equipment installed in the port area, which provides environmental conditions such as tide, current, wave, winds and precipitation, at the present time. The forecast module uses public data available on a regional scale (data from the National Institute of Meteorology – Inmet, for example) to transform them into information on points within the port using computational tools.

The regional information – with very large dimensional scale – that ports have today is insufficient to ensure safety and efficiency in their operations.

In Salvador, for example, the available weather data is accurate to five kilometers, which means that the expected rainfall can fall at a certain point, five kilometers from there, or at any point in between.

Such information is not meaningful for the port: it requires a specific data of its location, so that it is possible to avoid a stranding or another type of accident. What the Preamar system does computationally resembles zooming with a camera: it increases the accuracy of the data, reducing the grid from 3 km to 30 m.



**The SOMC enables greater loading and navigation safety through accurate data of available depth below the keel.**

**More efficiency and profitability for the port sector.**



The modeling is like a blindfolded person walking on a straight line (..) This means our modeling will never get off the line because every time it tends to get off, the current data shows that it has to come back. This way, the system efficiency reaches 95%.

**Mateus Lima**  
Partner and  
Executive Director  
of Preamar



What makes the SOMC very different and appealing to practitioners and ports is that the system does not only provide the forecast or the information itself but an interpretation of how each parameter impacts the operation.

In other words, it is an artificial intelligence tool, which informs how the wind, tide, current, visibility, wave, precipitation, draft (distance between the base of the ship and the seabed), among other factors, help or hinder the maneuver of each type of ship. In time: each variable impacts each type of ship differently, so that the maneuverability of a container vessel is different from that of a ship carrying automobiles or grains, for example.

These evaluations, offered by the system, are performed through an algorithm developed by Preamar, based on the maneuver simulations and the instructions of each port, to determine whether or not a maneuver is possible.

From a technology point of view, the product is a modeling software, which uses less machine processing than others that do the same type of work in the world. Another differential is that the system works with machine learning. This means that it is self-taught, which makes it possible for a single oceanographer to serve 10 ports simultaneously.

How does that work in practice? The system transforms variables that are difficult to understand when analyzed individually by risk managers. Thus, the user visualizes graphs that indicate the risk, by means of a scale that goes from minimum to high, informing the practitioner or the terminal whether it is possible or not to start the maneuver or to load more or less the ship.

The update of these graphs occurs automatically every 30 minutes. There are also provided graphs, through which it is possible to view what will happen in the coming hours, with forecast information of up to three days in the future. That is, it is possible to verify both what is happening now, and what is yet to come.

System updates are made through topographic maps provided by the terminal. To obtain an operating license, the terminals must present current, wave, and tide studies. This past data is sufficient to feed the model and solve a series of mathematical equations, which forecast the conditions at any time, without any kind of measuring instrument.

Why does the SOMC include the installation of equipment in the port for the acquisition of real-time data? Because real-time data acquisition in the port complements the information and minimizes modeling error.

Mateus Lima, partner at Preamar, explains this concept in a very didactic manner: "Modeling is like a blindfolded person walking on a straight line. With her eyes closed, this person will naturally go off the line and, to walk straight on the line again, it needs to open its eyes a few times. In our case, the model is linear, but nature, which is our data source, is not – it suffers disturbances. Real-time data captures these disturbances, but the model cannot capture them. So we need to transfer these disturbances into the model, by means of statistical sets of equations – equivalent to the opening of the person's eyes walking on the line. This means our modeling will never get off the line because every time it tends to get off, the current data shows that it has to come back. This way, the system efficiency reaches 95%".

**REMO** is a Brazilian effort in physical oceanography and operational oceanography, carried out by a group of researchers, technicians and students associated with universities, research centers and the Brazilian Navy, financed by Petrobras and the National Agency of Petroleum, Natural Gas and Biofuels (ANP). Currently, the Federal University of Rio de Janeiro (UFRJ), the Federal University of Bahia (UFBA), the Center for Hydrography of the Navy (CHM) and Petrobras' Research and Development Center Leopoldo Miguez de Mello (CENPES) are part of REMO. In the period from 2007 to 2011, there was also participation of the Federal University of Rio Grande (FURG), the University of São Paulo (USP) and the Brazilian Navy's Institute of Ocean Studies Almirante Paulo Moreira Sea (IEAPM).

## The marriage between oceanography and computing

How did four young oceanographers create a company based on advanced computer skills?

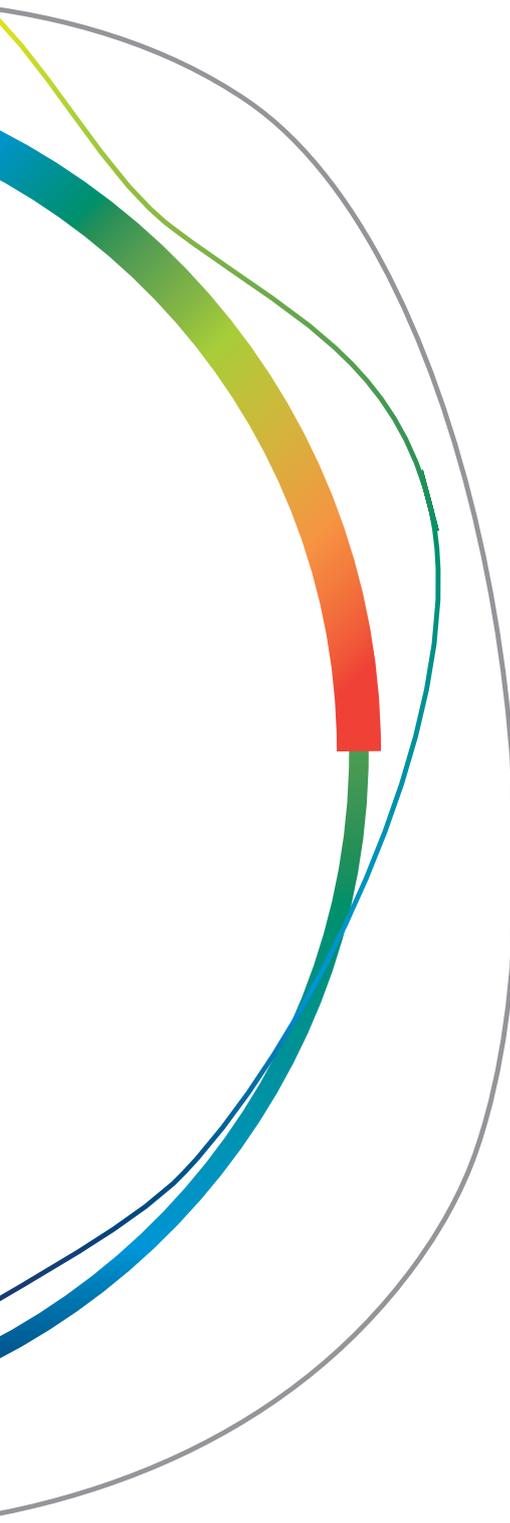
Before turning to this area, the first partners of Preamar, Mateus Lima and Bruno Balbi, at the end of their graduation in oceanography at UFBA, founded Preamar Gestão Costeira in 2013.

This first company was focused on coastal planning, and its business was to offer consulting services, so that Brazilian beaches were able to obtain the international certificate called Blue Flag<sup>1</sup> – something that by then in Brazil, only Jurerê Internacional Beach, in Florianópolis, had achieved (and lost shortly thereafter).

Right in the first client, Preamar managed to obtain, in only six months, the Pilot Flag (prior to the Blue one) – the fastest certification in Brazil – for the Ponta de Nossa Senhora beach, at Ilha dos Frades/BA, which received the Blue Flag one year later.

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<sup>1</sup> The Blue Flag is a yearly award given by the Foundation for Environmental Education (FEE) to beaches (sea and river) and marinas, that meet a set of environmental quality, safety, wellness, support infrastructures, information to users and environmental education requirements. Certified beaches and marinas are authorized to display the flag offered by FEE during the bathing season. The Blue Flag can therefore be considered a symbol of quality assurance for a beach or marina.



Still in the first year of development of this product, when the company still did not have any resources, an opportunity arose for Mateus, already a master student at UFBA. A professor appointed him to carry out a current study at the shipyard of Enseada do Paraguaçu, in Recôncavo Baiano. Even without knowledge in the area, Matthew accepted the challenge, – boldness of born entrepreneurs – already thinking about turning that type of work into a new business for the company.

That was how consulting services to obtain installation licenses, ventures, operation and environmental monitoring became part of Preamar's portfolio.

This new front was important not only to increase the inflow of resources, but also as a starting point for what would become Preamar's third business: operational modeling.

Two works in particular were important in this regard: consulting services for the Paraguaçu Shipyard itself and for the Port of Cabedelo, on the northern coast of Paraíba (a port that is still in the completion phase).

In the first, there were contacts with people responsible for simulations of vessel maneuvers, and in the second, a modeling study was carried out. In both cases, it was possible to identify the absence of environmental data (weather forecasts and oceanographic data) that accurately informed the risk of navigation and could increase the efficiency of the ports regarding loading.

This led to the idea of developing an oceanographic forecasting and information system based on operational modeling that would provide more accurate local data to reduce operations risks.

By this time, Preamar had already incorporated two more partners, Davi Mignac and Rafael Santana, both also oceanographers and with previous experience in REMO – Oceanographic Modeling and Observation Network, an institution that made Brazil able to make operational modeling of this nature.

The knowledge acquired, resulting from working together with IT professionals, included knowledge on implementing computer codes, with physical and oceanographic equations and less machine use.

This knowledge was decisive for the Preamar system to have lower computational cost, an important differential. The computational cost is directly associated with the number of information inserted in the model, requiring increasing computational power, and, consequently, increasing the final cost of the tool. "Today we use a machine with 33 processors. If we used the original model, we would need a machine with 126 processors. That is, our codes made the model more efficient and with a lower cost", explains Matthew.

The union of the four partners brought, therefore, a convergence of skills and profiles that were complemented, fundamental factors for the design of the project. They only needed to turn the idea into a business.

## Listening to the customer gave rise to innovation

The first step was to incubate the company at SENAI CIMATEC. Incubation was important in several respects; from the fund-raising to the realization of mentoring, crucial for the design of the business model. The project was awarded in 2014 with BRL 50 thousand for the purchase of machinery, in an announcement by Fapesb – Foundation for Research Support of the State of Bahia and with BRL77 thousand in the announcement by Sebraetec Diferenciação for the development of Dashboard, supported by SENAI CIMATEC's software department.

The advice that would change the product format and would become the main differential of the Preamar team came from a mentor. Bruno says that he approached the mentor and proudly showed him a letter of interest for the project, signed by a practitioner from Salvador. "We believed that would validate our idea. That was when he said: "I am interested in buying a Ferrari, but I do not have the money to buy a Ferrari. So, you did not validate anything. Go out there and validate it". This letdown was good to awaken the need to listen to potential customers and understand their expectations and interests.

The place chosen for the first direct contact with the target audience was Intermodal, in the city of São Paulo, the largest event in the Americas for the logistics, freight and foreign trade sectors.

There, after several unsuccessful attempts to introduce an "environmental monitoring tool" for ports, Preamar's creators had the insight that would shape SOMC. "When we talked about having a forecasting operating system to do environmental monitoring of the port, the person would turn around and leave. After the third attempt, we realized we were saying something wrong", says Mateus. "We then tried to say that we had a risk measurement system for each operation. Then they showed interest".

The experience of approaching the end consumer showed what was the key to the project success: the customer did not want the raw environmental data, what he really needed was a risk assessment that would help him in the decision making. "We realized that the important thing was to make the operational modeling easy for the decision maker", Bruno summarizes.

From there on, the modeling was reformulated to provide information capable of generating risk reduction, in addition to allowing the easy understanding of how each variable influences the navigation.

For this, it was necessary to develop a means to make this information available, with adaptations for each type of ship, something that did not exist in any other tool of its kind until then. In summary: the customers were the ones who, in fact, turned Preamar's product into an innovation.

**SENAI CIMATEC** focuses on Research and Innovation for the development of the industry. It has a singular performance, for integrating the processes of research and innovation of a Technology Center to the scientific and academic research of a Faculty of Technology. In addition to extensive experience in the execution of projects of various magnitudes and complexities, SENAI CIMATEC stands out in its the conduction of Research, Development and Innovation (RD&I), in partnerships with national and international companies and institutions, totaling more than BRL 180 million in project funds and high intellectual property indicators, with more than 60 patents filed.

## What does the customer get?

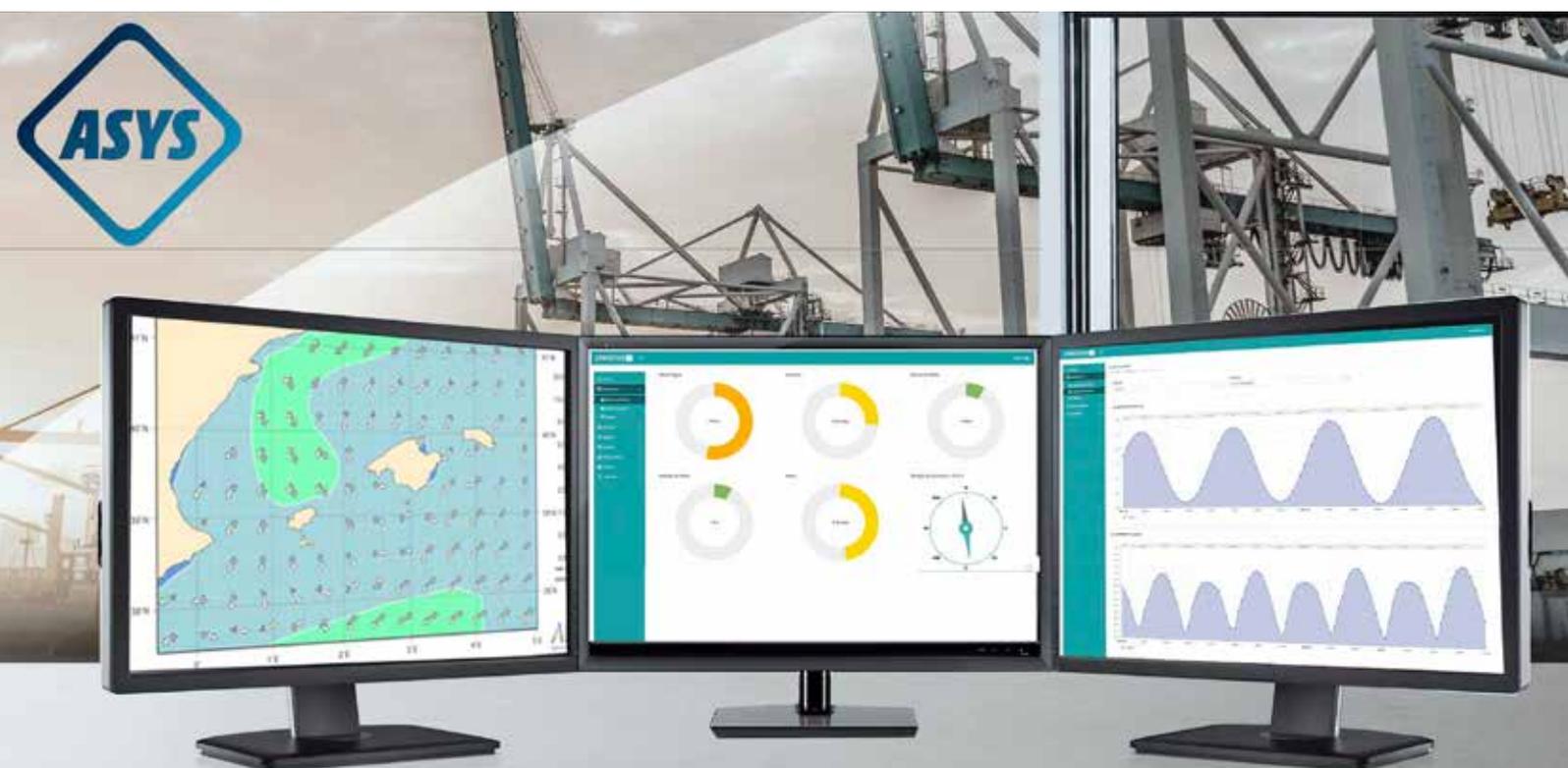
The system provided to customers consists of two modules: devices and technology.

The devices are 'wave-graphic' (devices that measure the height and frequency of waves), current meters (instruments used to calculate the speed of water flow at different depths and verticals), tide gauges (instruments that record the flow and ebb of tides), rain gauges (instruments that measure the amount of rainfall) and anemometers (devices that measure wind speed). These devices, installed in the port, remain property of Preamar, and their cost is included in the monthly fees charged, depending on the different plans offered.

The technology module concerns access to information, which includes weather and sea reports and risk analysis, all presented in a simple and self-explanatory dashboard.

The equipment and the access to the information vary, according to the plan chosen by the customer. There are three plans – basic, plus and premium – with different monthly charges. The plans differ in functionality within the system: oceanographic and meteorological forecasts (two to five days), number of users, types of vessels (from five to unlimited), number of monthly alerts (from one to unlimited) and database period (from one month to unlimited).

Also, only the premium plan provides 24-hour support and monthly reports, in addition to being customizable, that is, the customer can create new monitoring charts with available information and/or change existing risk parameters.



Currently, the company is also validating the system of charging per ship, aimed at smaller ports, for which it would be financially impossible to hire even the basic plan.

The system needs a six-month period to be installed and achieve 95% accuracy, time required to perform the complete diagnosis, which includes understanding how the operation works, preparing the model, preparing the data grid, understanding the local dynamics and inputting the port parameters into the system.

### **The impact of oceanographic modeling**

An important approach to sales is to maximize the gains, in several aspects, including the greater efficiency that the operations provided by SOMC can bring to those involved.

Standing ships represent sky-high cost – depending on cargo, a dead ship can cost USD 80 thousand per day! An interruption of the Itajaí channel (which is closed, on average, 10% of the year due to the weather) generates a loss of BRL 4 million per day, only for one of the customers.

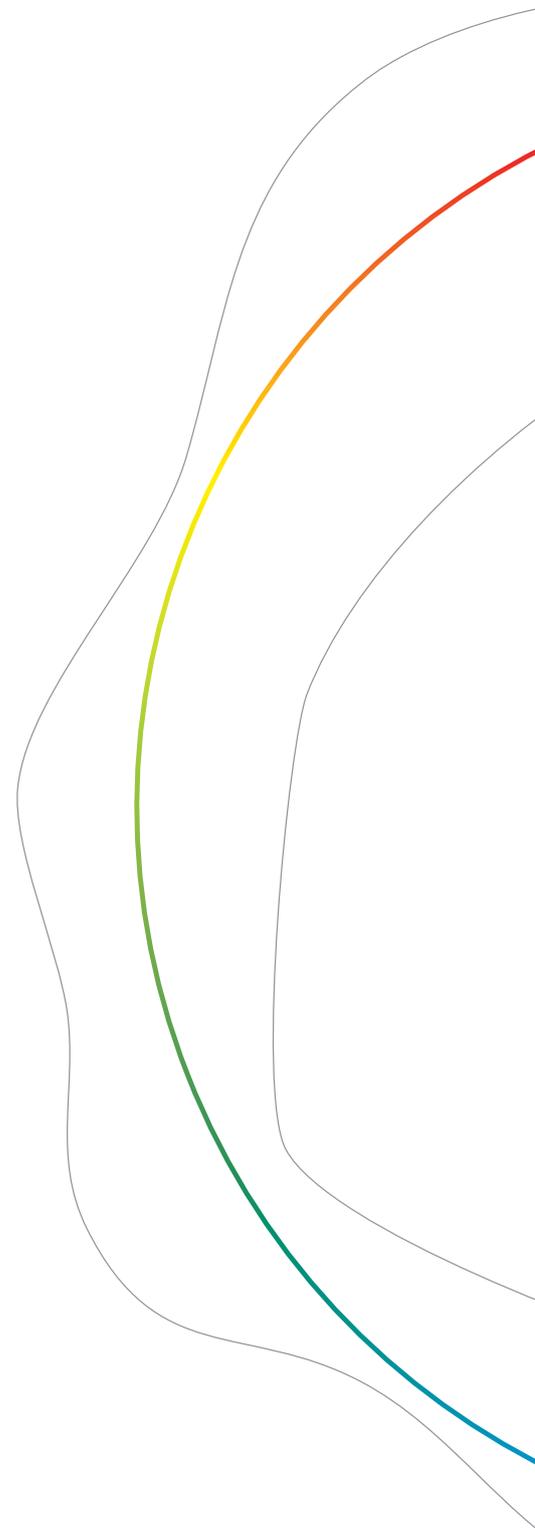
In Brazil, ports are closed on average for 14 days every year (at some of them, such as Itajai and Salvador, this number can rise to as much as 35 days), a period of time that SOMC, by providing the adequate variables for the risk management, can reduce.

The system also helps in the optimization of labor. The ports need to hire dockers, who only work when it does not rain. Today they do this hiring planning through websites, which provide global forecasts that are inefficient for specific areas. It is not uncommon for the port to hire dockers, based on no-rain forecast, and lose money for it. SOMC's 95% efficiency for local forecasts has the potential to substantially reduce this problem.

Predictions are also extremely important for the safety of operations, where errors can mean high costs. In Brazil alone, BRL 276 million were spent on five claims in 2015, three of them due to poor weather conditions, which were not properly evaluated. At the Babitonga bay alone, in the south of the country, BRL 65 million were paid in indemnities.

One last – but not least – positive aspect of the use of Preamar system is the improvement in the communication between the stakeholders: while the practitioner wants safety, the port wants efficiency. Therefore, each one has their way to evaluate what is a “bad weather” day.

The SOMC allows to unify the concepts, establishing the same “bad weather” for everyone. In fact, everybody wins with the use of the system: the practitioner, who can perform more maneuvers (the remuneration of a practitioner is made per maneuver), and the port, which may bring more ships.





Today, the practitioner's work resembles maneuvering a car in a dark garage, knowing only the car's AutoCAD design. What Preamar offers today is a light for the garage. For the future, the idea is, in addition to turning on the light, to allow the practitioner to be able to choose the parking spot and to know exactly how much load he can put on the vehicle.

**Mateus Lima**  
Partner and  
Executive director  
at Preamar



### Proving efficiency

Preamar's Coastal Modeling and Observation System has been in operation since July 2016 in Todos os Santos Bay, at some terminals in the port of Salvador. The system was made available for free for a six-month period for customer validation. Throughout this period, Preamar provided monthly reports and weather alerts, both for ports and ship-owners and for practitioners.

At the Cotegipe terminal, inside the Todos os Santos Bay, the use of SOMC allowed to reduce ship waiting time by 53%, which represents, in each harvest, at least USD 2 million.

### Promising horizons

The potential market for Preamar is very large, and the tide seems to be favorable. In Brazil, there are 360 ports and, in the world, approximately 8,000, 10% of which are controlled by only 10 companies.

There is no system in the world that, in addition to providing local information, makes the necessary adaptations for each type of ship, as SOMC does. Because of this, the Preamar's idea is to make a strong validation with domestic customers, and later expand its international coverage.

At the domestic level, the business plan foresees the completion of two more sales in 2017 and another four as from 2018, the internationalization movement is expected to be in place after 2018.

The company has also been considering several investment models. The participation in Criatec is also studied, as well as the partnership with other venture capital funds. Also, two angel investors were interested in the business.

The purpose of raising funds goes well beyond the business growth. The idea is to continue to improve the tool, so that in the future it can be turned into what partners call "Waze of the oceans", in reference to the automotive guidance application available for mobile devices.

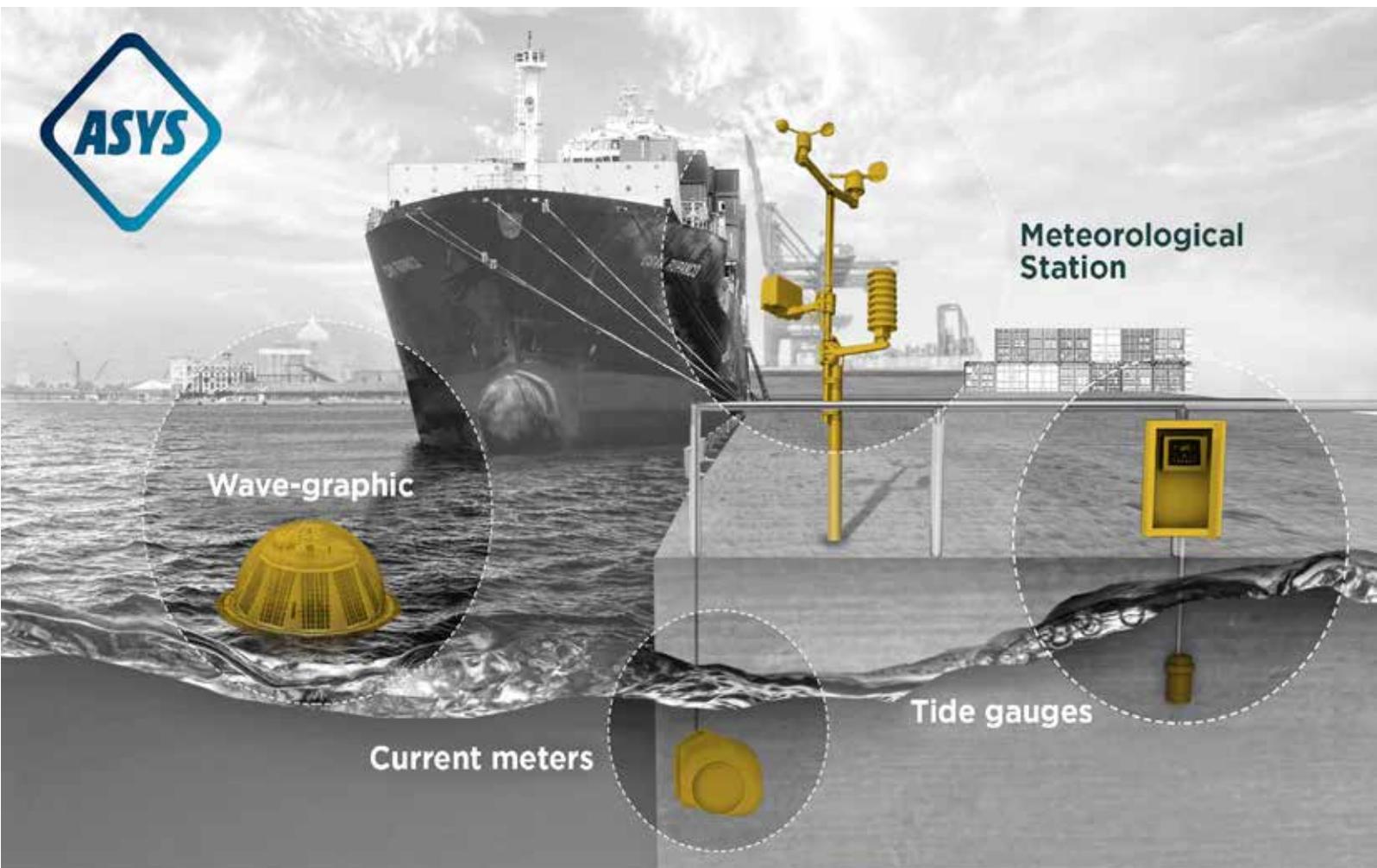
In Mateus' words "Today, the practitioner's work resembles maneuvering a car in a dark garage, knowing only the car's AutoCAD design. What Preamar offers today is a light for the garage. For the future, the idea is, in addition to turning on the light, to allow the practitioner to be able to choose the parking spot and to know exactly how much load he can put on the vehicle".

### Importance of STIs for startups such as Preamar

Preamar is a startup that, even with a short time of existence, has already undergone two market repositioning: it was born with a focus on tourism (Blue Flag certification), complemented the business with the provision of environmental consulting services, through which it identified a market gap that motivated the creation of an innovative tool capable of positioning it as a solution provider for risk management in port operations.

Throughout this process of maturation, the company went through an incubation period considered to be determinant for business design, technology development and fund-raising to enable the creation of the innovative product.

The case of Preamar is further proof of the importance of the insertion of nascent technology-based companies in the innovation ecosystems and the strengthening of the STIs – Science and Technology Institutions.







**Precon**<sup>®</sup>  
ENGENHARIA

# A BUILDING FACTORY – INNOVATION AND SUSTAINABILITY IN CONSTRUCTION

- PRECON ENGENHARIA
- Belo Horizonte/MG
- Medium-sized enterprise
- 1000 Employees
- Product/process innovation
- MEI Agenda: Regulatory Framework for Innovation

*Based on the production model of the automobile industry, Precon Engenharia reinvents the production process of prefabricated residential buildings*

## Assembly line of buildings

With more than 50 years of experience in the field of prefabricated concrete, Precon Engenharia has developed an innovative and sustainable system for the construction of buildings. The design of SHP – Precon Housing Solution – was based on the automobile industry production model, in which the same “chassis” – a company jargon – is produced and can be used to build different buildings.

The solution allows you to assemble – that’s right: assemble – eight-story buildings with 32 apartments over a 30-day period, with the work of only eight men, reducing construction time by half.

In addition, the process generates 85% less waste: for each two-bedroom apartment; with 47m<sup>2</sup> area, the reduction is 6 tons. According to Precon Engenharia, this means that if all the buildings in phase 3 of the Minha Casa Minha Vida program were built using SHP technology, the amount of rubble that would need not be produced could fill a row of bucket-trucks that would turn one and a half times around the planet!

## How does it work?

From the outset, the idea was to develop a housing-oriented construction system capable of reducing construction time and labor costs, lower environmental impact and greater predictability – standardization and serial production allow to determine in advance the amount of material that will be used and the exact cost of each apartment. These are exactly the fundamental principles of SHP: standardization and serial production.

In order to make a “buildings factory” possible, an extensive study was carried out on the municipal legislations of all the cities of Minas Gerais with more than 150,000 inhabitants, from which a unique plant was created, which allows to construct buildings of four or more floors, in any city of the state.

Thus, it is possible to work with a basic structure – the chassis of the building – and change parameters such as height, finishes, common areas and other peculiarities of each project.

While the “chassis” are the panels, pillars, beams and slabs produced at the factory, the panels are standardized walls, composed of a concrete armor, to support the entire assembly and enable transportation.

These walls are filled with ceramic brick, material chosen to give greater thermal and acoustic comfort. In order to favor productivity and non-generation of waste, only whole bricks or half-bricks are used, according to the standard of modular construction, with fixed thickness and dimensions, all placed on the wall in a vertical position, which makes it possible to carry out the electrical installation without the need to break them.

Called panels by Precon Engenharia's team, the prefabricated walls leave the factory with frames, claddings and built-in installations, ready to receive electrical and hydraulic installation – something that was only commercially feasible thanks to standardization.

The electrical installation in apartments does not take more than 30 minutes, thanks to the use of standardized whips, as in the industries of the white line. For this concept to be made viable, it was necessary to prove to suppliers that all ventures would have the same dimensions, unlike conventional constructions, where whip measurements cannot be standardized.

This means that Precon Engenharia buys lots of 5,000 whips, all identical, without any need for a return, which represents a great advantage for the supplier, who currently owns an assembly line dedicated to Precon Engenharia.

Hydraulics followed a similar logic. Inspired by high-standard international prefabrication projects, with reference mainly to Germany and Japan, it was decided to work with a flexible pipeline made of a material





called PEX (polyethylene chlorination), more resistant to oxidation and to the fire than PVC.

Despite being a more expensive material, the bulk economy counted in favor of the supplier and Precon Engenharia, that purchases products of standard dimensions in large quantities.

But how do the panels fit into the work? How, after all, does the construction of a building work with SHP? As in any other construction, the ground and foundation are first prepared and then the “chassis” is produced at the factory.

From then on, the pillars, beams, slabs and panels are transported and assembled at the construction site, in parallel with the electric and hydraulic installation kits, preprepared at the Precon Engenharia distribution center. The final step consists of the finishing (floor, tiles, painting).

The final product, the building itself, is identical to a building manufactured in conventional way, but with the advantage that all rooms have exactly the same dimensions in all units. “From the outside, it is not possible to identify that the building was constructed differently. It is a brick wall, it is a concrete pillar. Inside, if the resident wants to remove an entire wall, he can do it and gets an open space, without harming the structure of the building”, explains Marcelo Miranda, CEO of Precon Engenharia.

## The challenge of industrialization in construction

By describing the stages like this may seem very simple, but it was necessary to overcome a series of technological challenges until reaching the complete solution, both in the design of the structure and in the definition of the operation.

In Marcelo Miranda's words, "to imagine on paper that you want to make a Lego factory, an assembly toy, it's easy. But to do this, in real scale, is very different, deciding what the ideal model of parts, how to assemble. Then, even discovering that I want to make a wall like this, a door with such components, how do I produce it in an industrial factory, within the budget?".

Industrialization has always been the path chosen by Precon Engenharia. Fifty-three years ago, when engineer Milton Vianna Dias decided to create his company, the choice of prefabricated products met the desire to do something different and innovative. Precon Engenharia (acronym for prefabricated concrete) was responsible for the production of the first prefabricated prestressed concrete in Minas Gerais.

Since then, the company has become a regional leader in this market and today it is present in the entire national territory, carrying out, on request, any type of large work, both of infrastructure and commercial or industrial: bridges, highways and shopping centers, meeting the demands of companies from various sectors, such as construction, mining, oil and gas.

The idea of developing an assembly line of buildings, following the typical concepts of industries such as the automobile, was an old dream that only came out of the drawer in the early 1990s when the company began to study an industrialized solution for the housing market.

The option for the residential niche started from the perception that, in Brazil, this sector of the civil construction was still very handmade, unlike the commercial and industrial sectors – a reality that persists until today. "The highest standard building today, whether in São Paulo or Rio de Janeiro, is still built brick by brick: you lay the brick, apply the mass, break, apply the mass, break, builds the wall by hand, then settle the mass by hand..", says Marcelo.

The research and development process began with the study of materials and construction systems, which could be used more efficiently in construction.

Over the course of two decades, several tests were performed and several prototypes were built using different types of materials and layouts. There were tested, for example, systems for buildings with metal structure, self-supporting walls, concrete walls and CCA (autoclaved cellular concrete) blocks.



We already do a lot for the commercial and industrial sectors, but for the residential sector, here in Brazil, things are still very handmade. The highest standard building today, whether in São Paulo or Rio de Janeiro, is still built brick by brick...

**Marcelo Miranda**  
CEO at Precon  
Engenharia





The responsible team was composed by the company's own engineers, who dedicated their free time to the project. "We separated one corner of our factory for the tests, but there was no staff permanently dedicated to this project. We reunite, we have ideas and we test them. We built and demolished several times, always believing that it was possible to turn the dream into reality", says Bruno Dias, shareholder of the company that has run the project since its initial stages, along with his father, founder of Precon Engenharia.

Crucial points to evaluate each of the trials were, in addition to cost and quality, raw material availability, feasibility of standardization, ease and speed of assembly and reduction of waste.

Sustainability is an important value for Precon Engenharia, and the environmental impact, generated by construction, is an old nuisance within the company. "We are an industry that, despite corresponding to 10 to 15% of world GDP in the good moments, with economic and social benefits, deposits 30% of all waste and consumes more than 40% of raw materials", says Marcelo Miranda.

Thus, after several failed attempts, many tests and many calculations, in 2010 a prototype was finally built – still within the factory – with technical and economic feasibility and sustainability differentials.

Performance tests and final validation tests were then performed at the laboratories of the Federal University of Minas Gerais – UFMG and of the Falcão Bauer Institute. The prototype was approved in all of them. A patent was then filed with INPI – National Institute of Industrial Property, contemplating the manufacturing and assembly process and the hydraulic and electric sealing solutions.

The next step was to make the first full scale building to test consumer acceptance. The positive result started the project, which would promote not only the entry of Precon Engenharia into a new market niche, but also a restructuring of the company itself and the business.

### **The boldness of facing the risk of innovating**

When the company decided to transform its research, in 2010, civil engineer Marcelo Miranda, with extensive experience in large residential construction companies, joined the development team, with the mission of transforming the project into a business, together with four other executives of his trust.

It took six months of work so that, by adding the results of the team to the ideas brought by Marcelo, the prototype was made feasible. At that moment, the company management, composed by the founder and his sons, decided to create a new company within the Group, Precon Engenharia, to enter the residential niche through SHP, focused on innovation.

As part of this strategy, the board stepped away from the company management, managing the board of directors and the business, including the construction of the factory, of which Marcelo was in charge, as CEO at Precon Engenharia.

It is worth noting the boldness – a fundamental characteristic of entrepreneurs – to take the risk of repositioning themselves in the market, based on a process of extremely disruptive nature, which represented, besides the change from a handmade system to the industrial system, the option to redesign the business, by allocating an executive as a manager, all in an extremely traditional sector.

It is noteworthy, however, that Marcelo's choice was not mere chance. Since the early 2000s, when the then president of the Precon Group met Marcelo at industry events, Bruno identified the executive with an innovative profile, realizing that his discomfort with the status quo would be the "spice" that was missing to transform the buildings industry project into business. "We had the industry blood, but we did not have that of construction company – exactly what Marcelo would bring us", says Bruno. It was necessary, however, to wait for the right moment to bring Marcelo into the team. "It was no use having the right person without a product he could sell," says Bruno.

Marcelo is an engineer graduated from UFMG and has an executive career, developed in large civil construction companies, having worked in the areas of finance, business development and general administration.

In addition to professional experience, the engineer has in his curriculum several specialization courses abroad, in prestigious institutions such as Harvard, Stanford, Columbia, as well as an innovation course at Singularity University. For Marcelo, "it was fundamental to study abroad, where the culture of entrepreneurship is much more widespread than in Brazil. Abroad, people believe they can transform the world and they think big to do this".

And thinking big is a characteristic of Marcelo's profile. With the dream of transforming construction in Brazil, he has always been bothered by the fact that Brazilian companies do not think of innovation. "I spent a period in the United States studying to try to understand how technology companies, the startups from the Silicon Valley were able to do processes of innovation and product launch. I wanted to understand why Brazilian companies, especially those in the construction industry, had so much difficulty working with innovation and technology", he says. The idea was to bring a set of management actions, which could be put into practice to break this barrier.

And it worked. Marcelo brought to Precon Engenharia the concepts he had learned and not only did he transform the "buildings factory" into a successful business, he gradually promoted a deep culture change in the company, focusing on the mission of transforming the construction industry, through innovation and sustainability.



Abroad, people believe they can transform the world and they think big to do this.

**Marcelo Miranda**  
CEO at Precon  
Engenharia



**Singularity University** was founded in 2009 in California by Peter Diamandis, a leading North-American engineer and entrepreneur, and by Ray Kurzweil, inventor, one of the largest artificial intelligence gurus and engineering director at Google. Among the companies supporting the institution are Google itself, as well as Nokia, Kauffman and Cisco.

*The institution's focus is to transform people and organizations, equipping them with the skills and knowledge needed to cope with major global dilemmas.*



The culture of innovation has become the main asset of Precon Engenharia. The culture is more important than the idea.

**Marcelo Miranda**  
CEO at Precon  
Engenharia



## Change in internal culture

Transforming a traditional, family-owned company into an innovative company was a challenge that was gradually overcome. "It was necessary to create a purpose, a meaning for innovation within the company," says Marcelo, aware that it is necessary to engage people so that everyone participates.

The main elements "imported" from the Silicon Valley were experimentation, tolerance to error, the segmentation of innovation into small projects, so that people's "isolated" knowledge could be harnessed, and everyone felt to be significant elements for innovation.

The so-called innovation cycles were also created, through which the activities of each project are divided into small cycles of 15 to 20 days, so that the team can be gathered and celebrate the small advances and successes. According to Marcelo, "actions may seem simple, but they are far from the reality of traditional construction companies".

The culture of experimentation, for example, runs counter to the operation mode of the construction industry in Brazil, used to plastered planning, that makes the time required for a launch very long – sometimes years.

The idea of experimenting can drastically reduce this time. Thus, each new project is immediately tested and, if it does not work, "we knock it down, go back to the drawing board and then do it again, until it improves", says Marcelo.

However, in order for the culture of experimentation to effectively increase the speed of development, one must also implement the culture of acceptance of error, that is, people cannot be afraid of making mistakes. Throughout the SHP development, many mistakes have been made. Strategy errors, material errors, calculation errors. The sum of them all was very important for the creation of a team accustomed to make mistakes, to learn from mistakes and to work with more agility.

Of course, this is not so easy to do. If, on the one hand, the planning cycles were shortened and the experimentation was accelerated by the culture of error tolerance, on the other hand, it was necessary to accept the costs that errors can sometimes bring.

Marcelo explains that it is necessary to convince leaders to let their employees act, even when they believe it will go wrong. "I cannot tell him not to do it, otherwise he will not learn and it will not do the right thing", says Marcelo. "Besides, leaders are not always right. Many times, I thought something would go wrong, and it worked, changing very important processes", he says.

Another important element that was very effective in the engagement of the people was the "hackathons" (innovation weeks), called *Semana i9* at Precon.

In these events, lasting an entire week, the whole company stops activities to think about innovative solutions. From factory floor and work floor to management, everyone participates. The objective is to encourage participants to present innovative projects and ideas capable of increas-

ing productivity, with direct impacts on cost reduction, process optimization, reduction deadlines and reduced consumption of resources.

In the latest edition of *Semana i9*, more than 40 innovation projects were approved and implemented, generating productivity gains in several processes.

### The business

The culture of innovation has become the main asset of Precon Engenharia. In Marcelo's words, "the culture is more important than the idea. If the idea is bad, culture will fix it". SHP's business model itself is an example of this. The initial idea was to sell the solution to construction companies, but it was soon identified that this would be impracticable. Each construction company has dozens of different designs and to serve them all it would be necessary to change the setup so many times that the factory would no longer be productive. Therefore, the strategy was revised: to use industrialization in a more perennial and complete way, it was necessary to have control from start to finish, that is, it was necessary to verticalize the business and sell to the final customer.

This way, Precon Engenharia, which until then did not even operate in the residential sector, became responsible for all phases of the process/cycle of the building, from the selection and purchase of the land, legalization, approval of projects and licenses, construction (with the industrialized solution SHP) of the building and commercialization, to the delivery of the property to the resident.

All SHP apartments have the same floor plan, the same quality standard and are part of the Federal Government's **Minha Casa, Minha Vida** Program.

They are buildings with four apartments per floor, all with lift and accessibility for people with special needs, something that makes them superior to those offered by competition.



During the execution of the project, four standards of apartments were created: two bedrooms, two bedrooms with a suite, three bedrooms and four bedrooms. The first apartment to be launched was the two-bedroom apartment, with 47m<sup>2</sup>. The acceptance and sales results were so positive that, to this day, it is the only one to be produced.

### Five times in five years

This is the growth factor that SHP has provided to Precon Engenharia's revenues since the launch of the first real estate development in 2011 – currently SHP accounts for 70% of the company's revenues!

Only in 2015, when the construction industry in the country registered a drop of almost 10%, according to the IBGE, Precon Engenharia's revenues jumped 20% compared to the previous period.

So far, almost 4,000 apartments have been delivered, and another 2,500 are under construction, all in Minas Gerais. The forecast, starting in 2017, is to launch 2,000 apartments per year.

The final cost of the work is the same as a standard building constructed in a conventional manner, and the implementation of an innovation cycle is being planned in partnership with Finep, which will reduce the total cost of the work by 5%.

SHP's main gains from traditional construction are cost predictability and reduced execution time – SHP has a 100% higher productivity, that is, properties built in half the time, with significant reduction of manpower at the construction site.

And talking about construction site and manpower, the incredible 85% reduction in waste generation, achieved by SHP, earned several awards and certifications of sustainability.



- *First company in the Minha Casa Minha Vida (MCMV) model to obtain the Blue Seal of Sustainability by Caixa Econômica Federal, which evaluates the projects through strict sustainability criteria.*
- *SINAT | DATEC Certification, provided by the National System of Technical Approvals and Level A SiAC (Conformity Assessment System for Civil Construction Services and Works Companies) of the Brazilian Program for Housing Quality and Productivity (PBQP-H), both approved by the Ministry of Cities.*
- *Level III ABCIC Seal of Excellence, quality stamp of the Brazilian Association for Industrialized Construction of Concrete.*
- *2013: winner of the Ethos Institute Award in the category of Sustainable Business Cases.*
- *2014: third place in the Building Systems category of the CBIC Innovation and Sustainability Award, initiative of the Brazilian Chamber of Construction Industry, through its Committee on Materials, Technology, Quality and Productivity.*
- *2015: Precon Engenharia entered the Benchmarking Brazil ranking of organizations that have the best sustainability practices in the country.*
- *2016: highlighted as the most sustainable company in Brazil in the civil construction segment by Guia Exame de Sustentabilidade 2016. First place in sustainable product category by Sustentar (2015 and 2016), and for the fifth consecutive year, it was one of the winners of the ECHO Award, by AMCHAM, the country's most traditional business sustainability award.*

## Reaping good results and building the future

In addition to the awards, the positive effects generated by SHP also brought recognition to Precon Engenharia.

In 2016, the company was nominated as one of the 150 best companies to work in the country by Guia Você S/A, with the first place among the construction companies and the third in the construction segment, and in 2015, Precon was elected by Great Place of Work (GPTW) as the fourth best company to work in Minas Gerais.

CEO Marcelo Miranda was elected by Ernst Young as the entrepreneur of the year 2015, in the sustainability category, being included by Forbes magazine in the ranking of the 10 successful CEOs in Brazil, under 40 years of age.

In order to continue on this success trajectory, Precon Engenharia will maintain its investments in new sustainable technologies, to increase even more efficiency, control costs and deadlines and offer greater comfort to the customer.

In 2016, the company made a major investment in its physical structure, doubling the productive capacity of the factory park and acquiring new machines and equipment.

The expansion to other Brazilian states is another important topic in strategic planning. To prepare for this growth, the company has been investing, in the last three years, in training people, offering qualification programs and leadership training. Also underway is a project in partnership with Finep, which includes an investment of around BRL 25 million between 2016 and 2018.

### Quality seals in technology and management

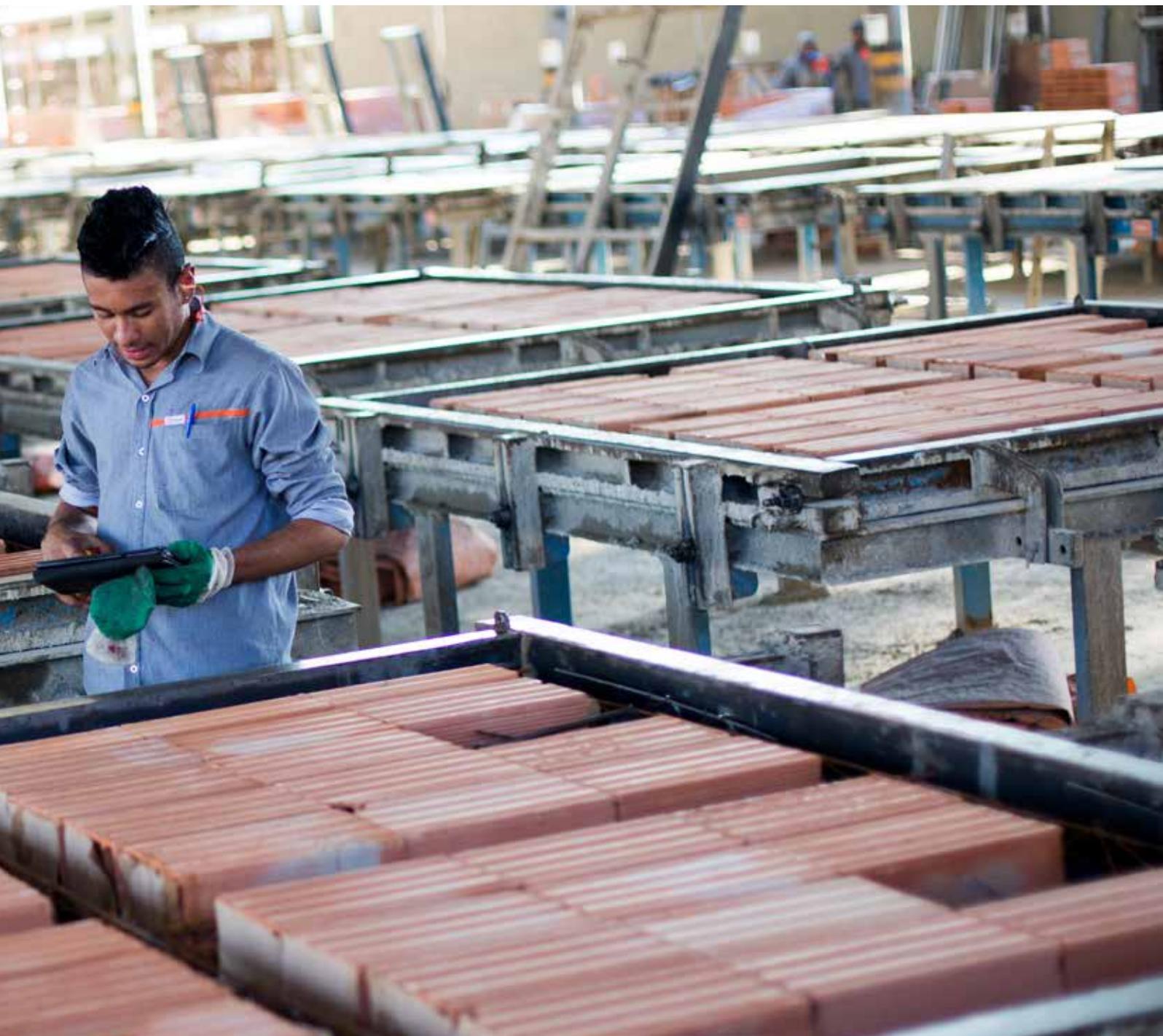
Precon Engenharia's relationship with Finep began in 2012, when the company was one of the participants of the 7<sup>th</sup> Capital Opening Forum. In the event, promoted by Finep, in partnership with BM&F Bovespa, three private companies presented their business to a public made up of institutional investors, banks, brokers and venture capital managers.

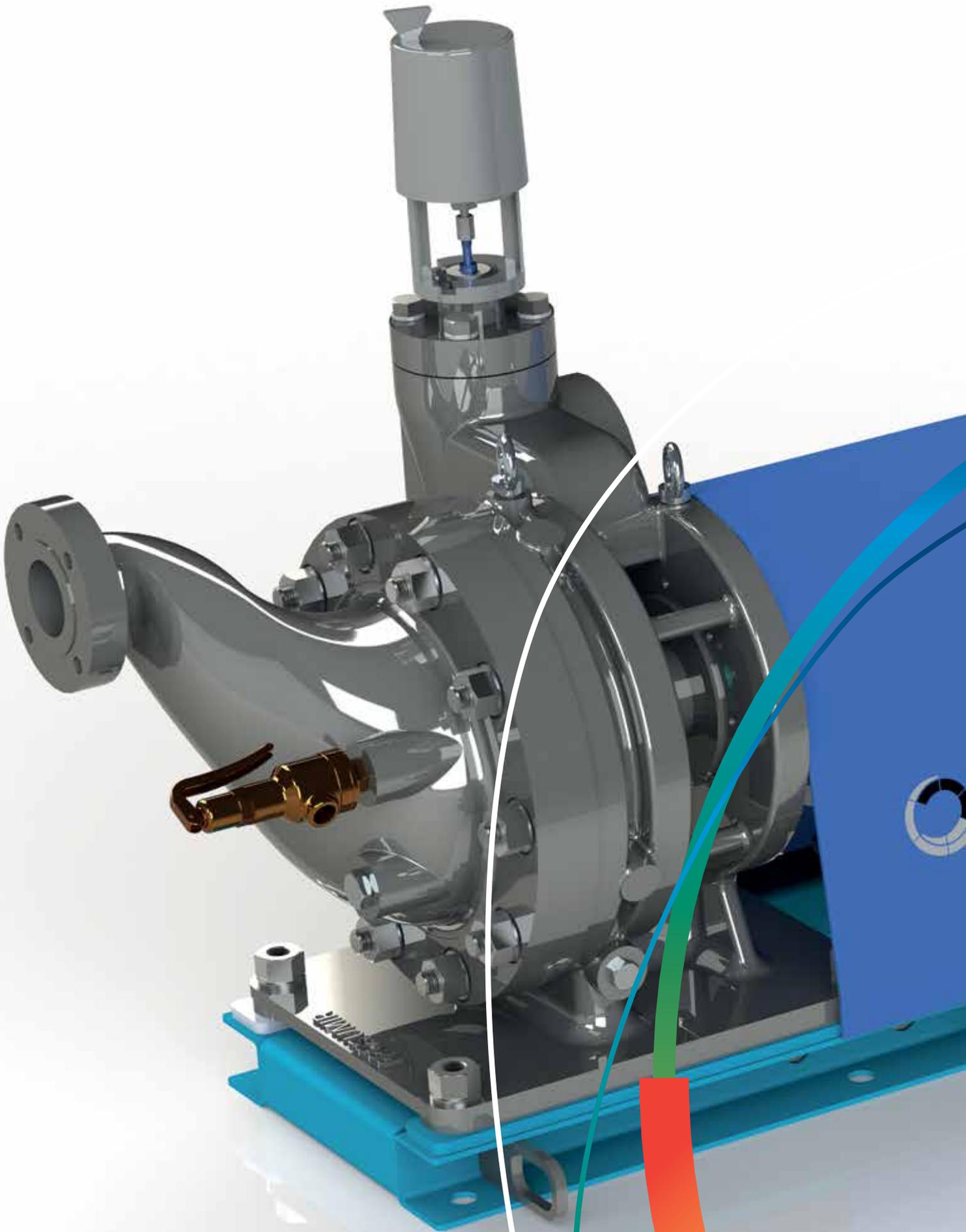
The following year, SHP was also recognized as an innovative initiative in sustainability, thanks to the ETHOS Institute Award, which allowed the company to represent Brazil at the World Forum of Responsible Economy in Lille, France.



Although not crucial in the strategic process, Precon Engenharia decided to patent the SHP system at INPI.

The application was filed in 2010, several documents have already been requested and delivered, but the process is still ongoing. This is yet another example of the need to optimize INPI's internal processes to reduce patent processing time, a highlight in the MEI Agenda as an important stimulus to innovation in the country.





PROSUMIR



**PROSUMIR** APROVEITAMENTO  
ENERGÉTICO

# SOLUTION FOR THE REUSE OF THERMAL ENERGY IN INDUSTRIAL PROCESSES

- PROSUMIR
- Porto Alegre/RS
- Micro-sized enterprise
- 5 Employees
- Product innovation
- MEI Agenda: Innovative SME

*Startup from Rio Grande do Sul, PROSUMIR creates equipment that generates energy through the use of waste heat in industries*

Study on industrial and residential energy efficiency, conducted by the Ministry of Mines and Energy in 2010<sup>1</sup>, showed that more than 34 GW of energy is wasted per year in Brazil, 16 GW in the form of thermal power, that is, heat.

To have an idea of what this loss means: 1 GW is enough energy to power 1 million households, representing an estimated loss of over BRL 10 billion per year!

Energy waste also carries other associated costs, such as increased fuel consumption – and resulting environmental impact – in addition to the loss of efficiency of processes, with a burden on competitiveness.

It was thinking about this problem that PROSUMIR, a startup from Porto Alegre, created a solution that allows energy generation, by taking advantage of the heat normally lost in industrial processes. The equipment, baptized by the company of Pressure Reducing Turbine (TRP), is a steam microturbine that converts the thermal energy that would be dissipated into mechanical energy, that can return to the process.

In Brazil, approximately 20% of industries use steam systems. In general, food, chemical, petrochemical and cellulose industries, as well as hospitals and laundries, use boilers to generate this steam, the heat source of their processes (such as heating, drying, blending and sterilization).

## Energy reuse

In cases where the pressure of the steam leaving a boiler is too high, it is necessary that the steam, before entering directly into a pipe or equipment, first passes through a pressure reducing valve (VRP), which uses mechanical friction as a way to decrease the output pressure. In this transition from high pressure steam to low pressure steam leaving the valve, the energy is dissipated in the form of heat:

With the replacement of VRP with PROSUMIR's TRP, the system converts energy – which would be dissipated with heat – into mechanical energy and, finally, into electric energy, which can be reused in the system itself. The "disposal" then becomes a gain.

In addition to performing the same operational function of the valve, the TRP solution avoids wastage in the generation of electricity – since there

<sup>1</sup> Ministério de Minas e Energia. EPE – Empresa de Pesquisa Energética. NOTA TÉCNICA DEA 14/10 Avaliação da eficiência energética na indústria e nas residências no horizonte decenal (2010-2019). Rio de Janeiro, 2010.

is no extra fuel consumption – promoting energy efficiency and reducing operating costs.

TRP was designed after many years of experience in the energy generation segment, from the perception of the existence of a significant unexplored potential of energy reuse.

But where does this unexplored niche come from? For large companies, producing turbines that generate less than 1 MW is less appealing in financial terms.

Thus, although there are large-scale processes in which pressure reducing valves are replaced with turbines, to generate power above 1 MW (for instance in petrochemicals), there is not the same type of solution that enables the reuse of thermal energy for industries, whose volume of steam generated is much lower.

This is why PROSUMIR focuses on micro-generation (powers ranging from 5 to 990 kW) – a niche hitherto scarcely explored when it comes to energy efficiency – and which includes industries from a variety of segments, especially food, beverages and agribusiness.

This positioning seems to be promising. Although there is not much detailed information on the market for pressure reducing valves, it is known that the Brazilian market for industrial valves moves, as a whole, more than USD 2 billion per year (a market that, worldwide, should exceed USD 78 billion in 2020). Based on the estimate that special pressure reducing valves correspond to 2%, the potential market would exceed \$ 1.5 billion. A share – even a small one – of this market represents an excellent opportunity.

### **Practical knowledge combined with academic knowledge**

The idea of reusing the energy from the pressure reduction process in industries was based on the experience of the founding partner, Julio Vieira, who worked with some of the world's leading manufacturers of large steam turbines for thermoelectric plants, totaling more than 16 years of experience in the power generation sector.



“

Many people have ideas, the difficult thing is to realize them. For this, it is essential to have a strong and aligned team and a good business management.

**Julio Vieira**  
Founding partner  
at Prosumir

”

During this period, Julio was able to visit power generation plants in Brazil and in different countries, carry out engineering works for the maintenance of turbines of up to 100 MW and participate in projects to develop new turbines of up to 20 MW (1 MW of energy is enough to supply approximately 1,800 households). This experience provided a solid foundation of practical knowledge about power generation in steam turbines.

With a technical degree in mechanics from the Technical College of Unicamp and a degree in Mechanical Technology from the Faculdade de Tecnologia – Fatec Sorocaba/SP, the founder completed his second degree in Mechanical Engineering from the Federal University of Rio Grande do Sul – UFRGS.

Always seeking to reconcile professional life and academic graduation, Júlio opened his first company in 2006, during graduation in the South, to provide services to turbine manufacturing companies in São Paulo and machinery and equipment companies in RS. But it closed the doors in 2010 amidst several economic difficulties, as well as a lack of strategic focus, growth prospects and innovation.

As a result of this experience, the entrepreneurial spirit remained, which motivated him to complement the technical profile with management and financial knowledge, through a master's degree in Business Administration at Unisinos.

Following the unsuccessful provision of services to turbine manufacturing companies, the following undertaking was to provide consulting services to companies in the Southern region in complete thermoelectric projects, focusing on the qualification for Reserve Energy Auctions of the National Electric Energy Agency – Aneel. He also worked for a year as a sales engineer for a global equipment company, where he was able to consolidate his knowledge of the commercial area.

The accumulated experiences – technical, administrative, consulting and commercial – added to the academic knowledge acquired in different types of graduations, were the basis for the idea that gave rise to PROSUMIR.

While the technical know-how brought the deep understanding of thermoelectric processes, the administrative and commercial knowledge contributed to a good structuring of the project and the business plan. “Many people have ideas, the difficult thing is to realize them. For this, it is essential to have a strong and aligned team and a good business management”, says Julio.

### From idea to business

Therefore, it was necessary to go a long way between the idea of the reuse of energy and the birth of the TRP. From the failure of his first company, Julio, while engaged in consulting work, thought of a solution capable of validating business concepts and models with potential clients, always focusing on energy efficiency. This effort was extended for two years until 2014, when the design of a micro-generation reducing turbine took shape.

With the project on paper, but with no money to invest, Julio entered UFRGS' incubator Hestia in 2014. Then, he submitted his project to the Sebrae innovation announcement (Edital Inova Pequena Empresa), for which he was also selected, receiving a contribution of BRL 100 thousand. In the same period, he started the doctorate at UFRGS, to study the generation of mechanical energy through the reuse of heat and to be able to improve the TRP idea. Also in 2014, he participated in the InovAtiva Brasil program (where he was one of the finalists) through which he received several mentoring.

Thanks to the resources obtained, Julio managed to produce some prototypes. But in order for the idea to "take off" and effectively be transformed into a business, he realized that he needed to seek partnerships and structure a work team.

But how to hire people without income? The solution found, already in 2015, was to seek partnerships with UFRGS and SENAI (through an Innovation Announcement), which resulted in the contribution of more than 1,600 technical hours for the TRP development, resulting in the construction of two prototypes, installed at UFRGS that same year.

It was also in 2015 that PROSUMIR got a new partner: André Thomazoni, Julio's graduation colleague. After finishing his master's degree in mechanical engineering, focused on thermal energy recovery systems, also at UFRGS, André worked in a company specialized in energy efficiency projects (APS, then the largest energy conservation company in Brazil) where he was able to consolidate the vision of business models in the energy efficiency area. André realized, in the PROSUMIR idea, an excellent opportunity to change the market for energy use by developing innovative solutions.

***InovAtiva Brasil** is a free, large-scale acceleration program for innovative businesses of any sector and place in Brazil, carried out by the Ministry of Industry, Foreign Trade and Services, run by the Reference Centers for Innovative Technologies Foundation (Certi), with Sebrae and SENAI as strategic partners.*

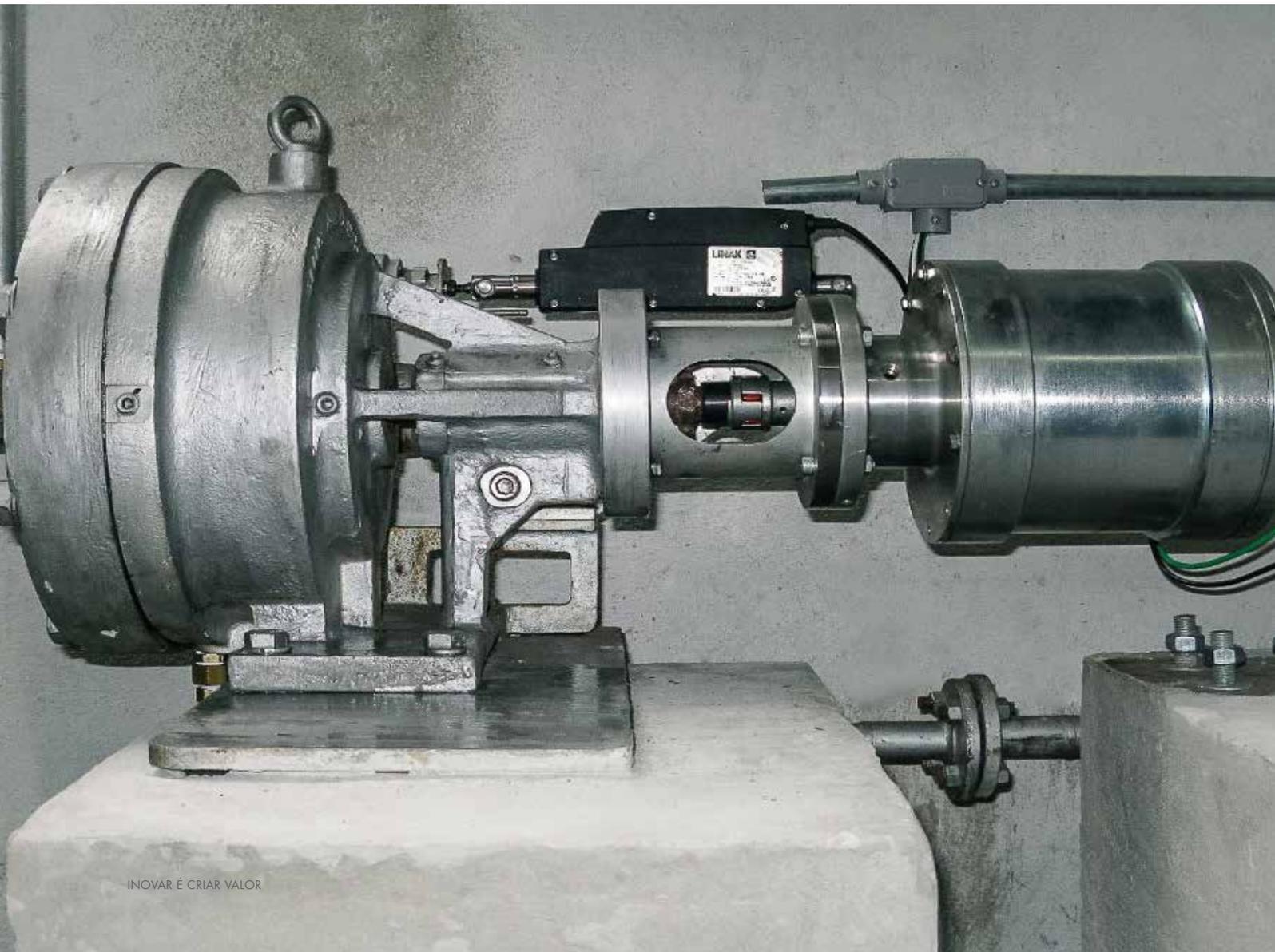


Later, APS was acquired by EDP Soluções em Energia, from the EDP Portugal Group, which agreed to be a strategic partner at PROSUMIR.

The partnership has been extremely positive for both parties: on the one hand, EDP relies on the TRP functionality in its energy efficiency projects; on the other hand, PROSUMIR opens a sales channel, through projects that are already born considering the application of its product.

This was how PROSUMIR was able to install its first pilot test in a food industry, located in the Porto Alegre area. The industry, which uses grain husks – the residue of its production – to feed the boiler and steam produced, now uses the TRP to generate energy. This turbine, which is the third and definitive prototype of the company, has 5 kW of power and has the capacity to generate up to 3,500 kWh per month, sufficient energy to supply, on average, the energy consumption of 14 houses during that same period. The final testing phase proved the effectiveness of the process and validated the product for its definite entry into the market.

The final consolidation of the TRP project, after prototyping and conducting the pilot test, was the filing in 2016 of two patents with the INPI. The intellectual property is shared between UFRGS, SENAI and PROSUMIR, and the company has the exclusivity of commercialization, paying royalties on the sale value of the equipment.



The patents contemplate parts and controls, with some peculiarities, if compared to a traditional turbine. The TRP needs to work on the “leftovers” of the process, which means that its operation is oscillating, varying according to the amount of steam required by the process, whereas a conventional turbine is applied in constant processes. For this reason, its control system is totally different from that adopted for conventional turbines.

Their construction method is also different: TRP replaces valves much smaller than ordinary turbines, and this replacement cannot cause disruption in the customer’s process.



PROSUMIR’s innovation: on the left, the turbine coupled to the generator and on the right, the system with the protective fairing.

### Each customer, a project

At the outset, it is not possible to specify how much energy is generated, with the replacement of the pressure reducing valve with the TRP, given that the power achieved depends a lot on each process.

This is an interesting and determining factor for the company’s business model: each customer demands a project of its own or, in other words, each sale requires the customization of the turbine, so that it fits perfectly in the customer’s process.

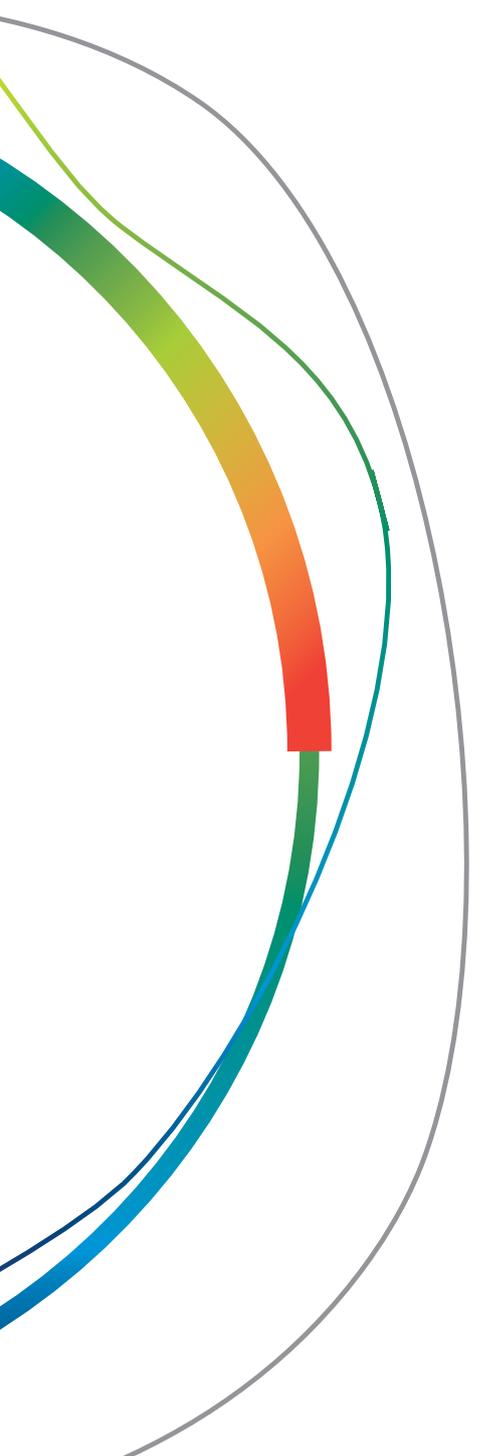
A project for the replacement of VRP with TRP is already being prepared by PROSUMIR for a large metallurgical company, which should generate around 250 electric kwh, providing savings of around BRL 400 thousand per year (considering that the turbine operates 24/7 and the cost of energy for a large company is around BRL 0.20 / kW).

For smaller companies, the generated power is around tens of kW. In a small food industry, using a 1 ton/h steam boiler to lower the pressure from 10 to 4 bar, for instance, TRP can generate up to 15 electric kW, corresponding to an annual saving of around BRL 60 thousand.

Thus, even at the higher cost (due to the small size), the savings from the reuse of energy allows a return on investment for TRP installation in less than four years (for larger companies, the estimated return is less than two years).

Thinking about the feasibility and agility of the customized sales, basic models of housings were designed for each range of generated power, which facilitates the adaptation to the different types of plants, through simple changes in the models, a process similar to the assembly of a Lego for each application.

To guarantee the standardization of the models and the perfect fitting of the parts, PROSUMIR carried out extensive qualification work of local suppliers, today partners and responsible for all the metal-mechanical process of the TRP production.



In addition to the solution offered to customers, PROSUMIR also currently offers turbine maintenance services. This diversification of the business arose from the finding of scarcity of companies able to carry out this kind of work in the South.

The range of complementary services offered also includes: turbine diagnostics, modernization and repowering, balancing, spare parts, reverse engineering, outage planning, operation monitoring, testing, essays and training.

There are clear commercial synergies between the two activities, since maintenance services allow the identification of new sales opportunities for TRP.

### **Positive results**

In July 2016, PROSUMIR finally launched TRP to the market. Prices range from BRL 52 thousand for lower-power turbines, to more than BRL 1 million for large ones. Since TRP is a low maintenance equipment, most of the costs are related to the purchase and installation.

Also in 2016, PROSUMIR was elected the fifth most attractive Startup for Investments in Brazil, in the 100 Open Startup program. This recognition generated a spontaneous marketing and a great visibility for the business, as well as attracting the attention of investors, which eventually attracted PROSUMIR's first major customer – Gerdau – for which a project was prepared that contemplates the installation of 600 kW in equipment, aiming to increase the energy efficiency of the process in the plant.

At the end of 2016, PROSUMIR participated in an investment campaign promoted by Equity Crowdfunding, through which the company received a contribution of BRL 300 thousand, which will be invested in the expansion of production capacity in 2017, the year in which it foresees the sale of nine equipments, with revenues above BRL 1 million.

These challenges have a counterpart in the structuring of the company, which today has a team of four engineers, one economist and five other professionals working in the metal-mechanical partner.

Between the second and fourth years the company intends to grow rapidly, to seize opportunities and consolidate its position in the market. The forecast is for an annual rate of over 40% per year. For the fourth year, planning foresees the transformation of the company into a joint-stock company and the search for a second round of investments.

### **Expanding the look**

Taking into account that they produce only clean energy – without extra fuel costs and without generating any form of new waste for the process – PROSUMIR microturbines have other possible applications, which do not necessarily involve valve replacement.

PROSUMIR's pressure reducing turbines can be used as a kind of micro-thermoelectric in medium-sized enterprises that generate excess waste and have to pay third parties to incinerate them. By using their own

boilers with a TRP installed in the steam outlet, companies can burn the waste and produce energy, thus reducing their operating costs.

It is worth mentioning, however, that this solution was designed for reuse and not for power generation: TRP works with saturated steam, which is not the most efficient for electric power generation. Because of this, its use is only indicated in cases where the fuel used in the boilers is zero cost or represents an environmental liability, which necessarily has to be burned.

Rio Grande do Sul, with its great potential for generating biogas of rural origin, is a promising case for this type of application. When the biogas is of high quality, it is possible to directly couple motors and turbines for the generation of energy. If there is a high concentration of contaminants and/or impurities (which may impair the operation of such equipment), it may be worth it – due to the high cost of gas filtration – to burn the biogas in boilers to generate steam and with it, through TRP, generate energy.

### **The importance of the local ecosystem to PROSUMIR's success**

The fact that the pressure-reducing turbine enables the generation of clean energy, by harnessing the heat that would be wasted – together with its customizable feature – places PROSUMIR as a solution provider, which deals with two prominent mega trends in the current scenario: energy efficiency and the so-called industry 4.0. It is a type of entrepreneurship that needs to be promoted as a way of technological strengthening and advancement of the Brazilian industry as a whole.

Like so many other startups and technology-based SMEs, PROSUMIR entrepreneurs had a good idea, but they needed capital and qualified human resources to transform it into a company, incubated at the University since its establishment.





The feasibility of the project was based on several innovation announcements for SMEs (Sebraetec, InovAtiva Brasil and SENAI de Inovação) in partnership with the Federal University of Rio Grande do Sul and with SENAI, as well as a major company and, more recently, with the contribution of an angel investment.

Therefore it is a case that emphasizes the importance of strengthening innovation ecosystems and funding sources, so that micro- and small-sized enterprises can overcome the often hostile barrier that separates the idea from successful business.

The MEI Agenda presents a series of proposals, aimed precisely at strengthening the performance of innovative SMEs, through investments and support to the formation of Local Innovation Systems and environments, in partnerships with academic institutions.

One of the points to be considered by the national innovation agenda is the improvement of the regulatory framework for the relationship of companies with public support entities (such as STIs), since sharing mechanisms can create barriers to the full development of the company and of their financing and business models.







**RHODIA**  
SOLVAY GROUP

# THE WORLD'S FIRST BIODEGRADABLE POLYAMIDE YARN IS BRAZILIAN

- RHODIA SOLVAY
- São Paulo/SP
- Large-sized enterprise
- 30,000 Employees
- Product innovation
- MEI Agenda: Global inclusion through innovation

*Rhodia Solvay develops the first polyamide textile yarn in Brazil, which completely decomposes in landfills*

Rhodia Solvay has developed Amni Soul Eco, the world's first biodegradable synthetic textile yarn. The characteristics of the traditional polyamide – the nylon – are entirely maintained in the biodegradable polyamide, among which mechanical aspects, dyeing and applications. Unlike most synthetic textiles, whose complete biodegradation can take tens or hundreds of years, Amni Soul Eco completely decomposes in less than four years after its disposal in landfills, dramatically reducing the environmental impact.

In addition to not leaving residues for future generations, the biodegradable fabric can accelerate the generation of biogas in the landfills, improving the productivity in the case of its use for co-generation of electric energy.

The product was fully developed in Brazil – Solvay's textile yarn division is 100% Brazilian – and the largest market is in Brazil and Latin America. But Solvay has global ambitions for the product.

## Why a biodegradable fabric?

Sustainability is one of the key trends in Rhodia Solvay's strategy, which prioritizes projects that have as their main motivation the creation or perfection of products to become more sustainable. In the case of biodegradable polyamide, the idea arose from the perception that all the polyamide produced to date – since 1955 in Rhodia Solvay's case – is still in the environment, since the degradation of the material is very slow.

The first approach the company sought to try to solve this issue was through reverse logistics, an action that proved fruitless for two main reasons: the National Policy on Solid Waste does not include the textile chain as one of its obligatory aspects, and the consumer has not yet assimilated the habits associated with recycling. "About ten years ago, a famous lingerie brand took the initiative to put boxes collect used polyamide parts in the stores, even giving customer benefits on purchase if they returned the used product. Months later the boxes were still empty", says Renato Boaventura, Fibers Unit President at Rhodia Solvay.

Although the company masters polyamide recycling technologies, using them regularly for its industrial waste, this recycling did not apply to products discarded by consumers, since the disposal is not done properly. Therefore, the reverse logistics approach, dependent on voluntary behaviors of consumers and end-users of products, would be doomed to failure – that is what accumulated experience has shown. That was the reason why the company decided to opt for another route.

As an alternative to recycling, the Rhodia Solvay team devised a strategy to develop a fabric that could decompose itself when discarded by consumers. Considering that 95% of the textile waste ends up in the landfill, biodegradable polyamide was designed and developed to decompose itself in this environment, unlike normal use, washing and storage conditions.

This was the technological challenge the company faced: producing a polyamide that would maintain the performance of conventional (non-degradable) material, but that would undergo accelerated degradation under the usual disposal conditions in landfills.



Once the purpose was clearly defined, the research of the new material demanded two and a half years of work from the R&D team. Early studies began with the idea of modifying the nylon molecule.

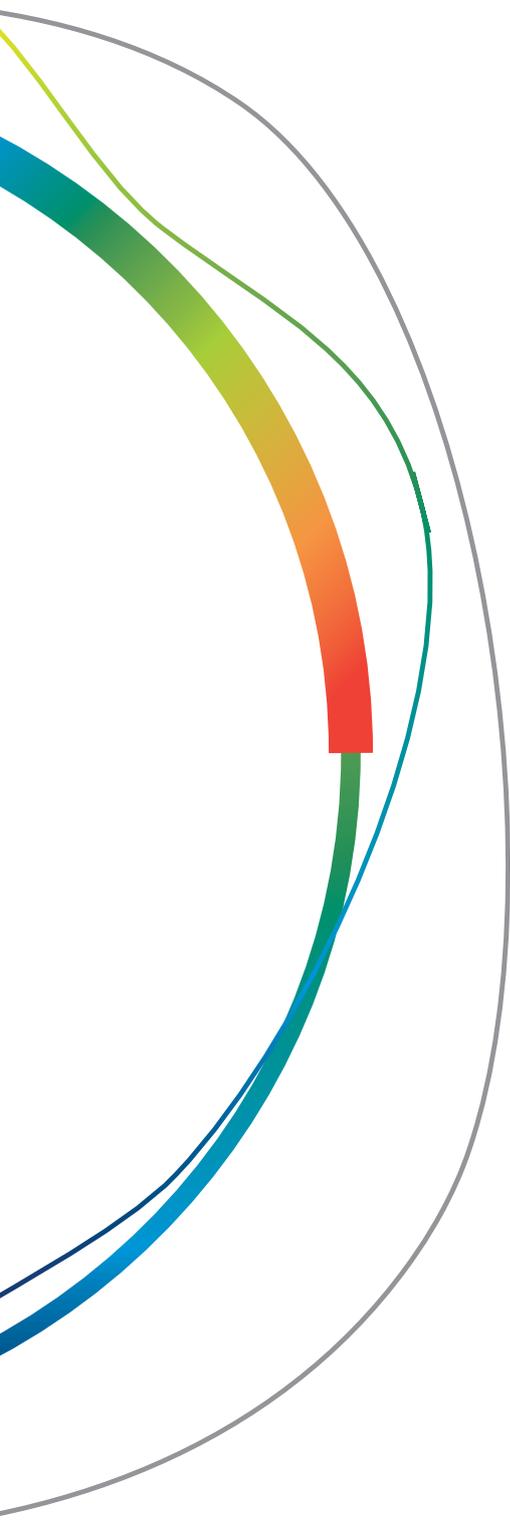
Initially it was considered to substitute one of the main raw materials for a polymer used in oxybiodegradable plastic bags (which also have accelerated decomposition). However, in addition to the durability problem, the strength was too low compared to the original polyamide, which would compromise processing in the chemical and textile chains.

“We realized that the product needed to be smart, to have a good performance over its lifetime, and, once discarded, to work as if it had some sort of a switch that informed it: ‘time for decomposition’”, explains Renato.

This trigger is the absence of oxygen, a situation that the material encounters in a landfill. It was necessary to maintain the base of the polyamide and to insert some modifications, that would make it “attractive” for anaerobic bacteria.

For this, the project team looked for elements that could be inserted into the chemical structure of the fiber to make it digestible by these bacteria, but without attracting bacteria from the everyday environment, which multiply in the presence of oxygen. In addition, a second element, which is easier to digest, was inserted as a kind of bait to attract the first bacteria and start the biodegradation process.

This “bait” causes the degradation of the polyamide by the anaerobic bacteria to resemble the termite attack on the wood, attracting them into the fibers, which are like tubes with 12 micron in diameter (1 micron = 0.0001 centimeter). Bacteria form channels between the tubes, and the larger the number of channels, the more bacteria come to feed, as if it were a chain reaction.



After defining these concepts and parameters, it was necessary to confirm the efficiency of the biodegradability achieved. As there is not yet a specific standard in the world for the biodegradation of textiles, tests have been conducted in the United States in accordance with the North American standard for the evaluation of biodegradation of plastics.

To carry out the tests, the material is inoculated with the anaerobic bacteria and placed in a greenhouse, which maintains the environment at a given temperature, for predefined periods. The chosen temperature was 52°C, considering the reality of a landfill in a tropical country like Brazil. The polymer, the yarn, the raw and dyed fabric, both washed with powdered soap, were tested.

The samples decomposed about 85% in three years. The tests continue and the trend curve over the years shows that all material should disappear in four years.

It is important to emphasize that in this type of test, the index of 100% is never reached. This is because the value is not calculated based on the sample weight reduction, but rather on how much carbon is converted into CO<sub>2</sub> and methane by bacteria, which in turn do not release all the carbon they consume (even cellulose, which is a natural source fabric, does not achieve 100% biodegradability in this type of test).

With the evidenced biodegradability, it was necessary to scale up and test the product industrially, that is, to have a customer who would weave the biodegradable yarn. After all, the weaving companies are between the yarn manufacturing and the end consumer. They are the ones that may or may not be interested in the new concepts and opportunities offered by the new material.

### **Partnership: key to development**

During the development of a product, the scale of the samples is gradually increased as the positive results are achieved. First, grams, then kilos, and so on are produced, until a typical level of industrial operations is reached.

In the case of the textile chain in which Rhodia Solvay operates, which only produces the yarns, it must seek partners to weave them, in order to attest to the feasibility of innovation in its industrial production processes and in the fabrics themselves.

“For that, we need partners who are open-minded and willing to take the risk of innovating, since innovation that works out at the first attempt does not exist”, says Gabriel Gorescu, Director of Research and Innovation for Latin America. There are always essays, tests, adjustments to be made. And the production units are not always willing to stop production lines or allocate resources (equipment and professionals) to carry them out.

The São Paulo weaving company Santaconstancia, Rhodia Solvay’s partner for a long time in other developments, was the one who “bought the idea” of Amni Soul Eco: it carried out the tests in its industrial plant and launched almost all the polyamide products that it commercializes

in the biodegradable version, with the purpose of transforming its product line into biodegradable.

"If today Amni Soul Eco is a reality in the market, much of it is due to Santaconstancia's work to believe in the technology", Gabriel points out. He explains that it is difficult to convince companies to invest in sustainability, because the question always is 'how much does it cost?'. "So one must have some belief in the story, as Solvay itself has to seek to transform the product portfolio. Santaconstancia came with this belief", praises Gabriel.

At São Paulo Fashion Week in 2014, Rhodia Solvay and Santaconstancia, in partnership with the designer Ronaldo Fraga, recognized for developing collections that use materials focused on sustainability, organized a fashion show only with pieces made with Amni Soul Eco, launching the biodegradable polyamide – a worldwide innovation – in the fashion market.

### **Serial innovations: a strategy to success**

The success of innovations like Amni Soul Eco is nothing new for Rhodia Solvay. After all, the company understands the textile world as a universe in constant transformation, which is why it always tries to be involved in this context in leadership positions, participating in the processes of transformation with new technologies and innovative products. "Today we are in a wave of transformation, which seeks functionality in the textile. The fabric is expected to bring, in addition to comfort and beauty, some additional contribution to those who wear it, whether in the area of well-being, health or the environment", explains Gabriel.

This is a new consumption behavior, in which the concern with the environmental impact and the quality of life emerge as new determinants for the choice of the consumers and the purchase decision.

In order to stay on top of the transformation, Solvay's global innovation strategy starts with the identification of megatrends, which are cross-referenced with the market in which the company operates and with the skills of the technical team in the group to define the technology, innovation and production guidelines.

In the case of fibers, there are four megatrends identified by the company: health and well-being, sustainability, urbanization and connectivity. Thus, innovation processes in recent years are focused on these four topics and, since 2005, very interesting innovations have been generated.

The first, in the scope of health and well-being, was the Eman yarn, a revolutionary development by Rhodia Solvay. It is a smart polyamide yarn, which contains bioactive minerals that interact with the body, offering thermoregulation properties, capable of improving blood circulation. In addition to softness and elasticity of the skin, frequent use contributes to the reduction of cellulite. Apart from the aesthetic aspect, which attracts the attention of many consumers, the product also has appeal to the sports market, because its thermoregulation properties allow the reduction of fatigue and acceleration of muscle recovery. Rhodia Solvay's global innovation was born in Brazil and is patented worldwide,



We need partners who are open-minded and willing to take the risk of innovating, since innovation that works out at the first attempt does not exist.

**Gabriel Gorescu**  
Director of Research  
and Innovation for  
Latin America



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Emana's technology should be one of the few cases in which Brazil receives royalties from countries known as technological.

**Renato Boaventura**  
Fibers Department  
President at Rhodia  
Solvay

”

with tangible and rare results: “Emana’s technology should be one of the few cases in which Brazil receives royalties from countries known as technological,” says Renato Boaventura.

Still in the scope of functionality focused on health and well-being, Rhodia Solvay launched Amni UV Protection, which gives skin protection against the harmful effects of solar radiation, and Amni Biotech, which has a bacteriostatic action, avoiding the odor of perspiration.

The second wave of innovations is based on sustainability, one of the main strategic axes of the company today. To move in that direction, the group has determined that, by 2025, it will have 50% of the product portfolio with innovations that will somehow benefit sustainability and reduce carbon emissions.

The first product developed with this focus was Amni Colors, a colored polyamide, the production process of which uses much less water during the dyeing stage. The second is the Amni Soul Eco, which, like the Emana, is a worldwide innovation, patented by Rhodia Brazil.

### **Rhodia Solvay: a Brazilian innovation core with global role**

The Solvay group is a global organization of Belgian origin, that produces and delivers chemical specialties in all regions of the world. With worldwide turnover of € 12 billion, it is made up of several companies, organized in 15 global business units, with a great diversity of products.

It was exactly Rhodia Solvay’s diversified portfolio of products, markets and technologies that motivated its purchase by Solvay in 2011. Rhodia Solvay’s products range from advanced materials, such as special polymers and composites for the aeronautics industry to advanced formulations for diverse markets such as agriculture, cosmetics, home and personal care, as well as silica for plastic applications. The fiber activity integrates the cluster of functional polymers.

Of French origin, Rhodia has been in Brazil for almost 100 years (it first came here in 1919), and the production of synthetic fibers was one of the first activities of the company in the country. The first textile operation began in the 1930s, in Santo André. Rhodia was the pioneer company in the artificial and synthetic fibers in the country: acetate, acrylic, polyester, polyamide. And it actively participated in the development of the Brazilian textile industry in the post-Second War period, in the 1950s, 1960s and 1970s, the golden age of Brazilian industrialization and accelerated growth.

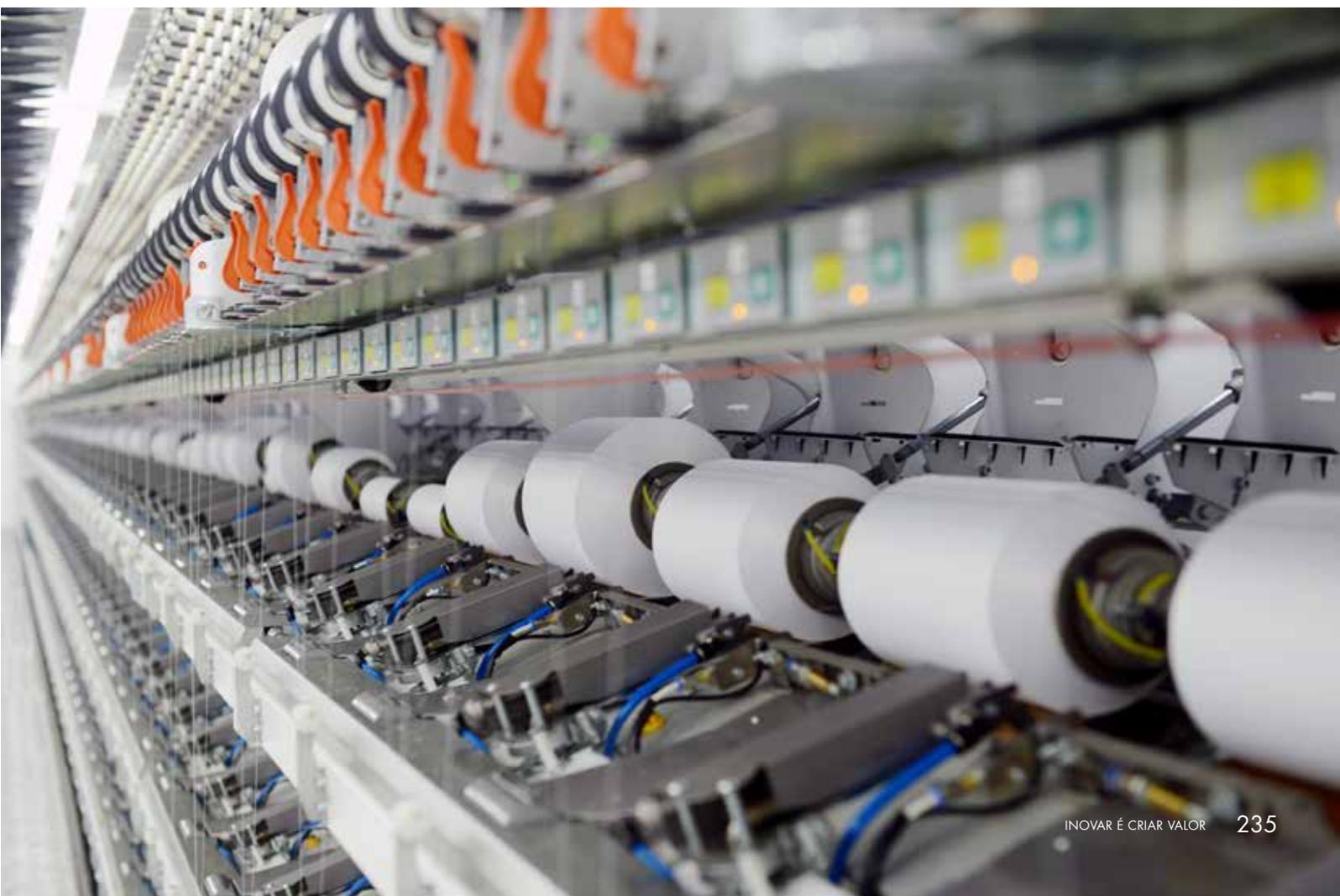
In the late 1990s, Rhodia decided to focus on polyamide production, due to the possibility of integrating the petrochemical chain with textiles. “In the other fibers, we did not have this integration. So the company decided to move away the acrylic and polyester, to focus on polyamide”, explains Gabriel.

Another important strategic movement of the company, in the early 2000s, was bringing fiber development to Brazil. Rhodia stopped producing it in Europe and concentrated research at the Brazilian Innovation Center for the development of new technologies, starting the Rhodia Brazil era of innovation.

Until then, the new technologies were brought from Europe and adapted to the Brazilian market – the so-called *tropicalization*. Starting in the year 2000, intelligent and sustainable fibers began to emerge, which today are the company’s flagship.

### **From Brazil to the world**

Launched in 2014, at designer Ronaldo Fraga’s fashion show at SPFW – São Paulo Fashion Week, Amni Soul Eco already accounts for about 10% of the group’s revenues in Brazil. Other brands got interested in the product and are conducting tests for its use in their manufacturing processes and in their products.





Internationally, Amni Soul Eco was presented at ITMA 2015, the largest exhibition of textile machinery and clothing technology, held in Milan, Italy. Two of Rhodia Solvay's biggest competitors were present and interested in buying the product. But Solvay's decision was not to sell the product and the technology to competitors, valuing, by exclusivity, the technological, industrial and commercial advantage achieved: "We know that other competitors have the capacity to do it, but it will still take around four years for them to develop it. So we will wait for the innovation value to increase", Renato explains.

The strategy adopted jointly by the Business and Innovation Division was to enter the European market through a partnership with an Italian fiber industry, which is already a customer in Emaná. It was a way of joining forces to compete with an Israeli company, which today dominates sales to Europe. A good amount of Amni Soul Eco has already been sold to Italy in 2016, and the development effort for the European market continues.

### Focus on expansion

The innovation made Rhodia Solvay rethink its global business strategy. For the "normal" products, the company does not have any competitive advantage to export, for different reasons of the external environment to the company.

But with Emaná and Amni Soul Eco it is different: they are innovative and unrivaled products, making entry into other markets doable and attractive. So much so that samples have already been sent to two partners operating in Asia, China and South Korea. "We sent the yarn and we are discussing whether they will finish the yarn over there or if we will sell the yarn finished", explains Gabriel.

At the same time, the development team in Brazil has been looking for alternatives to reduce the product cost, which is still an obstacle to Rhodia Solvay's ultimate goal: to convert all of its production to the new technology, making all products biodegradable.

In comparison to non-degradable material, the cost increment is now less than 20%, but the goal is to reduce that percentage to less than 5%. "The ideal is to match the price, because many top-tier companies say they will not buy it unless it is for the same price. The bigger the company, the more we get this answer", comments Gabriel.

In the long run, Rhodia Solvay's sustainability project is to have a complete package, a biodegradable product line, that consumes less energy and less water in the dyeing process, substantially reducing the impact of its production.

### **Innovation to strengthen the chain**

A strong point of Rhodia Solvay's fiber business in Brazil is the existing integration of the polyamide chain, ranging from petrochemical to textile and then to weaving and final products. Few countries in the world have the possibility of transforming domestic oil into high added-value products. Rhodia Solvay transforms raw materials derived from oil into polymers, and these polymers into strands.

Through this integration, the company, which is in essence a chemical industry, makes use of the national textile chain as a test pilot for its innovations. "People think the Brazilian textile industry is dying, but it is not true. The Brazilian textile industry is the fourth largest textile industry in the world. It is an organized and competent industry, has critical mass, and echoes the innovations made in the region", argues Renato.

The fact is that, despite not competing in the international market, the national textile industry supplies the domestic market, accounting for more than 80% of what is consumed in Brazil. As comparison, in the United States, 90% of what is consumed originates in Asia.

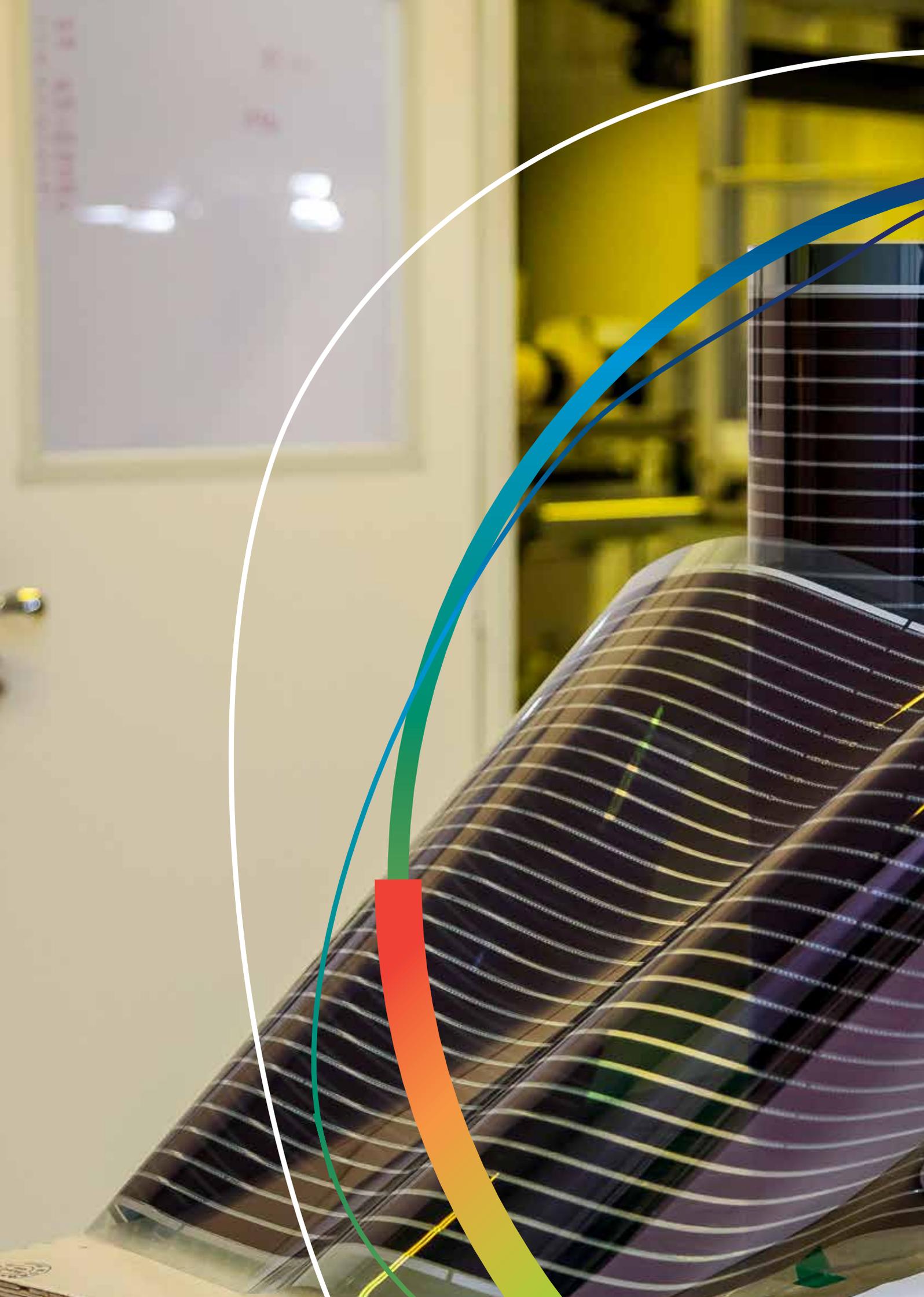
Betting on the competence of the national textile industry, Rhodia Solvay's goal is to mobilize the Brazilian production chain to export the products and innovations developed in Brazil. However, lack of competitiveness along the chain – for various reasons external to the company and industry – often makes it impossible to export the final product.

Today, in Brazil, only polyamide production is part of the petrochemical and textile chains. A recent attempt to integrate polyester in Pernambuco did not achieve the desired results and should be resumed with the sale of the production unit to another company at the end of 2016.

This is an important advance for the country if we consider that the consumption of polyamide accounts for 5% of the national textile market, whereas the polyester consumption accounts for 40%.

This means that promoting the integration of the petrochemical and textile chains into polyester has the potential to strengthen both chains, boost the domestic market and, perhaps, also exports.

We hope that this integration movement can also be leveraged by innovations, perhaps innovations with global reach. These are the ones that allow us to overcome structural deficiencies, which hinder competitiveness and prevent the Brazilian industrial development.





**SUN****EW**  
energy everywhere

# BRAZILIAN STARTUP REVOLUTIONIZES THE SOLAR ENERGY MARKET

- SUNEW
- Belo Horizonte/MG
- Small-sized enterprise
- 23 Employees
- Product and process innovation
- MEI Agenda: Innovative SME

*Sunew develops process that allows the generation of organic photovoltaic energy in glass facades of buildings and other applications*

A backpack that generates energy to charge a smartphone; a car that captures energy from sunlight, which enters through the roof and feeds the air conditioning; power-generating metal roofs from factories to sheds: these are some of the applications foreseen in the not too distant future for OPV (acronym designating the organic photovoltaics cells), the newest generation of solar energy production technologies. Whereas the backpack, car and roofs are still on the way to becoming a reality, Sunew has already realized an important application of OPV: its use in glass facades of buildings.

In order to do so, Sunew has managed to overcome two important technological challenges: producing large-scale OPVs and developing a method for laminating them, along with the glass. Thanks to this project, the company has become one of the world leaders in the production of organic photovoltaic films.

Sunew is a spin-off of CSEM Brasil, a private, non-profit Brazilian institution, focused on research and development of state-of-the-art technologies and created from the successful experience of the Center Suisse d'Électronique et Microtechnique (CSEM SA), in Switzerland.

The first customer of the innovative technology is Construtora Innovalli, which installed the OPV glasses on the facade of its new building in the city of São Paulo, to generate enough electricity to maintain more than 65 working positions daily.

## Research that turns into business: the model of CSEM Brasil and Sunew

About 30 years ago, Switzerland identified the loss of competitiveness of some of its industrial segments. Looking for alternatives to overcome the problem, the country identified that one of the ways to gain competitiveness was to differentiate itself by innovation, transforming technologies into innovative and applicable products and services, through the union of efforts from the government, companies and universities. For that, CSEM S.A. was created, which played a fundamental role in this process. The Center has created dozens of state-of-the-art technology companies and successfully executed more than a thousand technology projects worldwide.

CSEM Brasil was born in 2006, replicating the business model of CSEM S.A. Both are non-profit institutions that work independently, with or without collaboration. "We are not a branch from Switzerland, what we do here they do not know how to do there. We are partners, but everything we do here is Brazilian, from investment to technology", explains Marcos Maciel, CEO at Sunew.

The purpose of CSEM Brasil also follows the Swiss standard: to be a bridge between research and industry, transforming cutting-edge technologies into innovative products, services and companies. In general, CSEM develops basic research and, when there is economic and commercial viability, a spin-off is created, to transform the project or product into a business.

Located in the capital of Minas Gerais, in a space provided by the Federation of Industries of the State of Minas Gerais (Fiemg), CSEM Brasil was created as a joint venture between the Swiss CSEM and FIR Capital, the latter a venture capital company, which started from its expertise in building companies to establish research, oriented to new business.



CSEM Brasil works with two lines of applied research, one of ceramic micro-systems and the other of printed organic electronics, for power generation. The decision to invest in these two fronts is part of the proposal to always opt for technologies not yet fully disseminated, avoiding competition with large technology companies already established in Brazil.

Organic electronics is the science behind OPV. After 10 years developing the technology of organic photovoltaic cells, CSEM Brasil decided to create, in November 2015, the spin-off Sunew, to introduce the product in the market.

Sunew's main shareholder is CSEM Brasil, in partnership with the holdings branch of the National Economic and Social Development Bank (BNDESpar), with FIR Capital and the energy trading companies Tradener and CMU Energia. The total contribution in the business to date surpasses BRL 100 million.

Sunew is therefore the product of a business model generated by a research center – not the other way around. While the research centers of the large companies usually function as satellites of their main activity, CSEM Brasil was created to develop paths leading to the generation of new businesses.

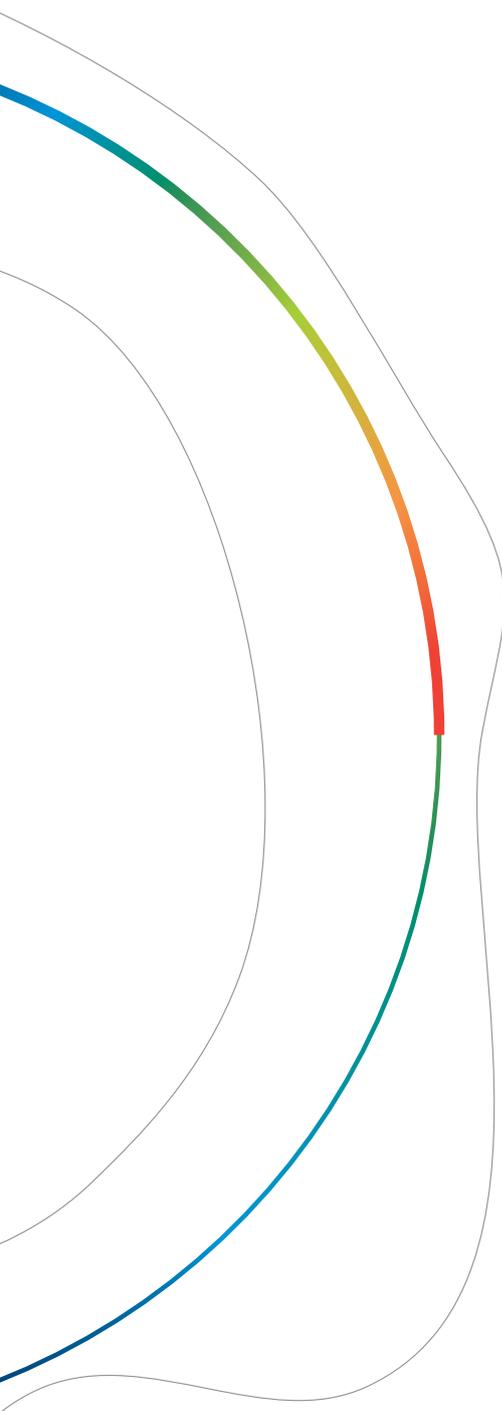
In this case, the Center was implemented with the purpose of changing the face of Minas Gerais' economy. One of the founders of FIR Capital is a Minas Gerais' citizen, a technology enthusiast, who wanted to foster local development through the implementation of new business models that did not depend on mining and agriculture, flagships of the state. He then went looking for world models that could be replicated, found the CSEM and decided to bring it to Minas Gerais.



CSEM Brasil is not a branch from Switzerland, what we do here they do not know how to do there. We are partners, but everything we do here is Brazilian, from investment to technology.

**Marcos Maciel**  
CEO at Sunew





## Energy that comes from the Sun

Solar energy is the most abundant source of energy, the only one capable of replacing fossil fuels. One hour of sunshine is enough to generate all the energy consumed on the planet for a year. We can take advantage of all this potential in favor of the amenities of our modern life by means of panels with photovoltaic cells, in which the incidence of sunlight generates a continuous flow of electrons – due to the properties of the different component materials – directly converted into electricity.

At the beginning of the 21<sup>st</sup> century, in an environment of high and rising oil prices, the global market for photovoltaic panels has grown significantly – by 30% a year – driven by the incentive policies initiated in countries such as Japan and Germany.

In 2002, for example, Japan installed 25,000 solar panels in households. Such growth reinforced the very promising future prospects for solar energy and stimulated studies and research, which sought to increase even more the efficiency of conductive plastics. The scenario is so positive that the German government predicts that, by 2050, photovoltaic energy will be able to meet 25% of global needs.

CSEM works with the estimate that the Brazilian solar field – that is, the potential for energy generation – is at least 60 times greater than that of Germany, today the largest producer in the world.

The use of solar panels as an energy source, however, is still not as widespread as its potential allows, due to a major barrier: the high cost. A significant fraction of this cost comes from the high energy consumption required for the manufacture of quartz and silicon solar panels. But this scenario is changing, since the emergence of organic electronics.

Organic solar cells, made from carbon-based materials, can be much cheaper than inorganic silicon solar cells, for example, because they can be made by roll-to-roll printing and printed on flexible and transparent substrates such as PET.

Flexibility, lightness, low dependence on degree of inclination, transparency, high color and shape customization and UV absorption are just some of the characteristics of this very versatile material. These are qualities that allow different applications and strongly allied to the design. Facades, street furniture, light covers, tensile structures, automobiles and gadgets are just a few of the examples.

Until recently, the scientific consensus was that silicon photovoltaic cells are efficient, but very expensive, while organic solar cells, although very cheap, are inefficient. Japanese researchers have recently proven that this idea is wrong.

They demonstrated that organic solar cells have a theoretical limit of photoelectric conversion efficiency of 21%. This is more than most of the silicon solar cell panels available today – the theoretical limit of which is 30%. Considering the theoretical limit is important, given that it is the level pursued by the researchers – if they believe that the level is lower, they can conclude that they have reached the limit, when there is still room for improvement.

The fact that organic electronics is still taking its first steps, while silicon panels are already close to stagnation (close to their theoretical limit), was decisive for CSEM's choice to work with this type of technology: there is still a lot to be developed and costs to be reduced.

There is also the possibility of using new materials such as photovoltaic pigment. This is the case of perovskite, which has already been studied in other countries, the efficiency theoretical limit of which is 49%. It is considered today one of the most promising materials in the world, chosen by Scientific American as one of the top 10 technologies of the future.

### **The challenge of scale**

There are already many works in the world with OPVs, and the basic principle for their production is already known. What is, then, Sunew's OPV differential over the others? The scale. Whereas several labs around the world are only able to produce films of small size and low volume, Sunew has been able to produce films on a large scale.

The industrial process developed by Sunew is roll-to-roll printing, the main features of which are the low energy demand and scalability, giving the company an annual production capacity of approximately 400,000 square meters of film, with uniform efficiency throughout its width and extension.





Sunew has an annual production capacity of approximately 400,000 square meters of photovoltaic film, with uniform efficiency throughout its width and extension.

**Marcos Maciel**  
CEO at Sunew



The method has been adapted from processes used in the textile and graphic industries, and in the case of OPV, the ink is the result of the semiconductor polymeric compound – a kind of carbon pigment – while the paper is a malleable transparent plastic (PET) substrate.

Developed entirely in Brazil, Sunew printing technology has required the work of a multidisciplinary and multinational team. A team of 30 people, from 11 different nationalities! The machine developed is the adaptation of a German screen printing equipment. This adaptation is the key to Sunew's project and, therefore, is an industry secret. "Industrial secrets are our differential in the market", explains Maciel.

The photovoltaic pigment is formed by a series of five overlapping layers. For each of them, Sunew has several suppliers, including chemical companies around the world, such as the German giant Merck, one of the largest suppliers of organic electronics polymers.

The choice to leave production to the chemical industry came from the understanding that the true value-added of Sunew's OVP is in the process of printing the film – not the ink. "We decided not to enter the chemistry dispute. It did not make sense for our reality to dispute this niche", concludes Marcos.

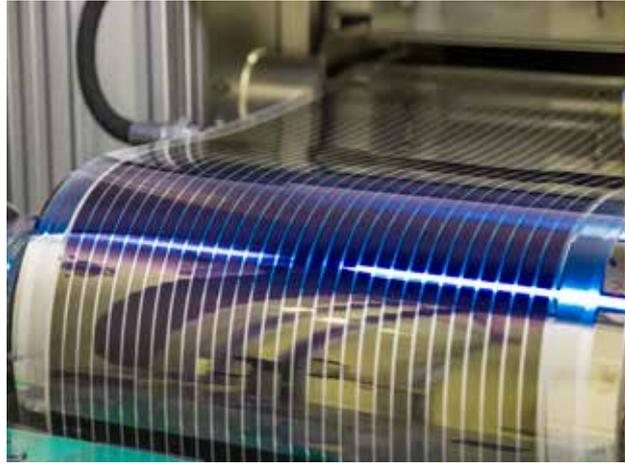
### Energy-producing glass

But photovoltaic film alone is of little use. It has been designed so that its technology can be aggregated to an infinite diversity of applications and can generate energy and value, in the most diverse ways. However, since Sunew's expertise is in the development of the film, for each application the company's engineering team needs to work with the partners and customers who will use it, called integrating partners by Sunew.



In order to make the first application chosen by Sunew, Sunew Glass – a glass to be used on the facade of buildings – a reality, it was imperative to find an integrating partner, a specialist in glass lamination and willing to develop the product in a joint way – in addition to betting on innovation as a competitive differential.

The project challenge was to understand the behavior of both the films and the laminates between glasses as necessary modifications in the production processes, in order to achieve a functional end product.



As it was necessary to maintain the characteristics of the two materials in the formation of the new product, studies and tests were carried out on the mechanical resistance of laminated glass with OPV, ideal transparency for maximum power generation, production process and several other factors.

A curiosity is that several European companies tried to solve the problem of the film's wrinkling during the lamination, which ended up being solved by Sunew's engineering team together with its integrating partner: Unividros, a national company. In addition to the technological issue, the partnership was essential to guarantee the scale of production, meeting the delivery and quality standards required by the construction market.

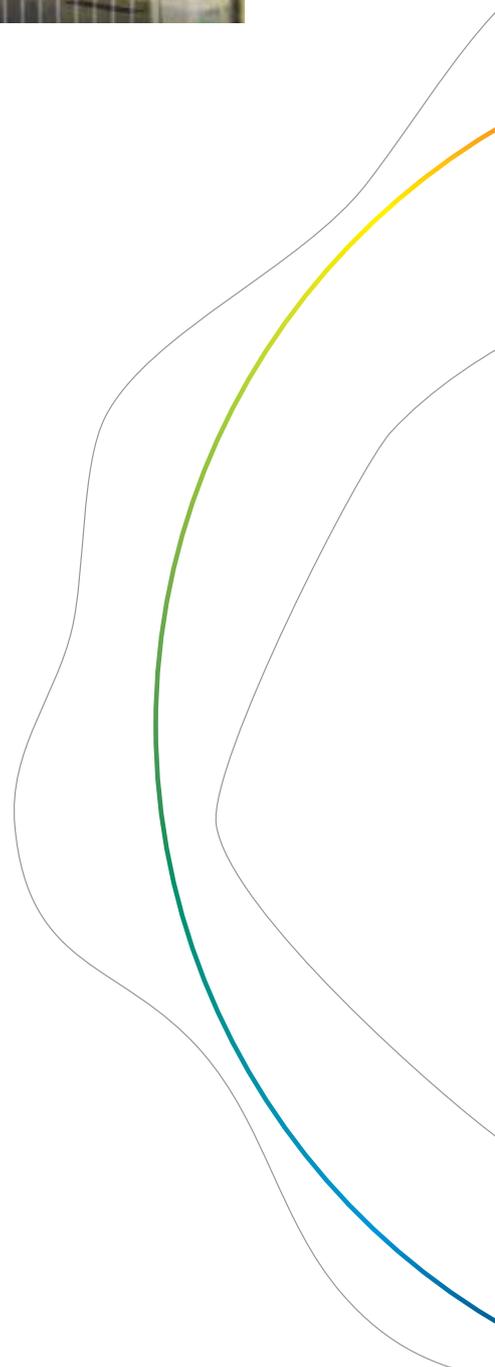
But what are the advantages of Sunew Glass after all? OPV glass is a product that combines functionality and design. This means that in addition to allowing the facade of a building itself to generate energy for the equipment inside, the different colors presented by the photovoltaic pigment can be used as a decorative element. And more: by reflecting the infrared rays, OPV glass aids in thermal comfort and, of course, contributes to the energy savings of air-conditioning.

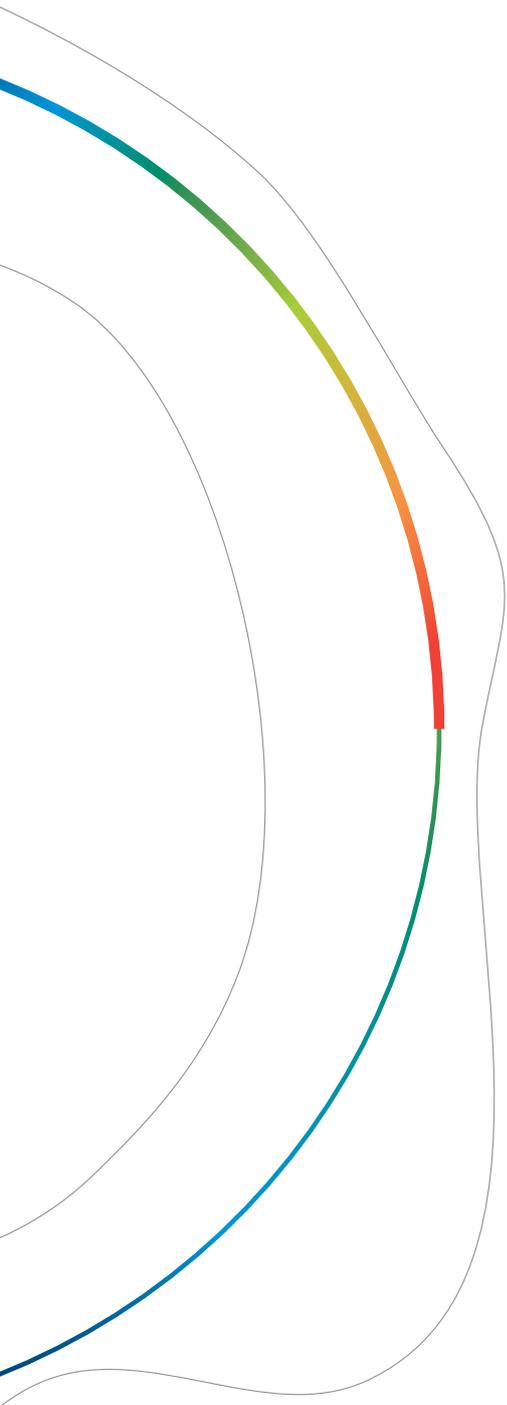
The glasses are connected in series and connected to the mains. What is Sunew Glass' lifespan? Because it is an organic product, the main enemies of the photovoltaic pigment are water and air. But since the OPV is packaged between plastic and glass layers, the lifespan of the OPV glass can be considered the same as for conventional glass.

### World pioneering

Launched on the market in June 2016, Sunew Glass is a totally innovative product in the world, for the construction and architecture market. The new glasses installed at Innovalli have cost 40% more than the traditional ones, an expenditure that should be offset by energy savings.

Although Sunew's focus is not to compete with silicon panels – but to seek markets where the traditional panel cannot operate – it is interesting to compare both technologies.





While a silicon panel needs a specific angulation (facing the midday sun) to generate energy, OPV generates energy even vertically and therefore can be installed on facades. Another difference is that, even in low light, the Sunew OPV panel generates energy, while a silicon panel spends 10 times more energy than an OPV panel, to be produced. Last, an OPV panel requires much less manpower, since its entire production process is automated, as well as being an organic, carbon-based compound that has no environmental impact.

With a unique technological structure, the Sunew plant has a larger production capacity than in Europe and Japan, which already makes it one of the global leaders in the segment, with a production capacity of more than 400,000 square meters per year, equivalent to tens of MW/year.

### **What's next**

Sunew's next steps are divided into two main fronts: market and technology. In the market, the company wants to gain space by reducing costs. In fact, one thing depends on the other: it is necessary to cheapen the product to increase the market and, considering the economy of scale, it is necessary to increase the market to cheapen the product. Therefore, the main strategy is focused on developing new applications for the OPV.

In this regard, the company has been working with different integrating partners. One example is Fiat, which has been testing to use the technology on its vehicles. The OPV, which can be placed on the roof of the cars, would reduce fuel consumption by 3%, usually spent to recharge the battery. The material would also make it possible to keep an exhaust fan running while the vehicle was parked in the sun, which would avoid raising the temperature inside the car. According to Maciel, "other likely uses are the coating of bus stops and warehouses".

As for technology, the great challenge is to increase the capacity of energy generation, with productivity. Increasing efficiency is now the main goal of researchers at Sunew and CSEM Brasil. In this direction, advances are being achieved. In the laboratory, the efficiency of 8% has already been reached, now transferred to the production line. In addition, initial tests are already being conducted with new materials, which reach 13% efficiency.

## Yes, we can

Sunew's case is a great example of how technology can turn into business. The CSEM model is very interesting and unprecedented in the country, and its pioneering work shows how the public-private partnership can be efficient, so that the country can become a provider of innovative technologies.

The exchange of knowledge, achieved through partnerships with research and technology centers around the world, is also an essential factor for Sunew's success, as well as the support of research funding entities such as Fapemig. Also, researchers from more than 11 countries participated in the development to assist – and learn from – the teams of Sunew and CSEM Brasil.

Sunew's lesson is that it is possible for the country to generate world-class technology and revolutionize a market that is innovative in its own right, such as solar energy. The evolution of Sunew, which has just begun, allows us to foresee the exciting future, which is yet to come.







# TUBE INNOVATES ONSHORE OIL PROSPECTING

- TECVIX
- Vitória/ES
- Medium-sized enterprise
- 200 Employees
- Product innovation
- MEI Agenda: Global inclusion through innovation, Innovation financing

*Tecvix develops tube to inject steam into terrestrial oil wells, with lower cost and greater efficiency than others available in the market*

One of the main characteristics of the oil produced in the terrestrial fields (called onshore) is its high density, which makes its extraction difficult. To make it more fluid and facilitate extraction, the main alternative employed is the injection of steam into the well.

Espírito Santo-based, Tecvix has developed an insulated tube, with high thermal efficiency, which surpasses competition not only in thermal aspects, but also in terms of costs. All the development was carried out in partnership with Petrobras, within the scope of Prominp – Program of Mobilization of the National Industry of Oil and Natural Gas, seeking to solve the problems faced by the company, resulting from breakages and frequent maintenance required by this type of equipment.

As the solution brought by Tecvix has a lower cost and greater thermal efficiency, the customer is able to make feasible the production of some onshore oil wells that were previously not feasible due to the cost of production and the price of oil.

Add to that the lower consumption of diesel, used in steam generators, because the higher thermal efficiency of the tube allows the steam to reach and maintain the desired temperature with less energy demand. It is important to note that, in addition to the lower cost of production, the reduction of consumption attenuates the emission of polluting gases.

With the project, Tecvix, which originated in another industrial area, diversified its business, entered the Oil and Gas sector and opened the door to the foreign market, since most of the world's oil production is onshore.

## How onshore prospecting works

In order to understand the importance of Tecvix's innovation, we must first understand how prospecting works in terrestrial fields. Onshore, oil is found at depths that can range from a few meters up to 6 km below the ground.

Typically, the oil is located beneath a high-pressure gas layer, which causes it to flow spontaneously when the well is drilled. When this pressure decreases, the pumpjacks come into play, equipment that pumps oil from the well to the surface.

However, when the oil is very dense, the pumpjack alone cannot pump it. It is necessary to carry out the injection of high-pressure and high-temperature steam inside the well, so that the heat decreases the viscosity of the oil, increasing its mobility, which makes the pressure help push it upwards, facilitating the extraction.

For this, the steam is generated on the surface and driven to the great depths of the wells by special ducts – the so-called steam injector tubes.

The complete steam injector tube is formed by two concentric tubes of different diameters, separated in their annular space by a thermal insulation, which has the function of preventing the heat of the water steam from being dissipated during its course to the bottom of the well.

Each of these tubes measures approximately ten meters, being connected to each other by means of threaded gloves, forming great columns of steam injection.

There are two methods for using steam onshore: continuous injection and cyclic injection. In the first, the extraction uses two wells, the injector well, where the steam is injected continuously, and the producing well, in which the pumpjack continuously works in the extraction.

In the second, the extraction uses only one well. When the injection is cyclic, the well receives the column, and the steam is injected for approximately three months. Then the injection column is removed, the production column is installed, and the extraction begins, which continues for the next nine months, during which viscosity increases again, until a new injection cycle begins.

In Brazil, the most widely used method is the cyclic one, the greatest advantage of which is to allow a steam generating unit to work with several wells. When the steam injection cycle ends in one well, the unit and column are removed and transported to another. The associated disadvantage is the wear of the column, especially of the connections, due to the successive operations of assembly and disassembly.

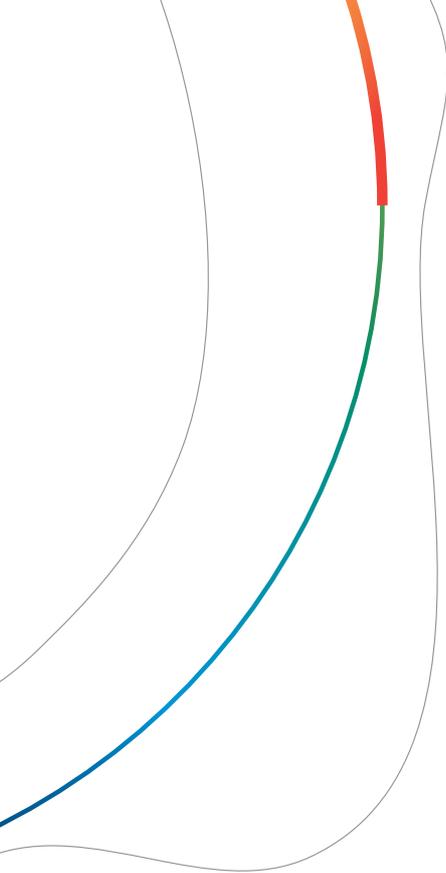
This was exactly the point where Petrobras had serious challenges in 2013, as the tubes could not withstand five reassemblies. The thermal insulation was compromised and cracks appeared, sometimes in the threads, others in the welds, rendering the pipes unusable and causing damage to the process. That was when the Prominp call was opened.

### Three problems, one solution

In addition to the durability, another prerequisite required by Petrobras was the high thermal insulation, which would allow the steam to be transported at 350 °C with minimal thermal loss, so that its arrival temperature at the bottom of the well was at least 315 °C.

The call also specified the requirement to include in the project an automated plant for serial production of the pipe, in order to guarantee a high level of control in the manufacturing process.





To meet these demands, it was therefore necessary to overcome three technological challenges: high-efficiency thermal insulation, more resistant threads and high-durability welds. The first step of Tecvix was to carry out a reverse engineering process on the product used by Petrobras until then. The objective was to identify the main characteristics of the product and points that could be improved.

The project was then divided into thermal, mechanical and welding project. For each of them, preliminary studies were carried out to understand the existing situation, to better understand demand and to seek strategic partners capable of assisting in development. "When we start to develop a project, the first thing we do is prospect in the international patent bank, to know the state-of-the-art of that technology we intend to develop", explains Luiz Alberto Carvalho, CEO at Tecvix.

### **Weld**

The complexity of the welding system results from the differences in temperature of the inner and outer tubes, which undergo different dilations and contractions, creating a voltage that goes to the weld. Therefore, the welding needs to be performed with the tube already dilated to a specific temperature range, called dimension. If the welding is made above this dimension, it breaks when cold, and, below that dimension, it also breaks, when hot. The challenge was to determine the most suitable welding dimension and procedure; the method chosen is called automated circumferential welding.

### **Thread**

The threads suffer the same problem of contractions and dilations different from the inner and outer tubes, which generates a great effort on this component, vital to the system. To minimize the risk of cracking and disruption, an extensive study was required to define the best geometry for the thread.



### **Insulating material**

For the thermal insulation, there was a very specific requirement about the minimum arrival temperature of the steam to the well, associated with a longer durability of the insulation. The challenge was to develop an insulation that, within a maximum space of seven millimeters, could keep the inner tube (hot face) at 350 °C and the outer one (cold face) at 80 °C, an abrupt reduction in temperature.

The market is currently dominated by vacuum-insulated tubes. Although conceptually the vacuum is the ideal insulator, the suppliers fail to achieve the perfect vacuum in the tubes, which causes the insulation to lose efficiency over time.

Tecvix then opted to seek super-insulating materials on the market, which had the necessary characteristics of thermal conductivity and applicability (physical characteristic) and which allowed to achieve a longer service life than the vacuum-insulation of tubes.

After a selection, carried out by the development team, Tecvix mobilized, through the CNPq's RHAE (Human Resources in Strategic Areas) program, a specialist of the Federal University of Espírito Santo (UFES), doctor of thermodynamics, to carry out simulations of the different insulating materials, in order to determine which would be the most suitable.

The result pointed to five materials, with which five prototypes were manufactured, three of which were approved, according to standards established by Petrobras. "We started to use the one that was most cost-effective, which is a nanoporous thermal insulation with high thermal efficiency. But, if necessary, we can use any of the other two", explains Mário César Batista Santos, Chief operating officer at Tecvix.

The decisive strategy for the success of the innovation was to seek specialist partners to assist in development. "In all our processes, we try to map the technologies to develop a particular product and, when we do not have the internal skills to do it alone, we seek partnerships with universities or even manufacturers", explains Luiz Alberto. One of the most important developments, resulting from the partnership, was the machine to automate the application of the insulation coating.

### **Innovation as survival strategy**

The paths that led Tecvix to be the solutions provider to one of the world's most important oil companies are very peculiar.

Tecvix was founded in 1999 as a company providing metalworking maintenance services for the cellulose and paper, chemical, mining, port and oil and gas sectors, which continues to this day.

In its first 10 years of existence, the company's largest market was the large cellulose and paper industries from the state of Espírito Santo.

This trend changed in the late 2000s, when there was a boom in the sector, which led to the emergence of new production centers in Eunápolis (BA) and Três Lagoas (MS), attracting new factories.

At that time, the world's major players restructured their businesses and started to offer maintenance services as well. This has caused Tecvix to begin to suffer the effects of the new competition with traditional and global companies.

Faced with the risk situation, CEO Luiz Alberto, also founder of the company, decided to hire a consultant to make a business plan, focused on the commercial recovery. After market research and mapping of opportunities, it was clear that it was necessary to redefine the company's strategy, increasing its focus on innovation.

**Prominp** – Program of Mobilization of the National Industry of Oil and Natural Gas – was created in 2003, with the purpose of maximizing the participation of the national industry supplying goods and services, on a competitive and sustainable basis, in the implementation of investment projects in the oil and gas sector, in Brazil and abroad.



In all our processes, we try to map the technologies to develop a particular product and, when we do not have the internal skills to do it alone, we seek partnerships with universities or even manufacturers.

**Luiz Alberto Carvalho**  
CEO of Tecvix



The concept of **local content** is nothing more than the proportion of national investments applied to a particular good or service, corresponding to the share of national industry's participation in the production of such good or service. Thus, when a platform or refinery, for example, has a high index of local content, it means that the goods and services used in its construction are national to a large extent, not imported.

One of the approved actions was the creation of an innovation management department, focused on the development of products for the Oil and Gas sector. The choice was made based on the high investments announced for pre-salt exploration and the local content requirements defined by the National Oil Agency (ANP) for investments in the sector.

From that decision, Tecvix created a spin-off, Tecvix Desenvolvimento e Inovação (Tecvix DI), incubated at TECVITÓRIA, an incubator for technology-based companies from Vitória (ES).

In the beginning, the DI team consisted only of two engineers, who started to dedicate themselves exclusively to innovation projects. According to Luiz Alberto, the incubation option was based on the fact that it was “a perfect environment for R&D companies, due not only to the support and advisory services to participate in the bidding process, but also to the possibility of establishing partnerships between incubated companies, universities, and Other entities”.

Thus, the strategy adopted by Tecvix DI was to use the open innovation model, seeking partnerships with companies, universities and specialists, in addition to customers, for the development of products.

But how, after all, has Tecvix gone into the designing the steam injector tube?

Almost simultaneously with the creation of the DI, an announcement was made for the Inova Petro Program, with demands for the pre-salt. Even without experience, the company team sought partnerships with UFES researchers to prepare the projects, four of which were approved: development of a three-phase separator (equipment that separates water, gas and sediments); development of a hydrocyclone treatment system; raiser accessories – equipment that assists in transporting oil from the well to the surface; and a robotic inspection system for underwater pipelines.

The quaint and unexpected aspect is that, only after approvals, Tecvix discovered that the resources it would receive would not be a lost investment, but a financing – and that Petrobras did not guarantee the purchase of the developed product.

Even in the face of this letdown, the company saw in the projects the opportunity to establish partnerships with research institutes, companies and suppliers operating in the Oil and Gas sector, a knowledge considered fundamental to continue its growth strategy through innovation.

The first project, still under development, was the hydrocyclone project, in partnership with the Federal University of Itajubá. Other cooperation agreements have also been established with the Federal Institute of Espírito Santo, UFES and Coppe – Alberto Luiz Coimbra Institute for Engineering Graduate Studies and Research, from the Federal University of Rio de Janeiro.

Around the same time as Inova Petro – but still before the establishment of DI – Tecvix had already begun to participate in Prominp, at the invitation of the Metal Industry Union.

The first demand received was for a centralizer for columns of oil well casings, equipment that improves the efficiency of the displacement in the operations of cementing the columns. The project has been in progress for six years, as it is a complex development, in which Petrobras requires a higher precision than the international standard.

It was due to the quality of the work developed on the two fronts, Prominp and Inova Petro, that Tecvix received, at the end of 2012, the consultation on the steam injector tube.

### Entering to win

The Prominp development project involves a technical cooperation agreement with Petrobras, which undertakes to purchase a first test lot, which allows product validation and allows the company to integrate the list of suppliers, in addition to participating in global tenders.

Early in project, it would have been defined that the test lot would be 100 tubes, but during the monitoring phase, Petrobras experts identified the project success and the tube quality, thus increasing the lot to 800 tubes, which totaled a turnover of around BRL 1.5 million.

*The **Inova Petro** Program is a joint initiative of Finep and BNDES, with the technical support of Petrobras. Its purpose is to foster projects that contemplate research, development, engineering, technological absorption, production and commercialization of innovative products, processes and/or services, aiming at the development, engineering, technological absorption, production and commercialization of innovative products, processes and/or services and stimulating the development and entry of Brazilian suppliers to the production chain of the oil and natural gas industry.*



As a result, Tecvix was able to lower the price compared to the previous supplier by 30%, thereby overcoming global competition, which guaranteed it a BRL 6million contract for exclusive commercialization until the end of 2017. The current volume of manufacture is 200 tubes per month.

The project also secured the filing of two patents, in which Petrobras has a 50% stake. The company is now preparing for a new tender, which will take place in 2017, to ensure continuity of supply.



That's what is fascinating about innovation: you go through maze, developing countless possibilities.

**Mário César Batista Santos**  
Chief Operating Officer at Tecvix

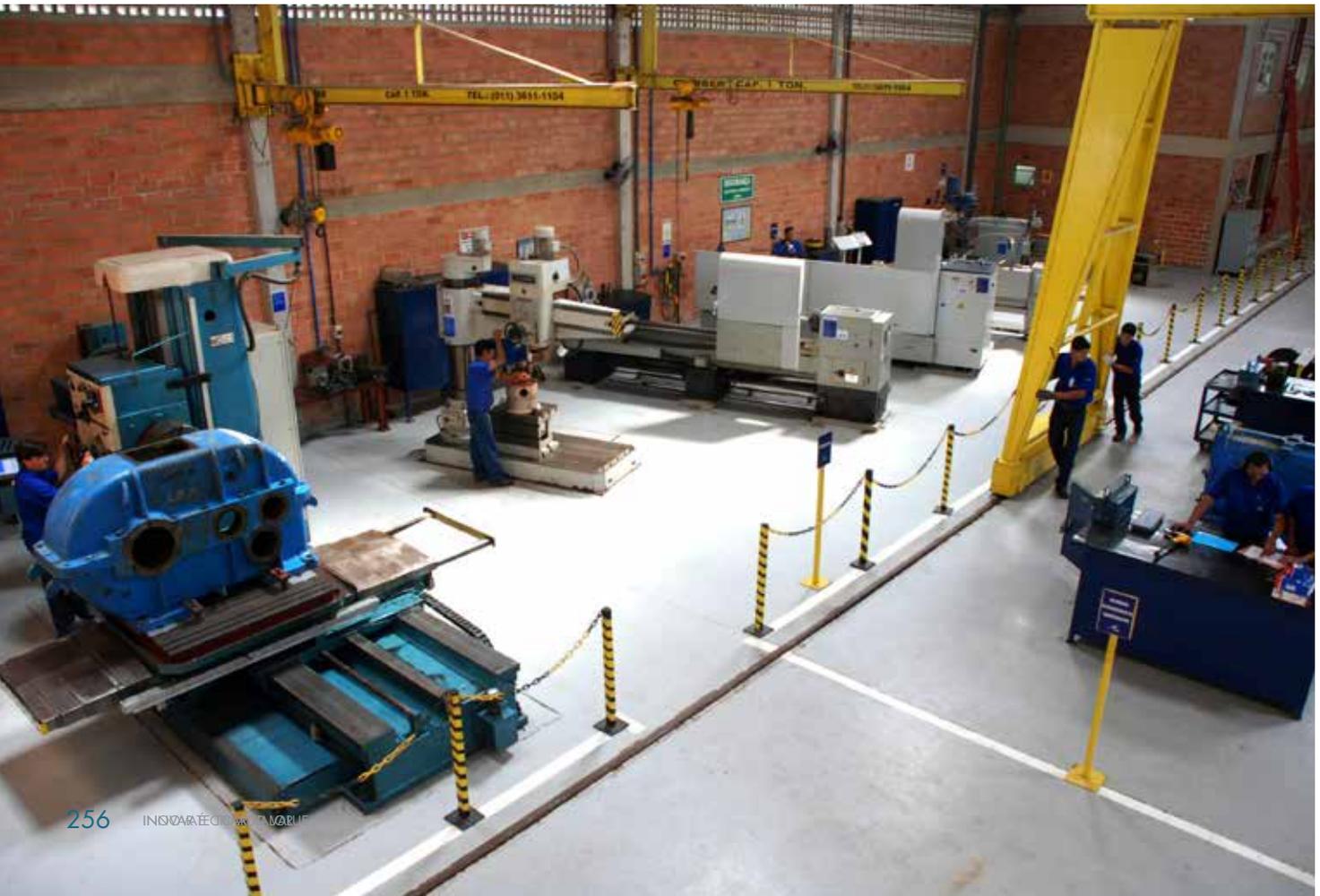


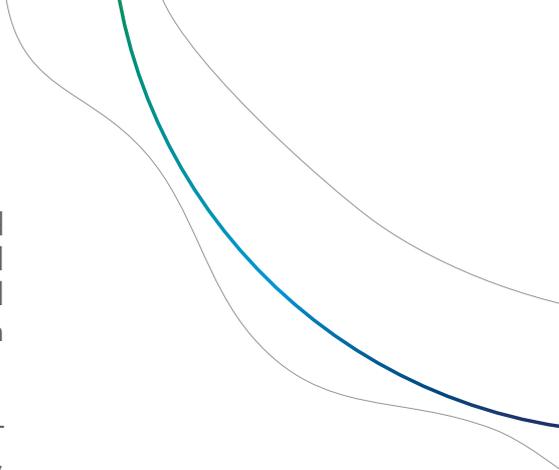
### The path points abroad

The future plans are for internationalization, since 70% of the world production of oil barrels comes from onshore wells. In the world there are 900 thousand wells in operation, while in Brazil there are only 9 thousand. The intention is to start commercializing abroad still in 2017.

With this in mind, Tecvix has been working, with the help of consultants specialized in the markets of each country, to adapt its product to the standards of England and Canada – from where an invitation to open a branch has already been made – in order to reduce logistics costs. The challenges to entering definitely Canadian soil are to break the culture of the local market – using vacuum-insulated pipes – and compete with the low price offered by the Chinese product.

At the same time, DI has been working on the software to identify, through data collected in the well, its recovery factor, that is, the volume that can still be extracted. This is very important information, especially for the independent producer.





Another possibility studied is to offer the steam injection service instead of selling the tubes in exchange for a percentage resulting from increased production. That is, Tecvix would go from a supplier of solutions to oil producer! “That’s what is fascinating about innovation: you go through maze, developing countless possibilities”, says Mário.

Tecvix DI plans to become a knowledge transformation company in technologies for the oil industry. With the other projects under development, the company intends to increase its portfolio and its manufacturing plant, since each product will require its own manufacturing. The estimated investment demand is BRL 15 million to reach the world scale of production. To do so, the company has been seeking investors and already has advanced talks to Canada and to the Middle East.

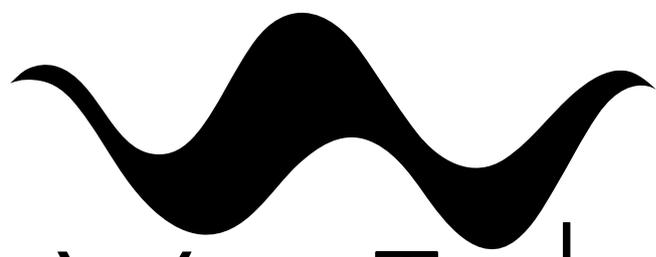
### **Innovation that transforms business**

Innovation financing is so important to Tecvix that it can be said that Tecvix DI would not exist without it. It was through Inova Petro, BNDES and Finep that the company was structured, set up an important network of relationships and developed its know-how, which will be fundamental for its growth and internationalization.

The capital, obtained through the financing, was used in the purchase of test equipment and in the development of technologies, which the company would not have been able to do only with its own resources.

If the internationalization plans materialize – and Tecvix starts exporting in 2017 – the company will consolidate the incredible story of a maintenance service provider in 2010, which has become an exporter of equipment with high technological content in 2017, thanks to innovation.





WaveTech

SOLUÇÕES TECNOLÓGICAS

# BRAZILIAN COMPANY ENTERS THE HEARING AID MARKET, INNOVATING WITH SIMPLICITY

- WAVETECH
- Florianópolis/SC
- Small-sized enterprise
- 22 Employees
- Product innovation
- MEI Agenda: Innovative SME

*Small company in Santa Catarina, pioneer in the production of national hearing aids, develops simple technology that reduces the price to the consumer*

Wavetech has created an AASI-type (Individual Sound Amplifier) hearing aid with technology developed in Brazil, coupled with programming software that meets the current demands of the domestic and international markets. The product breaks the paradigm that only with high technology is it possible to produce hearing aids – a market dominated by international giants, in which the world's smallest manufacturer makes around USD 500 million a year.

Incubated in Celta – Business Center for Advanced Technologies, in Florianópolis-SC, the young company was not intimidated by the competition and dared to develop and market a product that meets all the requirements of quality and aesthetics, at a price that can cost up to three times less.

At the end of 2016, Wavetech, which has authorization from Anvisa for commercialization, was able to approve a Partnership for Productive Development (PDP) of the Brazilian Ministry of Health, aiming to meet 50% of the demand for this type of apparatus in the Unified Health System, which means an average of 80,000 to 100,000 units per year and an estimated market of BRL 60 million.

## What Wavetech does differently

To understand the dimension of Wavetech's achievement, one must understand the technological complexity of a hearing aid. "Although its small size can give the apparent impression of simplicity, it is rated as one of the most complex and difficult-to-manufacture medical equipment", explains Guillaume Barrault, founding partner at Wavetech.

How big is this complexity? Manufacturing involves multidisciplinary knowledge, such as software, hardware, signal processing, ergonomics, design and plastic injection. This small equipment needs to embed a number of sensitive and sophisticated electronic devices that are integrated with each other and need to be connected to a sophisticated software that allows adjusting more than 200 parameters so that the device adapts to the particularities and needs of each patient.

This customized setup is essential to ensure the quality of hearing provided to the user. "An equipment may be the best in the world, but if it is misconfigured, the hearing quality will be poor, and the user will find it bad," Guillaume clarifies.

The same logic works the other way around: even if the equipment is not the top of the line, if the adaptation is done properly, the sound quality perceived by the user will be much higher.

The responsibility for configuring the parameters of a hearing aid is the task of a speech therapist. He is the one who examines the patient, so that, together, they make the necessary adjustments. As speech therapists are not exactly computer experts, the software interface should be as intuitive as possible, reason why it is even better if the system algorithm facilitates and adjusts the settings.

Wavetech's AASI software has important differentials. The first one is that the algorithm couples the parameters together, from mathematical and physical rules, so that the change of a given variable automatically causes changes in the complementary variables. In practice, this means that the software adjusts itself to every adjustment made by the speech pathologist – a kind of automated fine-tuning.

Another relevant feature concerns the before and after technique, similar to the work system used by ophthalmologists. In an adaptation, the professional changes a parameter and asks the patient if there was improvement or worsening. In the Wavetech device, with each change, the software registers the difference and, by dichotomy, it reaches an optimum point. In other systems, the set points can be infinite, which makes the activity more complex and difficult.

A third peculiarity is that Wavetech software has what is called psychoacoustic character<sup>1</sup>. This means that it interprets the patient's perceptions of sound and transfers them to the algorithm. "When the patient hears a noise, and classifies it, for example, as 'shower', the software interprets this as a high-frequency white noise. Then the speech therapist plays that sound, pushes a button and asks if it is better. We know that the word used by the patient corresponds to these parameters and so the professional begins to suit this patient's vocabulary", explains Barrault.

A great differential of the Wavetech's device, that allowed the cost reduction in comparison with the imported ones, is the method of manufacture. Unlike the international giants, which have fully automated production lines – which cost a lot of money and represent a barrier to the entry of new suppliers – the process developed by Wavetech is much cheaper because it is semiautomatic: welding of electronic components is automatic, but the assembly is manual and simple, similar to the assembly of Lego parts.

To facilitate and speed up the work of assemblers, the electronics are totally flexible and without any wire, something unheard of in such devices. The result is that Wavetech's production speed is one device every 5 minutes!



Although its small size can give the apparent impression of simplicity, it is rated as one of the 10 most difficult-to-manufacture medical equipment.

**Guillaume Barrault**

Founding partner and CEO at Wavetech



<sup>1</sup> Psychoacoustics is the study of sound perception. This includes how we listen, our psychological responses, and the physiological impact of sound on the human nervous system. Although the human ear is able to hear frequencies between 20 Hz and 20,000 Hz, the perception of sound is an idiosyncratic process, that is, each individual perceives and interprets the sounds differently, individually.

Another determinant factor, the cheapening of the process, were the adaptations made to the project, so that most of the components could be produced in Brazil. The result is that Wavetech's assembly line costs around BRL 20 thousand, while that of one of the manufacturers considered a reference in the sector costs between BRL 70 thousand and BRL 100 thousand.

### **An intruder among giants**

But who is this small company that decided to take on the challenge of facing global giants and became the only company in Latin America to develop and manufacture hearing aids?

Wavetech, founded by engineers Alexandre Ferreira and Guillaume Barrault, soon became a manufacturer of such promising equipment that the company became a supplier of the Brazilian Ministry of Health.

Frenchman Guillaume, an electrical engineer graduated from the Lille School of Engineering, has specialized in the sonar area, working in the American Navy. After a masters in the field, also in the United States – with a career enriched by work in the aerospace area –, he arrived in Brazil in 2003, to develop projects for two large Brazilian companies, whose work proposals were elaborated by Guillaume himself.

For the first company, in the white line industry, the project proposed the development of a refrigerator that would not generate noise. For the second company, in the aeronautical industry, the idea was to produce an intelligent wing, that had less friction with the air, allowing to reduce the fuel consumption.

Both companies have important partnerships with the Federal University of Santa Catarina – UFSC, where the projects were developed. "It was there that I had the opportunity to have as advisors two authorities in acoustics, which are professors Arcanjo Lenzi and José Carlos Bermudez, the greatest authority in the world today in adaptive control", says Guillaume.

As part of the projects and with the help of the advisors, the French engineer was able to work for a year and a half in Australia, focusing on adaptive noise controls, systems that study vibrations to try to eliminate them at source.

All of these experiences gained so far are part of a large area, called signal processing. Although working for a long time in this field, Guillaume's desire was to work with his application in the area of health.

It was during his doctorate, also at UFSC, that he met Alexandre Ferreira, an electrical engineer who was taking a master's degree in signal processing and worked in a small assembly of hearing aids in Pelotas (RS). "We started to interact and we saw that part of audio signal processing for hearing aids is the same as I was doing", explains Barrault.

Both had a common desire to develop and market hearing aids – but not just to assemble, like the Brazilian companies did. In 2006, when they finally made the decision to really set up a company in the business, they immediately met the financial constraint.

How to set up a company that would need an R&D department that would be devoted exclusively to development for at least four or five years?

That was the big question, considering that the billionaire companies that dominated – and dominate – the market usually take between five and six years to develop a new product. How could a small company do that?

As a means of capitalizing to invest, Guillaume decided to go to Oxford, England, where he worked for four years, using all his savings to found the company. In the meantime, Alexandre remained in Brazil and enhanced himself in the area of production and assembly of hearing aids.

At the end of 2011, Barrault returned to Brazil and together they made the final decision to turn their wish into reality. In May 2012, the company was formalized and, in July of the same year, after a strict selection process, Wavetech was one of the companies chosen to be part of the Business Center for Advanced Technologies – Celta, located in Florianópolis-SC.

Beginning with their own resources, the partners were able to set up a business model, which allowed them to provide medical equipment development consulting services and reinject 100% of the revenues in the AASI project, which lasted for four years. “One of the prerequisites for developing a quality, innovative hearing aid was having a team of highly competent engineers. They are experts in electronics, signal processing, software. With the team assembled we thought: why not use this differentiated human resource as a source of revenue? And so we set up our ‘survival strategy’”, explains Guillaume.

A fundamental support in this process was the partnership with UFSC’s Laboratory of Vibrations and Acoustics, which provided facilities for tests and trials. In addition, in 2014 the project was contemplated by the announcement Tecnova from Santa Catarina, managed by Fapesc – Foundation for Scientific and Technological Research Support of the State of Santa Catarina. The amount of BRL 600thousand received allowed to enlarge the AASI family and better structure the company.



*The Business Center for Advanced Technologies – Celta is the incubator of the Certi Foundation – Reference Centers for Innovative Technologies, located in Florianópolis/SC. It was created in 1986, as a response to the yearnings of development of the capital of Santa Catarina and with the purpose of enabling a promising economic sector, taking advantage of the talents and knowledge generated by the Federal University of Santa Catarina – UFSC.*

*Its mission is to support Technological Base Enterprises (EBTs) and at the same time stimulate and support their creation, development, consolidation and interaction with the business and scientific environment.*

*It is the largest incubator in Latin America, in number of companies and size – it has 10,500m<sup>2</sup> and 36 companies incubated.*

In the following year, Sebrae's participation had a very significant indirect impact as part of the consulting services executed by Wavetech, was directed to companies served by Sebraetec. "We got to manage five Sebraetec projects at the same time. We divided the team and made a technology management, because all the projects that we accept also add some value to our hearing aid", clarifies Barrault.

### Technological challenges

In addition to the difficulty represented by the scarcity of financial resources, a series of technological challenges had to be overcome during the development of the AASI. The project involved the development of plastic material – which should be injected into the established format –, electronics, signal processing algorithm and speech language software.

In the case of software, the challenge was to think of an interface and an operation that would maximize the work of speech therapists, in order to become an important differential. In time: it is a requirement of the Brazilian law that the device be adapted to each patient only by a speech and hearing specialist.

As the adjustable parameters belong to the field of advanced acoustics – something that Brazilian speech-language therapists are not familiar with – it was necessary to translate them into a simpler language. "We are talking about filters, cancellation of correlated and uncorrelated noise, environment detection, microphone cancellation, adaptive system to focus on the acoustics energy that is in front of it – there are thousands of parameters that needed to be simplified", Guillaume points out.



There was also the physical challenge of “fitting” all components within a dimension limit of 6x4x2 mm. To make all the electronics and algorithms fit in there and work properly. However, the smaller the system, the more things need to be fitted, and the problems end up being “fitted” as well.

Add to that the aesthetic question: if the device is not beautiful and looks nice, the patient will not choose it. Barrault believes that, in the aesthetic question, the devices will follow the trend of glasses, which were previously frowned upon and are now fashionable items.

Once transposed, the challenges were added together, until the goal of overcoming the largest of them was reached: to produce an AASI, capable of competing with those of the international giants. “The devices that are on the market are very good, very good indeed. They are companies with 20, 30, 40 years of experience, with factories that are worth millions of dollars”, recalls Guillaume.

What was then the strategy adopted to overcome this challenge? To think about the problem from the inside out. Regardless of the company size, given that the basic principle to produce a good device is in sound quality and acoustics, areas where the members had extensive experience.

Add to that a keen entrepreneurial spirit and a willingness to make a difference. The result is that today Wavetech is the first small company in the world to manufacture Individual Sound Amplifiers.

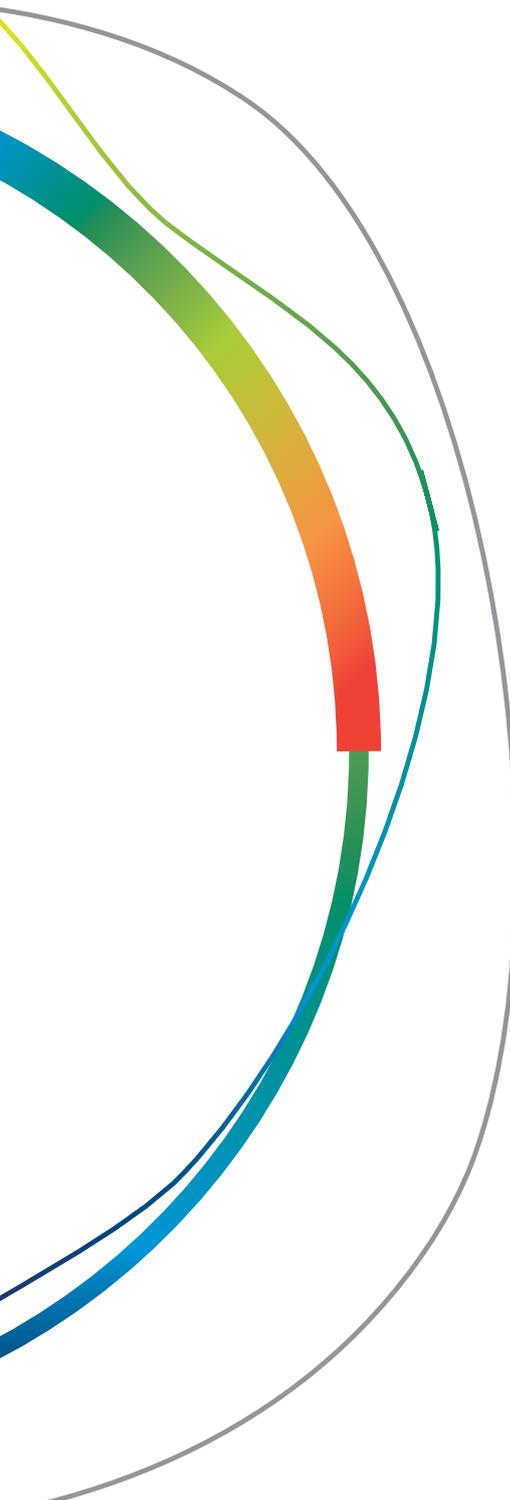
### **Motivation to venture**

Prior to making the final decision to launch the venture, Alexandre and Guillaume intensely studied the market to assess the feasibility of their business and the potential for success, and a number of factors identified were essential for the decision-making.

The first one was the context of hearing health. The main causes of hearing loss in the world are exposure to loud noises (33% of cases) and age (28% of cases). The aging of the population and the increase in the number of people exposed to noise generate a constant increase of demand, opening space for new companies in the sector.

Also, according to the WHO, hearing health has been rising steadily in the world ranking of disease morbidity, indicative of the main diseases that affect the populations, causing some type of incapacity. The forecast is that, following the current trend, hearing health will occupy the seventh place in the ranking, rising 18 positions compared to 2004.

*The purpose of Fapesc (Foundation for Scientific and Technological Research Support of the State of Santa Catarina)'s **Tecnova** announcement is to create favorable financial conditions and to support innovation – by means of economic subsidy resources – for the rapid growth of a significant group of micro and small-sized enterprises (revenues up to BRL 3.6 million per year). The idea is to support the development of new products, services and processes that add value to the business and increase competitive differentials.*



Considering that hearing problems affect all people, regardless of class and purchasing power, it was important to provide alternatives at more affordable costs. And why Brazil? Because it is a market with a lot of potential and insufficient service.

The few Brazilian companies operating in the domestic market are only assemblers, which purchase all inputs from international manufacturers – which account for 99% of the devices marketed in the country.

The Brazilian market accounts for 2% of the worldwide market, around 360,000 hearing aids per year. The largest unit buyer in the world is SUS, which buys 180,000 units a year, while the remaining 180,000 are bought by the private sector.

The IBGE estimates, however, that 5% of the Brazilian population needs a hearing aid. Even making a more conservative estimate – considering only 1% of the population – that would be two million people, which would mean that demand is far from being supplied.

Regardless of the causes of this repressed demand, whether due to disinformation or high cost, the fact is there is a high potential for growth and an open door for Wavetech. Local production also avoids fluctuations in the dollar, protecting consumers and public policies, as well as providing services to other middle-income markets.

### **Starting on the right foot**

The signs that confirm the success of this strategy came from the market itself: while waiting for Anvisa's approval for domestic marketing, obtained in late 2016, Wavetech began exporting to Turkey. The first delivery totaled 100 units, already guaranteeing a new sale of 1,000 units.

Other evidence of the company's success is the result of bidding for a PDP from the Ministry of Health – won by Wavetech, competing with the world's top player.

With this result, Wavetech was responsible for meeting 50% of SUS demand, accounting for an estimated market of BRL 60 million, which proves the technical quality of the product.

The PDP imposes the existence of a public producer, which Wavetech is not. After mapping all the public producers that corresponded to its activity, the company chose Lafergs – Pharmaceutical Laboratory of the State of Rio Grande do Sul as partner, for evaluating that it met all the necessary criteria. The next step is to train the partner laboratory to begin production.

Although 50% of the SUS demand represents around 100,000 units per year – and Wavetech already has a production capacity of 15,000 units per month – the forecast is that, in 2017, this limit is not yet reached, since there are still contracts in force with the Ministry of Health, which end this year.

## Goals and dreams

Despite its youth, Wavetech is considered a benchmark in the development of complex health products. The company is a member of the Brazilian Dental-Medical-Hospital Committee (ABNT/CB-26), in the Hearing Aid Study Committee (CE 26: 120.03), participating in the elaboration of the new Brazilian technical standard for AASI, one of the technical references of the Ministry of Health in hearing health.

With this important recognition, reinforced by the early commercial victories, Wavetech maintains the dream of becoming “the popular hearing aid store”. “We want to provide good quality hearing aids at an even lower price”, says Guillaume.

To realize this dream, they must first increase the scale and the profit margin. In the agreement with the SUS, the public producer gets a percentage of the business, which makes the margin for Wavetech very small. So, even with the large sales volume, they need to buy raw materials in a much larger amount, so that this margin goes up.

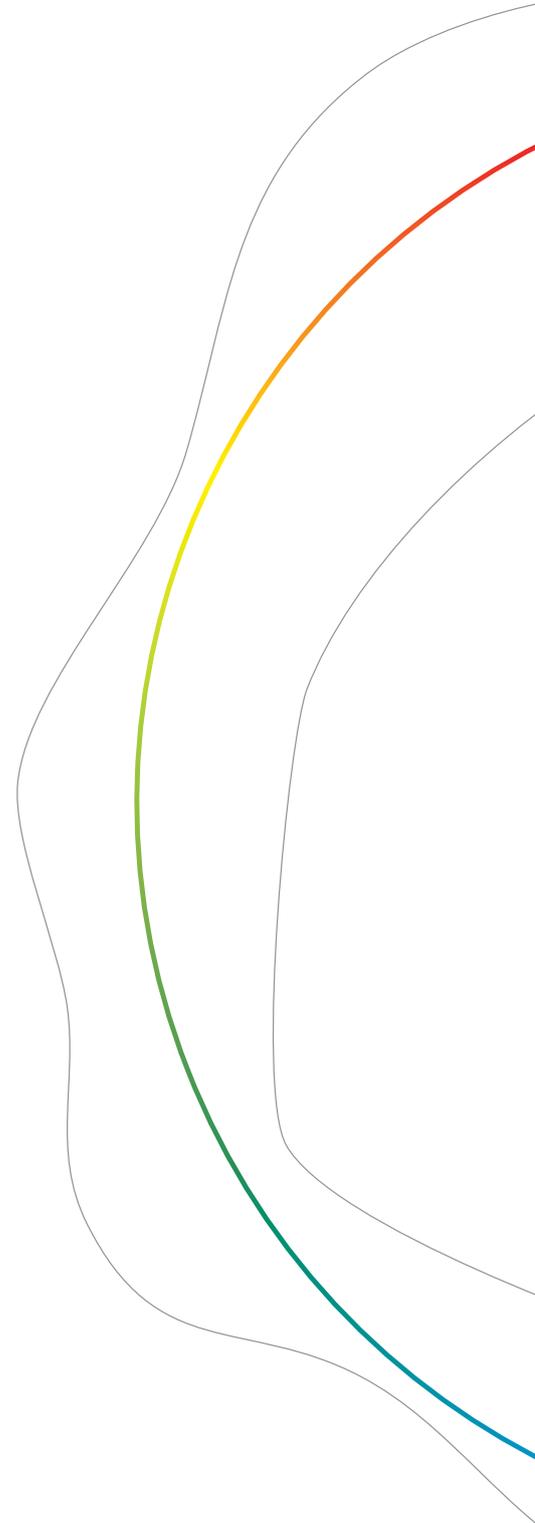
Therefore, the strategy now is to target the private sector, with differentiated prices to be able to better serve the population with lower purchasing power. “It would be foolhardy to base the company’s stability on a single major customer”, says Barrault. One of the approaches to penetration in the market is to create reference centers in hearing health for both doctors and clients.

Another Wavetech’s initiative to establish itself definitively in the market is to work on complementary research fronts, aiming to consolidate a complete line of solutions for hearing health. One of the most promising projects is an invisible cochlear implant.

For ease of understanding: cochlear implantation is necessary when the mechanical, sensorineural part within the cochlea does not work. The cochlea is like a snail with many lashes, and it is the movement of these lashes, caused by the vibration of the sound, that allows us to hear. For a person who does not have lashes, it is necessary to send an electric stimulus.

The implant inside the cochlea has exactly the function of effecting this electric discharge. In traditional implants, the sound is captured outside the patient’s ear, and the electric discharge comes along with that external sound.

The project that Wavetech has been developing, in partnership with UFSC and with the Otopedia auditory center, the largest hearing center in Santa Catarina, has as principle the installation of an accelerometer in the patient’s middle ear, in one of the ossicles, producing the electrical stimulus necessary to capture the sound, which eliminates the visible part of the current devices. The project also has financial support from Finep.



### Investing is necessary

The fact that Guillaume worked with research abroad and subsequently opened a company in Brazil gives him the perspective to compare the environments for technology-based companies, providing important elements of reflection in building an agenda of improvements. "What I perceive as the most striking difference today is that when a crisis occurs, Finland, Norway, Switzerland, France, Italy, Japan, Singapore cut an amount of things, take a lot of money and put it into startups, in small companies that invest in technology. This is their way out of the crisis. In Brazil, it is the opposite, they cut all the investment that goes to small companies and put them into even larger companies", he reflects.

When questioned about why he opted to undertake in Brazil, the answer is categorical: "The ecosystem is favorable for our

hearing aid. We will penetrate and we will conquer the private market, there is room for us. What happens is that we could suffer a little less". He explains that the entry ticket for a business like Wavetech's is extremely high, which is why it was necessary for the partners to take personal debt to make the project feasible.

He praises Fapesc's support through Tecnova as an initiative that, although important, has not yet been sufficient. "If we had not made personal investments, which now total almost BRL 4 million, we would not have achieved the level we did", he summarizes.

According to him, there is a lack of investors and incentives for companies that, like Wavetech, need time to dedicate themselves exclusively to R&D, whose maturity can reach eight years.



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