

COVER

PIPE 20 years

With an innovation project contracted every business day, the FAPESP program gave a boost to more than 1,100 small and medium-sized technology companies

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A milestone in support for technological companies in Brazil was celebrated in São Paulo at the end of June, 2017. FAPESP's Innovative Research in Small Businesses Program (PIPE) celebrated its 20th anniversary, with 1,788 projects contracted and an investment of more than R\$360 million. The PIPE program provides support to entrepreneurs who want to transform knowledge into new products or services and frequently promotes innovation at a crucial high-risk stage at the beginning. Every three months, a new public notice is issued by the Foundation, in search of projects that are in the initial phases of technological development.

Phase 1 covers research proposals at the initial stage. This phase is focused on demonstrating the technical and commercial viability of innovations that emerge from work done to solve a research problem. In this phase, the funding limit is R\$200,000 for up to nine months. In Phase 2, which lasts up to two years, the research proposal itself is developed, which may include, for example, building a prototype, and up to R\$1 million is offered for each initiative. The objective of Phase 3, in which FAPESP participates with partners (so far only with the Brazilian Innovation Agency (Finep)), is the final development of innovation and the pioneering offer for sale. "PIPE is the largest startup support program in Brazil. It brings together innovation and a meritocracy and created an enormous aquarium that investors want to fish in, according to technicians from the Brazilian Development Bank (BNDES) who visited us

recently,” says José Goldemberg, president of FAPESP, at an event held to commemorate the program’s anniversary on June 30, 2017.

In 2016, the program invested R\$56,000,000 and contracted 228 projects, the largest number ever (see the chart on page 6). “An innovative project was contracted almost every business day,” notes Carlos Henrique de Brito Cruz, scientific director of FAPESP, who highlights the efforts of the Foundation to expand the program despite the financial crisis affecting Brazil and its impact on FAPESP’s budget. PIPE has already supported companies in 125 municipalities in São Paulo State, but most are concentrated in cities such as São Paulo, Campinas, São Carlos, São José dos Campos and Ribeirão Preto, home to major universities and research institutions. “Technology-based innovation naturally arises around good research institutions,” says Brito Cruz.

Among the more than 1,100 companies with approved proposals, one of the most successful cases is that of Griaule. Established in 2002 in an incubator at the University of Campinas (Unicamp), Griaule developed algorithms and software programs for fingerprint recognition, such as those used in electronic voting machines in Brazil, in addition to voice and human face identification systems. The firm was the recipient of three PIPE projects. “They accelerated our growth. With the project-related research grants, we were able to bring together the critical mass to improve the algorithms that are our comparative advantage,” says Alexandre Creto, project manager at Griaule. Two researchers who were grant recipients in the most recent PIPE program, concluded in 2011, were hired and are still at Griaule today. The company, which began with five people in 2003 and with sales of R\$100,000, has 40 employees today, half of whom are working in research and development (R&D), and had 2016 sales of R\$40,000,000.

Another successful example is Promip Manejo Integrado de Pragas, headquartered in Limeira, which had a PIPE project approved in 2006 when it was installed at the incubator of the Luiz de Queiroz College of Agriculture of the University of São Paulo (ESALQ-USP). This research led to two biological products containing predatory mites that can control the two-spotted spider mite, a pest that attacks salad greens. “This was not a simple challenge. The biologic product did not exist, and the farmers did not understand how it could be important in reducing chemical in-



Apis Flora, from Ribeirão Preto, developed a dry propolis extract that is used as a raw material for medications

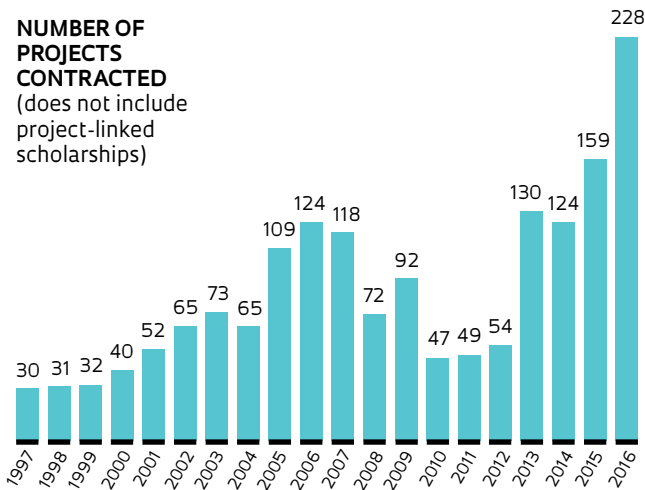
secticide use,” remembers Marcelo Poletti, who founded the company with two partners after finishing his doctorate in entomology at ESALQ. Other PIPE projects helped create products based on different types of predator insects and mites and to develop kits to monitor the resistance of *Aedes aegypti* mosquitos to chemical insecticides. Today, Griaule invests 8% of its revenues in R&D. With 100 collaborators, it had sales of R\$10,000,000 in 2016.

Promip sells five products and has another five under development. In 2014, its innovative profile earned the company a contribution of R\$4,000,000 from the São Paulo Innovation Fund, established by the Desenvolve São Paulo agency, in partnership with FAPESP, Finep, the Development Bank of Latin America (CAF), the Brazilian Micro and Small Business Support Service (Sebrae), and private investors. “FAPESP invested R\$10,000,000 in the fund to be allocated to daughter-companies of the PIPE program,” explains Francisco Jardim, manager of the São Paulo Innovation Fund. “We participated very enthusiastically, because there are businesses with a strong capacity to systematically promote innovation. We are preparing to double our bets in some of them.” Other clients of the PIPE program, such as Nexxto and Inprehnha Biotecnologia, received support from the fund. “The PIPE program, with its rigorous evaluation of proposals, and the manner in which it guides entrepreneurs, fills an important void. The funds can help startups to compete in the market and solve management problems, but they cannot do a good job evaluating the potential of research that could lead to innovations,” he affirms. According to Jardim,

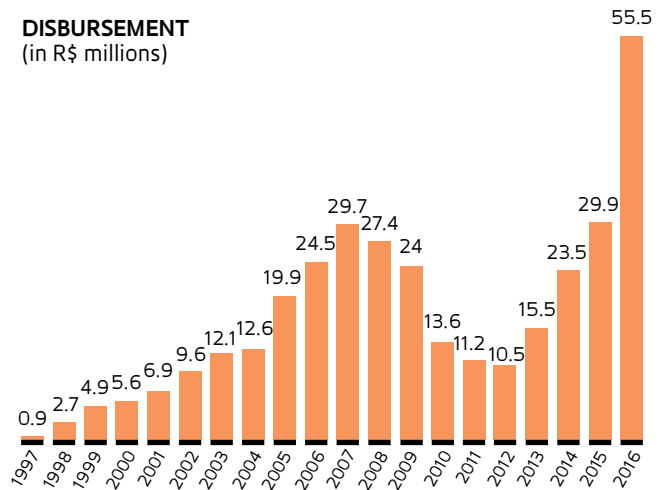
A leap forward in support for innovation

Yearly trend in the number of PIPE projects contracted and FAPESP disbursements under the program from 1997 to 2016

NUMBER OF PROJECTS CONTRACTED
(does not include project-linked scholarships)



DISBURSEMENT
(in R\$ millions)



SOURCE FAPESP

the fund has encouraged other companies that it supported, such as InCeres in the precision agriculture field and Ventrix in the health care area, to present projects to the PIPE program. “The capacity to carry out R&D internally multiplies the chances of a startup’s survival.”

The Pitanga Fund, established in 2011 with R\$100,000,000 in funding from Brazilian business executives from groups such as Natura and Itaú, spent two years analyzing 700 candidates for a grant. In 2013, it chose the first startup in its investment portfolio, I.Systems, founded in Campinas 10 years ago by four computer engineers from Unicamp. This startup provides major clients, such as Coca-Cola, Braskem, Ambev, Suzano and Raízen, with software that uses artificial intelligence to control industrial processes. Its programs are able to monitor a large volume of data and make decisions that reduce production costs by 2% to 10%. According to company president Igor Santiago, two PIPE projects, approved in 2009 and in 2012, were important for development of the first prototype, the Horus program, and for bringing the technology to market. “It would have taken a long time if we would have had to depend on our own funding,” he affirms. In 2015, the company received support from PIPE to develop a new product, called Leaf Captação, in the basic sanitation area: it controls the flow of water catchment pumps from rivers to supply cities, rationalizing energy consumption. I.Systems’ flagship product is a type of software program that was initially not thought to be very important, called Leaf for Windows, which runs on large computers used by industries. I.Systems has doubled its size every year in the past four years.

An evaluation of 214 PIPE projects developed between 1997 and 2006, conducted by the Study Group on Organization of Research and Innovation (Geopi), affiliated with Unicamp, showed that the program had an impact on several fronts (see *Pesquisa FAPESP Issue No. 147*). Approximately 60% of the projects evaluated led to technological innovations, a rate considered satisfactory. This represents 111 innovations, 59 of which are considered innovations in Brazil and 17 are viewed as such from a global perspective. “These were technology-based innovations, in line with the purpose of the program,” says Sérgio Salles-Filho, professor at Unicamp and one of the coordinators of the Geopi. These projects helped to create high-level jobs: at the companies evaluated, the increase in the number of employees with college degrees was 60%, and the increase for professionals with doctoral degrees was 91%. An article published in 2011 in the journal *Research Evaluation*, whose principal author was Salles-Filho, showed that each R\$1 allocated by FAPESP to the program generated a return of R\$10.50. A more recent evaluation, based on the period from 2007 to 2016, is being conducted by Geopi, comparing the results of the projects with those from programs in countries such as the United States, France and Japan. “The PIPE program will also begin to be monitored continuously, with data collected both after the end of the project and two years later,” affirms Salles-Filho.

ANGEL INVESTORS

XMobots, in São Carlos, which manufactures unmanned aerial vehicles (drones), with sales of more than R\$7 million a year, was able to build

its first drone for testing after approval of a PIPE Phase 1 project in 2009. “Until then, we depended on equipment borrowed from USP laboratories in São Paulo in order to work,” says engineer Giovanni Amianti, one of the founders. “Support from the PIPE program showed that our idea had potential. In other countries, angel investors play this role, helping to transform a good idea from the academic world into an emerging business,” notes Amianti, whose company now sells three types of drones and employs 40 people, 10 of whom are engineers on the R&D team.

Gustavo Pagotto Simões, president of Nanox, a startup in São Carlos that produces microparticles with bactericidal properties, calls attention to an unusual characteristic of the PIPE program: with four invitations issued per year, this FAPESP initiative has become an anchor for entrepreneurs in the state. “Whenever we needed to, there was an opportunity to submit a proposal to the PIPE. This regularity is not as common in other sources of funding,” acknowledges Simões, who has already received funds from Finep, BNDES, Sebrae and the National Council for Scientific and Technological Development (CNPq). Nanox had a dozen PIPE projects, but two of them were more important than the others. “The first, in 2005, was vital: that R\$70,000 enabled us to test our technology with clients,” says Simões, who opened the business with two colleagues from his graduate studies at São Paulo State University (Unesp), in Araraquara. In 2006, Nanox received support from the Novarum Fund. Its growth accelerated: in 2010, its sales were R\$2,300,000, compared to R\$1,300,000 just one year earlier in 2009.

The other major project came in 2012, when Nanox already produced 2 to 3 kilos of silver microparticles per day and wanted to multiply the operation by a factor of 10. “FAPESP and Finep issued a call for proposals for Phase 3 of the PIPE, and thanks to it, we were able to increase our

According to the evaluation, each R\$1 allocated by FAPESP to the program generated a return of R\$10.50

production capacity and manufacture 20 kilos of microparticles per day,” says Simões – current production is 60 kilos a day. Today, silver additives are used in milk boxes, PVC films, and dental instruments.

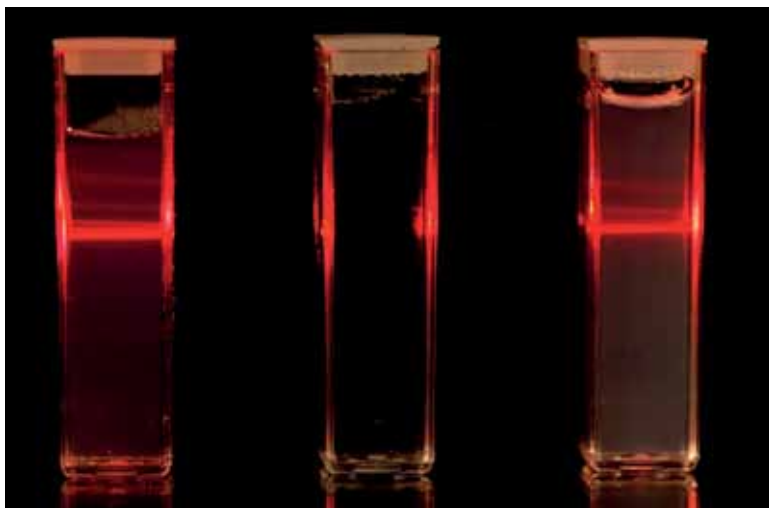
Several beneficiaries of the PIPE program have greatly increased their sales, but this is not the only measure of the program’s success. According to Sérgio Queiroz, professor at Unicamp and adjunct coordinator of the FAPESP Research for Innovation area, there are indirect benefits from the implementation of a culture of innovation at companies. One example of this is Apis Flora in Ribeirão Preto, which specializes in products and medications made from honey and propolis. Founded in 1983, in the last 10 years, the company reinforced its R&D structure in search of innovative products. The first PIPE funding was

approved in 2009 to develop a cellulose biomembrane, which, associated with propolis, could be applied to hard-to-heal wounds. “My doctoral work had demonstrated that this material is useful in the treatment of burns,” recalls Andresa Berretta e Silva, R&D and innovation manager at Apis Flora. In 2010, a project proposal sought to obtain a propolis-based gel to fight vaginal candidiasis. “With this project, our biotechnology laboratory took a giant step forward.”

Investments made beginning in 2009 have led to five innovative products, four of which are medications that have not yet reached the market. Even so, Apis Flora’s sales grew from R\$7,000,000 ten years ago to R\$38,000,000 in 2017. One of the reasons for this performance was the capacity developed by the company to produce a propolis extract in the form of microparticles, used as a raw material for medications. This capability, developed in research financed by CNPq, enabled the company to export the ingredient to China and made the difference in its sales. Another result of this work was the creation of a startup, Eleve Pesquisa e Desenvolvimento, incubated at Apis Flora. The new firm already has two approved PIPE projects focused on developing a medication against leishmaniosis and a model for a kind of skin that would eliminate the need to use animals in cosmetics testing.

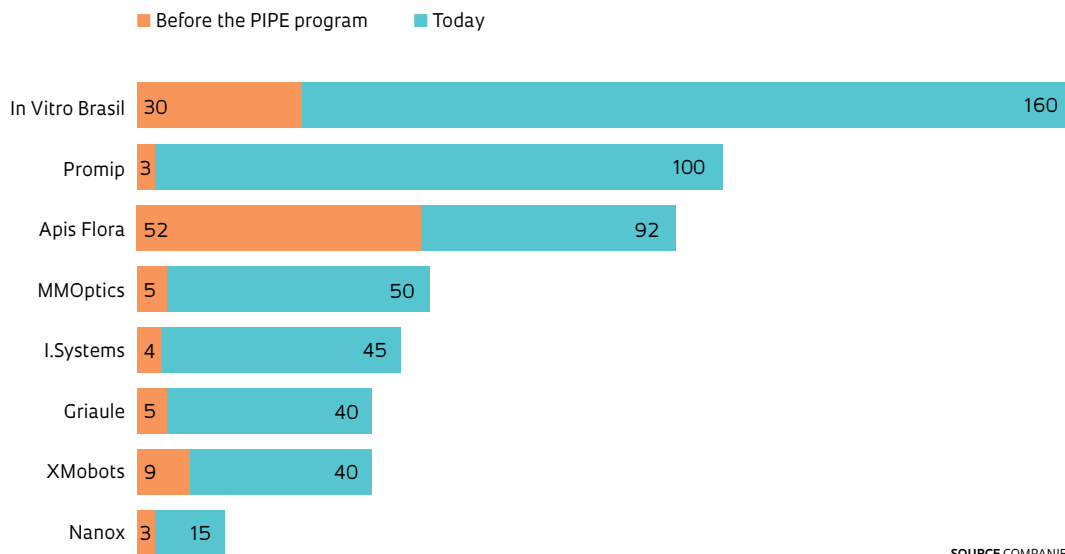
In Vitro Brasil, a company in Mogi Mirim, multiplied its sales after it began to invest in R&D, to the point of being responsible for over half the world’s production of *in vitro* bovine embryos. In 2015, it was purchased by the U.S. company ABS Global, the largest bull genetics company in the world. In Vitro was founded in 2002, but it took several years before it began to produce innova-

Microparticle compounds produced by Nanox in São Carlos



Job creation

Number of employees at the time of the first PIPE project, and current number, for selected companies



SOURCE COMPANIES

tions. According to Andrea Basso, the company's research coordinator, two PIPE projects resulted in approaches that are innovative in terms of the international market. One of them showed that it was feasible to produce embryos using calves instead of adult cows, with egg harvesting done by videolaparoscopy after hormonal stimulation. The other project developed a method of genetic analysis that made it possible to select embryos before they were transferred into the brood cows. "Until then, genotyping was used in the selection of newborn animals to be used as breeders. What we proposed was to genetically evaluate a sample of embryo cells, freeze them and, after concluding analysis, chose which animal would be born," says Basso. Today, the company has more than 160 employees, compared to 30 employees 10 years ago. It has built a network of 33 laboratory units that produced 450,000 embryos in 2016. Its 2016 sales were R\$28,000,000, a hundred times greater than those in 2007. In Vitro Brasil created a startup, In Vitro Brasil Clonagem Animal, which remains a Brazilian company, with Basso being one of the partners. It has just been accepted for a PIPE Phase 1 project for production of a protein that plays a key role in blood coagulation.

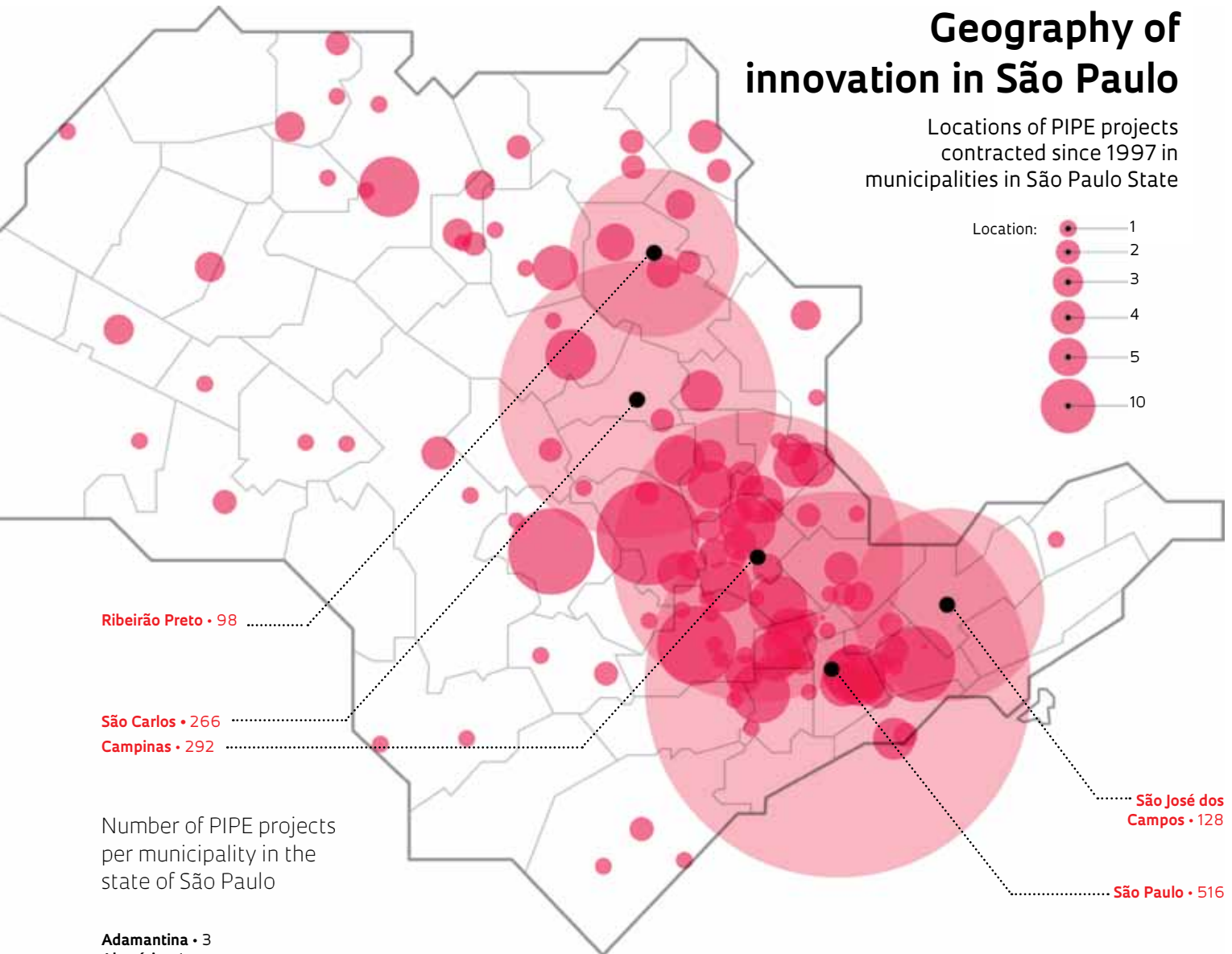
PIPE was the first funding modality in Brazil to invest non-reimbursable funds in research at companies. "With the passage of the Innovation Act of 2004, other agencies began to allocate money to non-recoverable loans in innovation in the private sector. But in 1997, that was almost a taboo, and we faced a great deal of resistance against

implementing the program," physicist José Fernando Perez recalls. He was scientific director of FAPESP when the program was launched. According to Perez, the PIPE program was inspired by the SBIR (Small Business Innovation Research) programs run by U.S. funding agencies that had a budget in excess of \$100,000,000. "When we learned about the SBIR programs, we saw that they were a good fit for what we wanted to implement at FAPESP, with the research being done within the company, resulting in an innovative product, process or service," affirms Perez. One of the arguments against the program, he says, was that the scarcity of candidates would make the initiative a fiasco. However, the decision was made to take that risk, and in the first call for proposals, there were 79 submissions, 30 of which were selected.

In the past five years, the program has picked up speed, becoming less restrictive about the size of companies—it is possible to submit a proposal even before a company is founded and to formalize its formation later. Whenever it issues a new invitation, FAPESP holds an event to answer questions from interested parties, known as Dialogue on Research Support for Innovation in Small Companies. "The event has been important in letting proponents know exactly what the program is and ensuring the high quality of the proposals presented," says Sérgio Queiroz. On July 29, 2017, the day before the commemoration of PIPE's 20th anniversary, the FAPESP auditorium was full of entrepreneurs interested in the next call for proposals. ■

Geography of innovation in São Paulo

Locations of PIPE projects contracted since 1997 in municipalities in São Paulo State



Ribeirão Preto • 98

São Carlos • 266

Campinas • 292

São José dos Campos • 128

São Paulo • 516

Number of PIPE projects per municipality in the state of São Paulo

SOURCE: FAPESP

- Adamantina • 3
- Alumínio • 1
- Americana • 4
- Américo de Campos • 1
- Amparo • 2
- Analândia • 2
- Angatuba • 1
- Araçariguama • 1
- Araçatuba • 3
- Araraquara • 9
- Araras • 5
- Ariranha • 2
- Artur Nogueira • 2
- Arujá • 2
- Assis • 2
- Atibaia • 2
- Barretos • 2
- Barueri • 9
- Batatais • 3
- Bauru • 4
- Boituva • 1
- Bom Jesus dos Perdões • 3
- Botucatu • 26
- Bragança Paulista • 4
- Caieiras • 1
- Cajamar • 7
- Cajobi • 3
- Campinas • 292
- Capivari • 3

- Carapicuíba • 2
- Cajati • 1
- Catanduva • 3
- Charqueada • 2
- Cotia • 13
- Cravinhos • 4
- Diadema • 9
- Dois Córregos • 2
- Engenheiro Coelho • 4
- Estiva Gerbi • 1
- Ferraz de Vasconcelos • 2
- Franca • 4
- Francisco Morato • 2
- Franco da Rocha • 1
- Garça • 1
- Guararema • 2
- Guaratinguetá • 1
- Guarujá • 2
- Guarulhos • 5
- Holambra • 8
- Hortolândia • 1
- Ibiúna • 1
- Ilha Comprida • 1
- Ilha Solteira • 1

- Indaiatuba • 9
- Itapeperica da Serra • 1
- Itapetininga • 2
- Itapeva • 1
- Itapira • 7
- Itararé • 1
- Itu • 1
- Itupeva • 1
- Jaboticabal • 7
- Jaguariúna • 2
- Jandira • 1
- Jarinu • 1
- Jundiaí • 12
- Juquitiba • 1
- Lençóis Paulista • 1
- Limeira • 8
- Mairinque • 1
- Marília • 1
- Matão • 1
- Mauá • 4
- Mirassol • 1
- Mococa • 3
- Mogi das Cruzes • 20
- Mogi Guaçu • 4

- Mogi Mirim • 7
- Monte Alto • 1
- Monte Aprazível • 1
- Monte Mor • 1
- Orlândia • 2
- Osasco • 2
- Palestina • 1
- Patrocínio Paulista • 2
- Paulínia • 11
- Pindorama • 1
- Piracicaba • 37
- Pirassununga • 6
- Poá • 4
- Porto Feliz • 1
- Rafard • 6
- Rancharia • 1
- Registro • 2
- Ribeirão Pires • 3
- Ribeirão Preto • 98
- Rio Claro • 9
- Riolândia • 2
- Salto • 1
- Santa Bárbara d'Oeste • 3
- Santa Maria da Serra • 1

- Santana de Parnaíba • 10
- Santo André • 8
- Santos • 6
- São Bernardo do Campo • 7
- São Caetano do Sul • 13
- São Carlos • 266
- São João da Boa Vista • 1
- Patrocínio Paulista • 2
- São José do Rio Preto • 13
- São José dos Campos • 128
- São Manuel • 1
- São Paulo • 516
- São Roque • 5
- Serrana • 2
- Sertãozinho • 5
- Socorro • 1
- Sorocaba • 22
- Sumaré • 4
- Suzano • 1
- Taboão da Serra • 2
- Tupã • 1
- Valinhos • 3
- Vista Alegre do Alto • 1
- Votuporanga • 3