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Public funding as a driver of innovative enterprises

O fomento público como impulsionador de empreendimentos inovadores

El fomento público como impulsor de emprendimientos innovadores

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ABSTRACT

Objective: to analyze the results generated by public funding provided by FAPESC in innovative ventures. **Methodology/approach:** a descriptive study with a quantitative approach was conducted through a survey of beneficiaries of FAPESC public calls for proposals. **Originality/relevance:** the study complements existing research on government incentives to stimulate innovation and helps public administrators analyze the impacts of economic subsidies on start-up businesses. **Main results:** the results of the research indicate that the resources provided by the government enabled the creation and development of innovative ventures that generated new products or services for the market. **Theoretical/methodological contributions:** public investment in innovation generates results for society, such as job creation, tax collection, and economic and social development. **Social contributions/contribution to management:** the results of the study enable public administrators to analyze the direction of public resources that seek to stimulate innovation through the creation of innovative ventures. And so that society is aware of the results generated by public investment in innovation and as a means of transparency in the use of public resources.

Keywords: Innovation. Promotion. Public resource. Economic subsidy.

RESUMO

Objetivo: analisar quais os resultados gerados pelo fomento público realizado pela FAPESC em empreendimentos inovadores. **Metodologia/abordagem:** realiza-se uma pesquisa descritiva, com abordagem quantitativa, por meio de *survey*, com beneficiados por editais de chamada pública da FAPESC. **Originalidade/relevância:** o estudo complementa a pesquisa existente sobre os incentivos do governo para estimular a inovação e colabora para que gestores públicos analisem os impactos da subvenção econômica em negócios iniciantes. **Principais resultados:** os resultados da pesquisa indicam que o recurso advindo do governo possibilitou a criação e o desenvolvimento de empreendimentos inovadores com geração de novos produtos ou serviços para o mercado. **Contribuições teóricas/metodológicas:** o investimento público na inovação gera resultados para a sociedade, tais como a geração de emprego, arrecadação de impostos e desenvolvimento econômico e social. **Contribuições sociais/contribuição para a gestão:** o resultado do estudo possibilita que administradores públicos analisem o direcionamento dos recursos públicos que buscam estimular a inovação por meio da criação de empreendimentos inovadores. E para que a sociedade conheça resultados gerados pelo investimento público na inovação e como meio de transparência do uso dos recursos públicos.

Palavras-chave: Inovação. Fomento. Recurso público. Subvenção econômica.

RESUMEN

Objetivo: analizar los resultados generados por el financiamiento público otorgado por FAPESC en emprendimientos innovadores. **Metodología/enfoque:** se realiza una investigación descriptiva, con enfoque cuantitativo, a través de una encuesta, con beneficiarios de las convocatorias públicas de la FAPESC. **Originalidad/relevancia:** el estudio complementa la investigación existente sobre los incentivos gubernamentales para estimular la innovación y ayuda a los gestores públicos a analizar los impactos de los subsidios económicos en las empresas emergentes. **Resultados principales:** Los resultados de la investigación indican que el recurso proveniente del gobierno posibilitó la creación y desarrollo de emprendimientos innovadores con la generación de nuevos productos o servicios para el mercado. **Aportes teóricos/metodológicos:** la inversión pública en innovación genera resultados para la sociedad, como creación de empleo, recaudación fiscal y desarrollo económico y social. **Contribuciones sociales/contribución a la gestión:** los resultados del estudio permiten a los administradores públicos analizar la dirección de los recursos públicos que buscan estimular la innovación a través de la creación de emprendimientos innovadores. Y para que la sociedad conozca los resultados que genera la inversión pública en innovación y como medio de transparencia en el uso de los recursos públicos.

Palabras clave: Innovación. Promoción. Recurso público. Subsidio económico.

INTRODUCTION

Innovation is considered the main source of a nation's economic development (Tidd & Bessant, 2015), driven by the ability of entrepreneurs and organizations to establish relationships and detect opportunities (Tidd & Bessant, 2015; Zhao & Song, 2018). Economic growth is boosted by entrepreneurship and innovation ecosystems (Carayannis et al., 2018; Yang; Kim & Yim, 2019; Vargas & Santos, 2021), so that organizational arrangements have been created to assist in improving the innovation process (Etzkowitz, 2013). For Etzkowitz (2013), the interaction among university, industry, and government is one of the main pillars of innovation ecosystems, with this interaction being the primary promoting, creating, and encouraging source of innovation.

The encouragement of innovation arises from the interaction of a set of actors from different sectors of society, among which is the government, which, besides establishing regulatory frameworks, fosters some mechanisms through policies, such as research, funding, and tax incentives for innovative businesses, to boost innovation and the development of a country (Panisson; Willerding & Lapolli, 2018; Yang; Kim & Yim, 2019; Mazzucato; Kattel & Ryan-Collins, 2020).

Government policies to support innovation aim to stimulate the generation and dissemination of new products, services, processes, new business models, and organizational arrangements (Leal & Figueiredo, 2021). The incentives for innovation are related to tax benefits, capital funds, specific financing lines, non-repayable resources, and grant funding (Panisson; Willerding & Lapolli, 2018; Mello et al., 2020).

Among the actors in the government sphere that stimulate innovation, there are the Research Support Foundations (Brufem; Silveira & Freitas, 2018). These authors argue that the first foundation created was the São Paulo State Research Support Foundation (FAPESP, as per its Portuguese acronym). FAPESP is considered one of the most important foundations with initiatives for science, technology, and innovation (CT&I) (Turchi & De Morais, 2017).

The state of Santa Catarina has the Santa Catarina State Research and Innovation Support Foundation (FAPESC, as per its Portuguese acronym) as the agency responsible for implementing the state policy of science, technology, and innovation (FAPESC, 2023). This Foundation, in partnership with the *Fundação CERTI* (translated as CERTI Foundation), created and operationalized a program called *Sinapse da Inovação* (translated as Innovation Synapse), which aimed for the results of scientific and technological research to be transformed into businesses and generate innovative enterprises. To this end, the Program provided economic subsidy through public call notices (CERTI Foundation, 2014). Later, this program was renamed *Centelha* (translated as Spark).

In this direction, the study has the research problem: what are the results generated by public funding carried out via FAPESC in innovative enterprises? In this sense, the objective of this study is to analyze what results are generated by public funding carried out via FAPESC in innovative enterprises.

To this end, descriptive research is conducted with a quantitative approach, using a survey, with beneficiaries of public call notices from FAPESC of the programs selected for the study. The call notices were published between 2010 and 2021.

The study is justified by exploring the results produced by the promotion of innovation for the economic development, aiming at the economic growth of the region and the country, with the government being the main investor in basic research, which does not necessarily have a focus on practical application, while companies are seen as the means to operationalize applied research (Zhao & Song, 2018; Howell, 2024). In addition, governments, companies, and institutions are pressured to change their structure and system due to the so-called Fourth Industrial Revolution, which has caused technological and cultural changes in society. This demands new dynamics of operation and production, requiring innovation from organizations (Yan & Yim, 2019).

The study complements existing research on government incentives to stimulate innovation generation. It helps public managers to analyze the impacts generated by the economic subsidies spent on entrepreneurs seeking to transform an idea into a business. Moreover, it is hoped that society can see the results that are being generated by public investment in innovation.

The results found may serve as a means to analyze the need or not for revision and/or redirection of government investments. The study contributes to the 2030 Agenda of the United Nations (UN) by addressing the themes of Sustainable Development Goals (SDGs) 8 and 9, which aim for productive increase with technological modernization and innovation, the encouragement of policies for job creation, income, business growth, and development of scientific and technological research.

THE GOVERNMENT AND THE PROMOTION OF INNOVATION

Public Promotion of Innovation

Technological advances and the convergence of technologies are driving the creation of new markets and demands. As a result, initiatives have been focused on encouraging innovation and the creation of innovation ecosystems (Yang; Kim & Yim, 2019; Mazzucato; Kattel & Ryan-Collins, 2020). In order to promote innovation, it is necessary to have the interaction and cooperation of various factors (culture, labor, institutions, cities, companies, among others) that can be established through public-private partnerships (Yang; Kim & Yim, 2019).

In this sense, policymakers and public leaders from various countries seek to implement policies that coordinate and align the actors involved in innovation systems (Tidd & Bessant, 2015; Carayannis et al., 2018; Panisson; Willerding & Lapolli, 2018). Accordingly, the interaction among university, industry, and government is crucial for innovation, as it generates knowledge, technology transfer, stimulation of innovation, support structures for entrepreneurship, and leverages the emergence of new organizational formats, contributing to regional economic development and innovation (Etzkowitz, 2013).

Developed countries have innovation as a central point for development (Zhao & Song, 2018; Bloom; Reenen & Williams, 2019), so much so that institutions seek to change business practices in order to "not fall behind" in the so-called Fourth Industrial Revolution (a fusion of technologies that alters the way of life and work) (Yang; Kim & Yim, 2019), being in a scientific and technological race (Diniz, 2019). Accordingly, developed countries have established strategies and policies to adapt and meet the new demands and business models that promote innovative activities (Yang; Kim & Yim, 2019).

Among developed countries, there is China, which has adopted actions to boost innovation, with the government being an important provider of Research and Development (R&D) funds to support institutions and companies, thus significantly increasing the productivity of innovation and economic growth (Zhao & Song, 2018). According to the authors, an appropriate combination of innovation capacity, development of basic knowledge, and technical absorption is necessary for the government to invest in R&D.

In turn, Brazil set a goal to invest 2% of the national Gross Domestic Product (GDP) in R&D by 2012. Subsequently, the target was projected until 2019 (Brazil, 2002; Santos & Vargas, 2021); however, despite the efforts spent, the outlined amount was not reached, as the allocation of resources was lower than necessary (Diniz, 2019; Santos & Vargas, 2021), as seen in the report from the Ministry of Science, Technology, and Innovation in 2022. The aforementioned report indicates that the highest value reached was in 2015, when the country invested 1.37% of its GDP in R&D (MCTI, 2023). By way of comparison with the investment made by Brazil, China invested 2.40% of its GDP in R&D in 2020 (MCTI, 2023).

It should be noted that, while developed countries have the private sector as the largest investor in R&D, accounting for 70% of the investment value, in Brazil, the reality is different. The private sector's investment accounts for 40% of the R&D investments, and a portion of this invested amount comes from subsidized public financing and tax exemption, meaning there is indirect government support (Diniz, 2019).

The government's contribution to promoting innovation generally involves financing conditions (Tidd & Bessant, 2015), and it is known that public policies influence innovation based on the supply and demand mechanisms of knowledge and the competition conditions among markets (Basant, 2018). As a supply-side mechanism, there is the provision of technical assistance and financing and the establishment of scientific and technological infrastructure; and, on the demand side, there is the institution of government procurement and contracts for the development of innovative products, processes, and services (Gordon & Cassiolato, 2019).

Thus, the main incentives arising from innovation policy are linked to tax policies favoring research and development, government subsidies for research, policies aimed at increasing the supply of qualified human capital, intellectual property policies, and pro-competitive policies (Bloom; Reenen & Williams, 2019). These innovation policies generate various mechanisms for public stimulation, which involve industrial policy; foreign investment; trade; education and technology; intellectual property rights; technology licensing; public procurement; R&D funding; tax credits; and industrial clusters (Basant, 2018).

Innovation stimulation policies have stood out in recent decades with the establishment of the National Innovation System (NIS), which focused

governmental initiatives on strengthening public research institutions, training researchers, and financing research and innovation (Turchi & De Morais, 2017). Among the actors in the Brazilian NIS, there are the Research Support Foundations (FAP, as per its Portuguese acronym), which are funding agencies present in almost all Brazilian states (Brufem; Silveira & Freitas, 2018).

Research Support Foundations (FAP)

The Research Support Foundations (FAP, as per its Portuguese acronym) are entities that provide resources that enable the development of research in the fields of science and technology and carry out the national scientific-technological policy (Brufem; Silveira & Freitas, 2018). The FAP act as funding agencies and are linked to a state government department, having a percentage of the state (or district) revenue as a budget for their maintenance and investments (Gonçalves-Alvim & Marino, 2022).

The state of Santa Catarina has the Santa Catarina State Research and Innovation Support Foundation (FAPESC, as per its Portuguese acronym), created in 1990 under the name of the Rotating Fund for the Promotion of Scientific and Technological Research (FUNCITEC, as per its Portuguese acronym), and was renamed FAPESC in 2005. FAPESC is linked to the Department of Economic Development and Sustainability, serving as the agency responsible for implementing the state policy of science, technology, and innovation in the state of Santa Catarina. Its budget comprises less than 2% of the current revenue of the state of Santa Catarina, deducting the portions that belong to municipalities, with at least half allocated for agricultural research (Santa Catarina, 1989).

The FAPESC's mission is to promote the Santa Catarina ecosystem of CT&I, promoting and integrating agents involved in research and innovation. To this end, it implements programs, projects, and actions in the areas of human resources training; science and research; innovation and technology; events and dissemination in science, technology, and innovation; international cooperation; in addition to resource funding and mobilization. The funding is intended for researchers, entrepreneurs, institutions, companies, or government agencies of the State that submit projects (and are approved) to the public calls made by FAPESC (FAPESC, 2022).

Among the public calls for economic subsidy from FAPESC, there are those related to the Innovation Synapse program, which are carried out in partnership with the CERTI Foundation, having other agencies from the state of Santa Catarina as partners, as well as sponsorship from institutions like the Brazilian Micro and Small Enterprises Support Service (SEBRAE/SC, as per its Portuguese acronym), the Financing Agency for Studies and Projects (FINEP, as per its Portuguese acronym), and the Ministry of Science, Technology and Innovation (MCTI, as per its Portuguese acronym) (Fundação CERTI, 2014).

The Innovation Synapse program aims for the results generated by scientific and technological research to be transformed into products and new innovative enterprises, providing solutions for society. The program aims to engage the innovative entrepreneurial community, train qualified innovative startups for incubators, prioritize innovative enterprises with social, environmental, and technological impact, and induce a culture of innovative entrepreneurship (Fundação CERTI, 2014).

METHODOLOGICAL PROCEDURES

The study has the objective of analyzing the results generated by public funding provided by FAPESC in innovative enterprises. To this end, descriptive research is conducted. In terms of objectives and procedures, it is a survey. The approach of the study is quantitative.

The study setting is FAPESC, the foundation responsible for implementing the state policy of science, technology, and innovation in the state of Santa Catarina, which distributes resources to stimulate innovation through public call notices. Notices from two of the Foundation's programs were analyzed, the Innovation Synapse program and the Spark program, which aim to promote the transformation of ideas into businesses. The delimitation of the study arises from the fact that the Foundation is one of the main agents promoting innovation in the state. The selection of call notices was based on accessibility, specifically those available on the Foundation's website, as various attempts to contact FAPESC to obtain all the call notices from the previously mentioned programs were unsuccessful.

The research population comprises the beneficiaries listed in the final result notices (obtained from the FAPESC website) of the selection of the Innovation Synapse and Spark programs, totaling 428 projects. It is underlined that the beneficiaries listed in the call notices have not necessarily received the funding, as there are requirements to be fulfilled after approval in the stages of the call notice for the funding to be made available. Accordingly, the study considered as beneficiaries all projects listed in the final result notices of the public call (i.e., 428). Of these, it was possible to locate some means of contact (email, professional social network, and personal social network) for 234 project applicants approved to receive the benefits. A total of 69 beneficiaries who received the resources responded to the questionnaire. Thus, the sample of this research is non-probabilistic, and the selected beneficiaries were chosen based on accessibility. The accessibility sample is one in which the "researcher selects the elements they have access to, assuming that these may, in some way, represent the universe" (Prodanov & De Freitas, 2013).

Data collection took place through an unstructured interview with the executive director of the CERTI Foundation (a technology-based institution that contributes to the competitiveness of companies), which was a partner of FAPESC in the development of the programs, in order to understand the context of the Innovation Synapse (conceived by the CERTI Foundation) and Spark programs.

It was found that the Innovation Synapse program has provided resources through six public call notices since its creation; however, research was able to locate four notices from the program. Under the name of the Spark program, two notices were published.

The next stage of data collection included researching the call notices of the previously mentioned programs on the FAPESC website, compiling the list of projects/applicants that were beneficiaries as stated in the final results notice of the public calls, and seeking contact with the beneficiaries.

Based on that, a questionnaire was applied to the benefited projects that were possible to contact. The questionnaire was created in Google Forms based on the Oslo Manual (third edition) and the information from the Semiannual Technological Innovation Survey (PINTEC, as per its Portuguese acronym), according to Table 1.

Table 1

Research construct

Block	Questions	Aim
Identification of the research respondents	1 to 3	To identify the municipality of residence at the time of project submission, the segment/area of the project, and the call notice and year of project submission.
Project characteristics	4 to 6	To characterize whether the project was implemented and whether it was an innovative or improved product or service.
Use of the resource from the public call notice	7 to 8	To determine whether the funding received was sufficient to implement the project and what type of expenses it was used for.
Result obtained with the use of the resource from the public call notice	9 to 12	To specify whether the implementation of the project resulted in patent registration, job creation, establishment of a CNPJ, and whether taxes were collected.
Use of other sources of financial resources	13 to 14	To point out whether there was the use of other sources of resources for the implementation of the project.
Search result	15	To check whether the respondent is interested in receiving the survey results and the email address for sending.

The questionnaire underwent two pre-tests, first with PhD professors in the field and then with six beneficiaries, selecting one beneficiary from each call notice. The purpose of the pre-test was to make the questionnaire as understandable as possible. After validating the questionnaire, the link to the questionnaire was sent to the beneficiaries for whom a means of contact was located (234 benefited projects), inviting them to participate in the research. The questionnaire was available from 10/21/2023 to 11/04/2023. It is important to note that the research was conducted in accordance with ethical principles, with participants being informed of the study's objectives and the privacy and confidentiality of their responses.

The collected data was tabulated in a spreadsheet and the analysis was conducted through descriptive analysis, related to the characterization of programs and projects, the use of resources, and the results generated by the allocation of public resources. Based on that, a descriptive analysis was carried out.

PRESENTATION AND DISCUSSION OF RESULTS

Characterization of the Programs

The methodology of the Innovation Synapse program was designed by the CERTI Foundation, with the pilot project being carried out in 2008, covering only residents in the municipality of Florianópolis. The program was implemented in partnership with FAPESC, with the CERTI Foundation responsible for its operationalization, and the program received improvements and adaptations with each edition. The first edition was produced in 2009 and covered the entire state of Santa Catarina. In total, the program had six editions, as reported by the interviewee.

The objective of this program is to support emerging businesses in the development of innovative products and processes, stimulating innovative entrepreneurship. To this end, it provided non-repayable financial resources and study grants. In order to be eligible, it was necessary to submit the project to a public call notice, to be approved in the selection phases, and subsequently, to comply with the criteria established in the notice for the funds to be transferred. Each call notice had its own specific criteria regarding the requirements that the project applicant should meet in terms of the amount of funding and the number of projects that would be supported.

The interviewed executive director emphasizes that the result of the Innovation Synapse program project carried out in Santa Catarina was considered a success, so much so that it was replicated in other states across the country starting in 2015. Subsequently, the program underwent adjustments and the name was changed to Spark, becoming a program of FINEP and MCTI. Table 2 displays a summary of information from the opening notices of the public calls.

Table 2

Characterization of the notices

Program	Call notice	Estimated number of beneficiaries	Benefit amount	Project duration	Need for CNPJ
Innovation Synapse	5/2010	40 enterprises	R$ 50,000.00	Information not found	Information not found
Innovation Synapse	4/2013	Between 50 and 100 companies	R$ 50,000.00	Up to 12 months	Yes
Innovation Synapse	3/2015	Between 50 and 100 companies	Up to R$ 60,000.00	12 months	Yes
Innovation Synapse	4/2017	Up to 100 projects	Up to R$ 60,000.00	12 months	Yes
Spark	3/2019	Up to 28 projects	Up to R$ 60,000.00	Not mentioned	No
Spark	46/2021	Up to 50 projects	Up to R$ 60,000.00	Not mentioned	No

In Table 2, it can be seen that the Innovation Synapse program has increased the number of projects that could be benefited over the editions, as well as the amount of resources allocated for it. In the Spark program, there was an increase in the number of projects awarded, but the benefit amount remained the same. It is also possible to note that, in most editions of the Innovation Synapse program, it was required to have a registered CNPJ or to establish one in order to participate in it. In the Spark program, there was no such requirement. It should be underlined that not all the call notices included in the research had all the information available on the FAPESC website.

Characterization of The Projects

The research includes participants from all the located public notices that make up the survey of the research population, as can be seen in Table 3.

Table 3

Call notice of project submission

Call notice	Respondents	Percentages
3/2015	18	26,1%
4/2017	16	23,2%
46/2021	10	14,5%
3/2019	10	14,5%
4/2013	9	13%
5/2010	6	8,7%
Total	**69**	**100%**

According to data displayed in Table 3, of the 69 survey respondents, 18 (26.1%) correspond to projects submitted to notice 3/2015, 16 (23.2%) respondents to notice 4/2017, and 10 (14.5%) to notices 46/2021 and 3/2019. Another 9 (13%) respondents submitted the project to notice 4/2013 and another 6 (8.7%) to notice 5/2010. Table 4 displays the Santa Catarina municipalities in which the project applicants resided at the time of project submission.

Table 4

Municipality of residence of the beneficiaries

Municipality	Respondents	Percentages
Florianópolis	16	23,2%
Blumenau	10	14,5%
Joinville	10	14,5%
Chapecó	6	8,7%
Lages	5	7,2%
Balneário Camboriú	3	4,3%
Camboriú	2	2,9%
Criciúma	2	2,9%
Jaraguá do Sul	2	2,9%
Luzerna	2	2,9%
Araranguá	1	1,4%
Coronel Freitas	1	1,4%
Itajaí	1	1,4%
Joaçaba	1	1,4%
Laguna	1	1,4%
Mafra	1	1,4%
Pinheiro Preto	1	1,4%
Rio do Sul	1	1,4%
Tubarão	1	1,4%
Urussanga	1	1,4%
Videira	1	1,4%
Total	**69**	**100%**

The beneficiaries were distributed across 21 municipalities in Santa Catarina, according to Table 4. Of the 69 respondents, there is a predominance of beneficiaries residing in the municipality of Florianópolis, with 16 (23.2%) respondents; Blumenau and Joinville, with 10 (14.5%) respondents each; and Chapecó, with 6 (8.7%) respondents. These four municipalities accounted for 60.9% of the research respondents.

The other municipalities in which the project applicants resided are Lages, with five (7.2%) respondents; Balneário Camboriú, with four (4.3%); Camboriú, Criciúma, Jaraguá do Sul, and Luzerna, with two (2.9%) each; and Araranguá, Coronel Freitas, Itajaí, Joaçaba, Laguna, Mafra, Pinheiro Preto, Rio do Sul, Tubarão, Urussanga, and Videira, with one (1.4%) respondent each.

It is indicated that, according to the provisions in the opening notice of the public call, those responsible for submitting the projects should be residents of the state of Santa Catarina. Possibly, the requirement to reside in the state is linked to the fact that the funding, or part of it, comes from the state budget. Table 5 encompasses the segments of these projects.

Table 5

Project segment

Segment	Respondents	Percentages
Services sector	23	33,3%
Industrial Production	22	31,9%
Agricultural Production, Extractivism, Mining, and similar fields	9	13%
Technology	3	4,3%
Health	3	4,3%
Software	2	2,9%
Computer Science	1	1,4%
Information Technology	1	1,4%
IT and Communication	1	1,4%
Industrial Automation	1	1,4%
Construtech	1	1,4%
Chemistry Education	1	1,4%
Educational Innovation	1	1,4%
Total	**69**	**100%**

Table 5 allows us to note that the predominant business areas of the 69 respondents of the survey were the services sector, with 23 (33.3%) respondents, followed by the Industrial Production sector, with 22 (31.9%) respondents, and Agricultural Production, Extractivism, Mining, and similar fields, with 9 (13%) respondents. These three activity areas represent the operating segment of 54 (78.3%) of the benefited respondents.

The other segments mentioned by the respondents were Technology and Health, with three (4.3%) respondents each; Software, with two (2.9%) respondents; and Computer Science, Information Technology, IT and Communication, Industrial Automation, *Construtech*, and Chemistry Education, with one (1.4%) respondent for each area.

The call notices of the analyzed programs provided for the submission of projects aimed at the development of innovative products and processes, in order to transform ideas and research into businesses and stimulate innovative entrepreneurship. Nevertheless, as pointed out by the respondents, not all projects were successful in implementation, as displayed in Table 6.

Table 6

Project status

Project status	Respondents	Percentages
Implemented	35	50.7%
Abandoned	18	26.1%
Currently under development	16	23.2%
Total	**69**	**100%**

It can be seen in Table 6 that, of the 69 projects that received financial support from FAPESC, the majority were successful in their implementation. For 35 (50.7%) respondents, the project was implemented in the market, and another 16 (23.2%) respondents indicated that the project was still under development (at the time of the research, in 2023). Meanwhile, the other 18 (26.1%) respondents marked that the project was abandoned.

Accordingly, it is noted that there was effectiveness in achieving the objectives of the programs, emphasizing that government policies to stimulate innovation encouraged the creation of new products, services, and processes, as pointed out by Leal and Figueiredo (2021). Table 7 displays in which years the approved projects in the public calls were implemented.

Table 7

Year of project implementation

Year	Respondents	Percentages
2018	6	17,1%
2014	5	14,3%
2015	4	11,4%
2020	4	11,4%
2016	3	8,6%
2019	3	8,6%
2023	3	8,6%
2011	2	5,7%
2017	2	5,7%
2021	2	5,7%
2022	1	2,9%
Total	**35**	**100%**

In Table 7, it can be seen that the projects were implemented in 11 distinct years, with a predominance of implementation in 2018, with six (17.1%) projects, followed by 2014, with five (14.3%) projects, and by 2015 and 2020, with four (11.4%) projects each. These four years (2018, 2014, 2015, and 2020) condense the period in which most, 19 (54.3%), of the projects were implemented. The other projects were implemented in different years, with three (8.6%) projects

in the years 2016, 2019, and 2023, another two (5.7%) projects in the years 2011, 2017, and 2021, and one (2.9%) project in the year 2022.

The realization of projects in the market indicates the fulfillment of the government's objective to transform ideas into innovative businesses through public financial support of incentive policies to boost innovation, as pointed out by Panisson, Willerding, and Lapolli (2018), Yang, Kim, and Yim (2019), Mazzucato, Kattel, and Ryan-Collins (2020). Not all the projects funded by the public calls were successful in development, which is why they were abandoned in subsequent years after implementation (the reasons for the project's abandonment are not within the scope of this research). Thus, Table 8 displays the year in which projects were abandoned.

Table 8

Year of project abandonment

Year of call notice	Year of project abandonment	Number of abandoned projects	Percentages
2013 (3 projects) 2015 (1 project)	2016	4	23,5%
2015	2017	3	17,6%
2013, 2015, 2017	2018	3	17,6%
2017, 2019	2021	2	11,8%
2010	2012	1	5,9%
2013	2015	1	5,9%
2019	2019	1	5,9%
2017	2020	1	5,9%
2019	2022	1	5,9%
Total		**17**	**100%**

As displayed in Table 8, of the 18 abandoned projects, 17 respondents indicated the year in which the project was abandoned. Accordingly, the desertion of four (23.5%) projects occurred in the year 2016, and three (17.6%) projects in the year 2017 and in the year 2018. These three years total 10 (58.8%) abandoned projects. The other projects were abandoned in different years, with two (11.8%) in the year 2021 and one (5.9%) in the years 2012, 2015, 2019, 2020, and 2022. The abandonment of projects may be related to insufficient resources for entrepreneurs to consolidate them, as the resources available in the notices were not enough to develop the project.

The Innovation Synapse and Spark programs sought to capture and transform ideas and research into innovative products and processes. Thus, Table 9 indicates the level of innovation of the projects that make up this research.

Table 9

Level of project innovation

Project	Respondents	Percentages
New product or service for the market	43	62.3%
Improved product or service, but already existing in the market	26	37.7%
Total	**69**	**100%**

In Table 9, it can be seen that, out of the 69 projects submitted to the analyzed call notices, 43 (62.3%) proposed to offer a new product or service in the market, while another 26 (37.7%) aimed to offer a service or product that already existed in the market but with improvements. Based on that, it is clear that the offering of a new product or service in the market, which accounted for the majority of the projects submitted to the call notices, is in line with the demand for the creation of new markets generated by technological advancement and the merging of technologies, as pointed out by Yang, Kim, and Yim (2019) and Mazzucato, Kattel, and Ryan-Collins (2020).

Resource use

The research respondents expressed their understanding, on a five-point Likert scale, as to whether the received funds, as provided for in the call notices in which they submitted the project, were sufficient for the development of the project, as displayed in Table 10.

Table 10

Sufficiency of resources received from call notices

Level of agreement/disagreement	Respondents	Percentages
Neither disagree nor agree	24	34.8%
Disagree	20	29%
Agree	12	17.4%
Totally agree	7	10.1%
Totally disagree	6	8.7%
Total	**69**	**100%**

Table 10 displays that, out of the 69 respondents, 20 (29%) disagree and 6 (8.7%) totally disagree that the funding obtained from the public call selection was sufficient to develop the project. These 26 respondents represent that 37.7% of the beneficiaries disagree regarding the sufficiency of the funding from the call notice to enable the business.

Another 34.8% neither disagree nor agree that the amount obtained through the public call was sufficient for the development of the business, in addition to the fact that 12 (17.4%) respondents agreed and 7 (10.1%) totally agreed that the resource was sufficient to make the project viable, totaling

19 (27.5%) respondents who agreed that the resource was sufficient for the project.

It should be underlined that each call notice specified which expenses could be funded and which could not be covered by the resources. This may have influenced the beneficiaries' perception of the sufficiency of the resources for the project, depending on the area of each project.

Result Generated by Resource Contribution

The development of innovative projects can lead to the registration of an invention patent for a new technology for a product or process, provided that the requirements of novelty, inventive activity, and industrial application are met, and whether it is the inventor's desire. The patent application for the invention is made to the National Institute of Intellectual Property (INPI), which is a Brazilian institute dedicated to space research and exploration. Table 11 presents information regarding the patent registration of the projects that make up this study.

Table 11

Patent registration

Registration	Respondents	Percentages
None	48	69.6%
There was one patent registration	17	24.6%
There were two or more patent registrations	4	5.8%
Total	**69**	**100%**

Table 11 displays that the resources raised by the beneficiaries through the public call notices from FAPESC resulted in the registration of one patent for 17 (24.6%) of the respondents and the registration of two or more patents for four (5.8%) of the beneficiaries. Accordingly, patent registration was carried out for 21 (30.4%) of the research respondents.

For the other 48 (69.6%) of the respondents, there was no patent registration for the project submitted to the call notice. It is noteworthy that 62.3% of the projects (Table 9) contained a new product or service for the market; however, despite this, most did not have patent registration.

The development of projects funded with public resources results in benefits and/or returns for society, such as job creation and tax collection. Table 12 displays information about the number of jobs generated by projects supported by FAPESC.

Table 12

Jobs generated

Number of jobs	Respondents	Percentages
1 to 5	33	47.8%
None	26	37.7%
More than 10	7	10,1%
6 to 10	3	4.3%
Total	**69**	**100%**

Table 12 displays that 33 (47.8%) of the projects generated 1 to 5 jobs, 7 (10.1%) projects generated more than 10 jobs, and 3 (4.3%) projects generated between 6 and 10 jobs. Accordingly, 43 (62.3%) of the projects generated jobs. Another 26 (37.7%) of the projects did not result in job creation.

It is noted that most projects resulted in the creation of jobs, which contributes to generating employment and income in the region, stimulating the local and national economy, contributing to the growth of the country. This is due to public investment in the projects, aiming to operationalize research, as pointed out by Zhao and Song (2018). Table 13 displays the number of projects that used CNPJ for the submitted project.

Table 13

Need for CNPJ for the project

CNPJ	Respondents	Percentages
Yes	56	81,2%
It already had a CNPJ when submitting the idea to the Notice	9	13%
No	4	5.8%
Total	**69**	**100%**

Table 13 displays that the submission of the project to the call notice required a CNPJ from 56 (81.2%) of the respondents, while nine (13%) respondents indicated that they already had a CNPJ when they submitted the project and four (5.8%) respondents pointed out that they had not registered a CNPJ.

It should be noted that the call notices of the Innovation Synapse program required the presentation of a CNPJ (acronym for the Brazilian Corporate Taxpayers Registry), which may have influenced the amount of registered CNPJ numbers. The opening of a CNPJ entails tax collection for public coffers, according to the revenue (billing) of each legal entity. Accordingly, it is pointed out that the projects that had CNPJ contributed to tax payments, which return benefits to society. Table 14 displays the tax range collected by the projects financially subsidized by call notices from FAPESC.

Table 14

Tax range collected by the projects

Tax range	Respondents	Percentages
Up to R$1,000.00 per year	19	27.5%
From R$1,001.00 to R$10,000.00 per year	14	20.3%
From R$10,001.00 to R$20,000.00 per year	10	14.5%
From R$20,001.00 to R$50,000.00 per year	4	5.8%
More than R$50,001.00 per year	12	17.4%
No return	10	14.5%
Total	**69**	**100%**

According to Table 14, the projects promoted mostly resulted in tax collection, with the range of up to R$1,000.00 per year marked by 19 (27.5%) of the respondents. For 14 (20.3%) respondents, the annual tax collection was between 1,001.00 and 10,000.00; while, for another 10 (14.5%) respondents, the range of 10,001.00 to 20,000.00 in tax collection was indicated. Another 10 (14.5%) respondents reported that there was no tax collection.

It should be underlined that 12 (17.4%) respondents indicated having collected more than R$50,001.00 in annual taxes. Considering that the call notices stipulated the subsidy amount between R$50,000.00 and R$60,000.00, the collection of taxes in an amount greater than R$50,000.00 deserves emphasis. It is pointed out that the government's own investment in the projects returned in the form of taxes to public coffers. In addition, the tax collection generated by the projects contributes to the return of services to society in general.

In addition to the resource obtained from the public calls, there are projects that used resources from other sources to enable the business, as displayed in Table 15.

Table 15

Sources of financial resources used in the project

Source of resource	Respondents	Percentages
Own capital	36	34.6%
Only from the Innovation Synapse or Spark programs	16	15.4%
Other funding call notices (besides the Innovation Synapse or Spark programs)	14	13.5%
Angel investor	13	12.5%
Bank loan	10	9.6%
Others	10	9.6%
Venture capital	5	4.8%
Total	**104**	**100%**

According to the data displayed in Table 15, other sources of resources were used for the development of the project, with 36 (34.6%) respondents indicating that they used their own capital, 14 (13.5%) respondents used resources from other funding call notices, 13 (12.5%) respondents turned to angel investors, 10 (9.6%) respondents sought bank loans and other forms of financing, and 5 (4.8%) respondents made use of venture capital. For 16 (15.4%) respondents, only the resources from the call notices proposed by the Innovation Synapse or Spark programs were sufficient to develop the project.

It is noteworthy in Table 15 that the largest source of funding indicated by the respondents was their own capital, which highlights the importance of this resource for the viability of projects. It can be inferred that various businesses were developed and implemented solely with public resources from the FAPESC call notices, which shows the significance of government economic subsidies in stimulating entrepreneurship and innovation. It is underlined that the non-repayable economic subsidy from the government in innovation is important for sharing the business risk with the entrepreneur. In this sense, Tidd and Bessant (2015) emphasize that, through public funding, the government plays an important role in the development of innovation.

In this direction, Panisson, Willerding, and Lapolli (2018), Yang, Kim, and Yim (2019), and Mazzucato, Kattel, and Ryan-Collins (2020) point out that, besides defining regulations, the government has created mechanisms that stimulate the development of innovation in society, such as the resources made available through the Support Foundations, which, through public calls, enable projects to be supported in their development and implementation. Table 16 displays the range of the own capital invested by respondents who indicated that they had used this source of investment.

Table 16

Range of own capital used in the project

Range of own capital	Respondents	Percentages
Up to 100,000.00	19	59.4%
100,001.00 to 200,000.00	5	15.6%
200,001.00 to 300,000.00	3	9.4%
Above 500,001.00	3	9.4%
300,001.00 to 400,000.00	1	3.1%
400,001.00 to 500,000.00	1	3.1%
Total	**32**	**100%**

Table 16 displays that, for 19 (59.4%) of the respondents, who indicated they had used their own capital in the project, the amount of personal capital employed did not exceed R$100,000. For five (15.6%) respondents, the amount of personal capital spent was in the range of R$100,001 to R$200,000; for another three (9.4%) respondents, the use was between R$200,001 and R$300,000 and above R$500,001 of personal capital in the project. Moreover, one (3.1%) respondent indicated having used a personal capital range of R$300,001 to R$400,000, and another (3.1%) respondent indicated having used a range of R$400,001 to R$500,000 of personal capital in the project.

Accordingly, the relevance of own capital for the promotion of business should be emphasized. Moreover, it should be underlined that, with the amount of up to R$100,000.00, several innovative projects have been made viable. It is noteworthy that, of the 36 respondents who indicated having used their own capital in Table 14, four did not indicate the range of their own capital used in the project.

FINAL CONSIDERATIONS

The study had the objective of analyzing the results generated by public funding conducted by FAPESC in innovative enterprises. A descriptive research method was used through a survey.

It is concluded that the government's investment generated economic, social, and technological impacts for the development of the state of Santa Catarina, taking into account the jobs created by the implementation of the projects, the collection of taxes, and the innovative products/services made available to society. Accordingly, it is noted that the application of public resources in innovation brings returns to society and promotes regional development.

It is deduced that the granting of non-repayable economic subsidies by the government is important for stimulating innovative entrepreneurship, creating innovative businesses, and enabling regional economic development, since the study indicated that several projects were funded exclusively with resources from the FAPESC call notices.

It is inferred that the development of a new innovative product or service in the market can be considered a competitive advantage for the business, allowing the company to differentiate itself in the market. This enables companies to add value to the business. In this direction, it should be underlined that, despite the fact that most respondents (62.3%) indicated that the submitted project aimed to offer an innovative product or service that was new to the market, when asked about patent registration, only 30.4% of the respondents reported having registered a patent. The importance of patent registration should be emphasized to ensure ownership rights over the invention, preventing third parties from appropriating the innovative idea.

The importance of projects that encourage innovative entrepreneurship should be highlighted, such as, for example, the analyzed programs that promoted the entrepreneurial culture in the country. In addition, these programs facilitated the establishment of innovative enterprises that meet the demand for modernization of business/industrial sectors in the scientific and technological race triggered by the Fourth Industrial Revolution.

As for the limitations of this study, it can be said that the results found cannot be generalized, as they refer only to the analyzed public notices, in addition to the fact that not all beneficiaries of these public notices could be contacted. Moreover, it is noted that there was a limitation in accessing the data, given the unavailability of information on the FAPESC website and the lack of response to the email messages sent to FAPESC. The importance of publicizing information about all call notices should be emphasized, from the different stages that make up the programs, in order to ensure transparency in the allocation of public resources and to enable research.

When analyzing the data, it was observed that 17 projects were abandoned, however, the focus of this work did not allow for the identification of the reason for the abandonment of these projects. Therefore, it is suggested to conduct research to determine the reasons behind the abandonment of the projects.

In light of the foregoing, it is suggested to conduct future studies that propose mechanisms to measure the results generated by government investment in innovation, in order to analyze whether the allocation of resources is appropriate or needs to be resized. It should be emphasized that these mechanisms need to be specifically aimed at the type of benefit granted (study grant, economic subsidy, training courses, among others) and should be adaptable to each region and/or research context, given the existing regional differences in the country.

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