Financing Innovation in Brazil: Recent Achievements and Future Challenges

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Abstract This article discusses some of the financing mechanisms for innovation created recently by the Brazilian Government, in particular those with participation of BNDES and FINEP. Brazil, despite having redirected its Science and Technology Policy in the late 90s and reformulated its funding mechanisms inspired in OECD countries, did not achieve satisfactory results, as shown in this study. Investments in innovation are shy, with little participation of the private sector. In recent years, the Brazilian Government has been developing a series of initiatives to broaden and make more effective its participation in financing innovation, as well as stimulate private investment. It may be observed that these initiatives seek to fill existing gaps and seem to consider some successful characteristics of foreign mechanisms, seeking a greater alignment with the interests of the market and focus on small and medium-sized companies, as well as focusing on increasing the link between academia and business, and unifying efforts among government agencies. Some improvements, however, still seem to be necessary, not only in the financing mechanisms, but also when tackling larger country issues.

Keywords BNDES • Financing • FINEP • Innovation • R&D

1 Introduction

At the end of the 90s, there was a major shift in the Brazilian Science and Technology Policy. Government actions approached the ones adopted by OECD countries, in particular Europeans', and the importance of the National Innovation Systems was emphasized. Since then, important initiatives have been incorporated, such as the creation of sector funds, economic subvention regulations, institutional changes and tax incentives.

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However, despite the undeniable progress, innovation indicators show Brazil is far behind developed countries, in addition to been losing competitiveness compared to other emerging markets. The country still underinvests in Research & Development (R&D) and innovation, having low private sector participation. There are few records of patents and a small amount of really innovative companies, besides not having overcome the gap between academia and business.

Seeking to improve this situation, the Brazilian Government has been developing some new actions directed to broaden and make more effective its participation in funding for innovation, as well as stimulate private investment.

The main objective of this work is to analyse some of the financing mechanisms for innovation recently created by the Brazilian Government, in particular those with participation of Brazilian Development Bank (BNDES) and Brazilian Innovation Agency (FINEP). It proposed to identify how these initiatives intend to broaden and make more effective the Government's participation in the financing to innovation, and how they seek to fill existing gaps in the Brazilian scenario.

Besides Introduction and Conclusions, this has three sections. Section 2 explains the research methodology carried out. Section 3 presents a theoretical background about innovation investments and financing, considering peculiarities of each step of the innovative process. Section 4 discusses the results in two parts: the first presents the Brazilian scenario in innovation investments and shows the main existing country gaps; the second describes and analyses some of the recent actions of the Brazilian Government directed to financing innovation, in addition to comparing these actions to other countries' initiatives, pointing out challenges still to be faced.

2 Methodology

To achieve the objectives proposed in this study, an exploratory research through bibliographical survey and unstructured interviews was conducted. Besides, information available in publications such as books, thesis and articles of national and international origin were sought in order to submit a review of relevant literature on the topic.

The main data on investment and financing mechanisms for innovation were collected in annual reports, magazines and websites of major Government and private institutions, as well as through interviews.

The most important interviews were conducted with executives from BNDES, some of them being experts in innovation, belonging to different sectors of the institution: Planning Area, responsible for the development of operational policies and financial instruments of the Bank; Entrepreneur Capital Area, responsible, along with the Capital Markets Area, for BNDES activity in shareholding through funds, debentures and direct participation; Industrial Area, responsible for the financing of part of the Brazilian industry sector.

In Brazil, this research had focused on BNDES and FINEP, since they are the institutions that mainly finance innovation in the country, in addition to information of the Ministry of Science, Technology and Innovation (MCTI) and the Ministry of Development, Industry and Foreign Trade (MDIC).

Finally, it is worth noting that the present study did not focus on the governmental funding for innovation through tax incentives, given that the main objective was to analyse new funding mechanisms that had the participation of BNDES and FINEP. Nevertheless, the authors understand the importance of tax benefits, and that the theme deserves specific studies for improvement.

3 Theoretical Background

3.1 Characteristics of Investments in Innovation

According to Hall and Lerner (2009), investments in R&D have some characteristics that are different from other types of investment. Most of the costs are related to the payment of scientists, researchers and engineers, generating an intangible asset that typically does not create immediate profit. This tacit knowledge is embedded in the human capital of the firm and may be lost in the event of employee leave.

Another relevant aspect is the uncertainty associated with investments in innovation, particularly at the beginning of a research programme or development project.

These peculiarities conduct to the requirement of higher rates of return for these projects and give the investment a character of financial option, being difficult to evaluate it using traditional statistical techniques.

This unpredictability of the return brings also two other problems: the asymmetric information and moral hazard.

If there is a big uncertainty for the entrepreneur himself, that is even greater for potential investors or financiers, who will demand higher rates of return. The asymmetric information causes a difference between the cost of equity and debt required for such projects. The solution for this problem is not simple, because firms avoid disclosing details of their ongoing developments, fearful of imitation by competitors.

Due to these characteristics, companies which are intensive in R&D are less leveraged than others, and prioritize the use of own resources for investment in innovation. The empirical work of Hall (1992) and Himmelberg and Petersen (1994) shows the importance of a positive cash flow for investments in R&D, both in manufacturing firms as in small technology companies, in the U.S.

In addition to the high cost of debt, another reason lies in the fact that investments in R&D generate intangible assets, and these companies usually do not have sufficient physical assets to offer as collateral for bank loans. Finally, for the

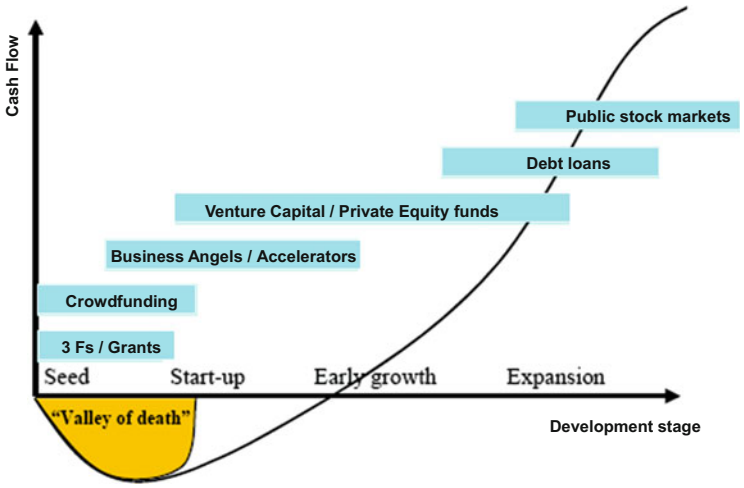

Fig. 1 Development stages, cash flow and sources of finance (Prepared by the authors based on UNECE 2009)

payment of the debt, it is desirable that these companies have a constant and predictable cash flow, which does not usually occur.

3.2 Financing Mechanisms for Innovation

The financing mechanisms for innovation will be influenced by the phase in which the company or the project is.

Figure 1 illustrates the typical cash flow throughout each of the financing stages. In the seed and start-up phases flow is negative, since the company does not obtain revenue from the sales of the new business; it only makes investments and expenses. In the following stages, flow tends to be positive. It is worth noting that despite the necessary amount of resources is much higher in the last stages, the business risks are much smaller, and traditional sources of funding can be obtained more easily (UNECE – United Nations Economic Commission for Europe 2009).

The founders, family or friends' (3Fs) personal financial resources are important at the beginning of life of innovative companies, but normally insufficient to cover all needs. Personal loans at banks are not suitable, as there is a long time required for the company to begin to generate cash. Finally, as already discussed, financing the new company via debt is practically infeasible. As a result, the alternatives presented in the early stages are the non-reimbursable financing and the search for foreign partners.

Non-reimbursable resources are normally granted by public bodies, in line with economic and social objectives of a country. They are resources granted as non-repayable fund, often in the form of "grants", and used for the initial development of the concept and market research. As there are usually strict criteria for the selection of the initiatives to be benefited, this type of funding can also be an important certification to the company to seek private investors (Lerner 1999).

The crowdfunding is a recent development of collaborative funding that is supported by internet platforms, and is an alternative way for financing innovative projects in the early stages. The crowdfunders receive acknowledgement and gifts, and may become a project partner.

The typical providers via equity financing in the early stages are business angels (BAs), accelerators and venture capital (VC) funds. BAs and accelerators tend to be entrepreneurs with previous successful experiences. According to UNECE (2009), the amounts invested are low, not exceeding US$ 500,000. On VC funds, between US$ 1 million and US$ 5 million are invested in each company, focusing on promising innovative or technology based businesses.

In a more mature phase, opportunities arise through the private equity (PE) funds, which can contribute to restructuring, consolidation and/or business expansion. Invested amounts are larger, typically above US$ 10 million per company.

Finally, when the company is already established, traditional financing as bank loans and access to capital markets become viable and attractive.

4 Results and Discussion

4.1 Brazilian Scenario of Investments in Innovation

This first part of the results aims to compare the Brazilian scenario with other countries, showing the main gaps Brazil must still overcome for effective promotion of innovation.

The total investment in R&D in relation to GDP in Brazil is low if compared to developed countries, losing positions to some emerging markets. The U.S., Germany and Japan, countries with a tradition in technology generation, annually invest around 3 % of their respective GDPs (MCTI 2013). Other nations are increasing spending in percentage terms, as South Korea and China (Table 1).

Booz & Co (2012) examined 1,000 publicly traded companies that had the greatest expenses with R&D in 2011. The investment of Brazilian companies presented in the study grew from US$ 1.9 billion to US$ 3.7 billion, however, represented only 0.61 % of total expenses in the companies identified in the ranking. The best placed were Vale (81st) and Petrobras (92nd).

This reduced private investment can be explained in part by the current stage of development in which Brazil is. According to Fonseca (2001), the higher the existence of a stable political, economic and legal environment, the greater the incentive for investment in physical and human capital is, since they reduce the

Table 1 R&D investments 2000–2011 as % of GDP (MCTI 2013)

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
S. Africa	–	0.73	–	0.79	0.85	0.90	0.93	0.92	0.93	0.87	–	–
Germany	2.47	2.47	2.5	2.54	2.5	2.51	2.54	2.53	2.69	2.82	2.8	2.88
Brazil	1.02	1.04	0.98	0.96	0.90	0.97	1.01	1.10	1.11	1.17	1.16	1.21
Canada	1.91	2.09	2.04	2.04	2.07	2.04	2,00	1.96	1.92	1.94	1.85	1.74
China	0.9	0.95	1.07	1.13	1.23	1.32	1.39	1.4	1.47	1.7	1.76	1.84
Singapore	1.85	2.06	2.1	2.05	2.13	2.19	2.16	2.36	2.64	2.2	2.05	2.23
Korea	2.3	2.47	2.4	2.49	2.68	2.79	3.01	3.21	3.36	3.56	3.74	4.03
Spain	0.91	0.92	0.99	1.05	1.06	1.12	1.2	1.27	1.35	1.39	1.39	1.33
USA	2.71	2.72	2.62	2.61	2.55	2.59	2.65	2.72	2.86	2.91	2.83	2.77
France	2.15	2.2	2.24	2.18	2.16	2.11	2.11	2.08	2.12	2.27	2.24	2.24
India	0.81	0.84	0.81	0.8	0.79	0.84	0.88	0.87	0.88	–	–	–
Italy	1.04	1.08	1.12	1.1	1.09	1.09	1.13	1.17	1.21	1.26	1.26	1.25
Japan	3.00	3.07	3.12	3.14	3.13	3.31	3.41	3.46	3.47	3.36	3.25	3.39
Portugal	0.73	0.77	0.73	0.71	0.74	0.78	0.99	1.17	1.5	1.64	1.59	1.49
UK	1.82	1.79	1.8	1.75	1.69	1.72	1.74	1.77	1.78	1.84	1.8	1.77
Russia	1.05	1.18	1.25	1.29	1.15	1.07	1.07	1.12	1.04	1.25	1.13	1.09

In 2011, while Brazil spent US$ 27.6 billion in R&D, the U.S. performed US$ 415.2 billion and China US$ 208.2 billion
Besides, it is verified in Brazil, that the leading role of private investment in R&D is low, representing just 0.55 % of GDP (Fig. 2)

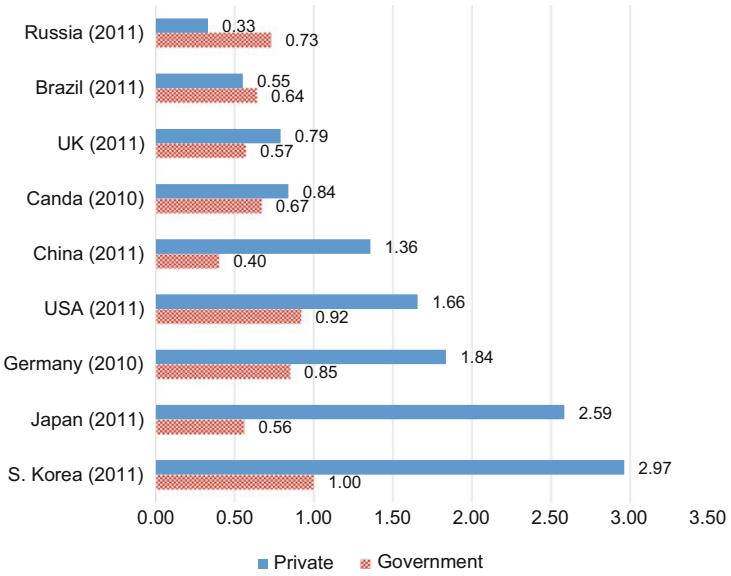

Fig. 2 Private and government investments in R&D – as % of GDP (MCTI 2013)

uncertainties in relation to the expected return. Brazil obtained recent macroeconomic advances as the fall in inflation and interest rate reduction. However, there are uncertainties regarding the maintenance of these achievements, as well as the country's capacity to implement reforms and investments in pursuit of growth sustainability.

Despite having a few universities and research centres of excellence, Brazil offers qualified technical staff in insufficient number,[1] raising labour force cost. It has a poor basic education system, further reducing the potential for new students to go to universities and technical courses.

There is a low presence of researchers allocated in the business environment, an example of the poor link between academia and corporations. According to MCTI (2013), 73 % of Brazilian researchers work for the Government, mainly in universities. This proportion is reversed in several countries. In the U.S., Japan and South Korea, about 80 % of researchers work for private companies.

According to the World Intellectual Property Organization (WIPO), Brazil's participation in the amount of patent applications registered in the world was only 0.3 %, in 2012. Among the 50 companies with largest amount of requests, no one is Brazilian. MCTI data indicate that Brazil made 679 requests, overcoming, among the BRICs, only South Africa, with 318. China made 13,273 requests, India 5,663 and Russia 888.

[1] According to estimates of the Federal Council of Engineering, Architecture and Agronomy – Confea (2013), while Brazil graduates about 40,000 engineers per year, Russia, India and China graduate 190,000; 220,000 and 650,000, respectively.

The number of PINTEC (2011) also illustrates Brazilian companies are not so innovative. Among 128.699 companies surveyed, only 35.7 % implemented some product and/or new or substantially improved process. If we consider only the launch of new products in the domestic market, this percentage drops to 3.7 % in the case of industrial companies and 8.8 % of service companies.

That survey also points out that among companies that invest in innovation, a few access public resources, being the small and medium-sized companies (SMEs) the ones with greatest difficulty. In innovative industrial companies, only 34.6 % used at least one Brazilian Government support instrument. Considering companies over 500 employees, that percentage is higher (54.8 %). FINEP points out that this fact may be due to the lack of knowledge of businessmen in relation to which type of instrument best suits to their needs (Luna et al. 2008). According to interviews conducted for this study, BNDES corroborates with this vision, and some businessmen have the perception that it is laborious and bureaucratic to obtain public funding.

Besides the importance of SMEs to generate employment and income for a country, some studies indicate they seem more innovative than the others. Booz & Co (2012) has identified that financial and innovative performance of companies are more related to how the innovation strategy is performed – involving people, leadership and effectiveness – than to the amounts invested in R&D; and SMEs seem to be more effective, because their organisational issues are less complex and bureaucratic. Acemoglu et al. (2013) ratifies the importance of SMEs when he shows that in the American market, new firms are more innovative and productive, being responsible for most of the sales growth, employment and spending on R&D. Therefore, the author argues that industrial policies and subsidies should be focused on encouraging the development of these firms, instead of older companies that, even with an innovation history, tend to settle in over time.

Barriers to innovation financing in Brazil also may be related to the country's still low developed venture capital industry.

Currently, the number of BAs in Brazil is around 6,300 while in the U.S. is 268,000. The start-up accelerators appeared only in 2011. It is estimated that there are approximately 30 institutions of this nature in the country, while in the world, according F6S (2014), this number jumps to 2,345.

VC/PE funds are also underdeveloped. According to ABVCAP (2013), Brazil ended 2012 with US$ 40.7 billion of capital committed to VC/PE funds, with US$ 25.8 billion already being invested. Of the total invested, only 3.5 % referred to VC funds, because foreign investors and pension funds concentrate investments in mature companies. Despite an increase of 33 % in relation to December 2011, the amount invested in VC/PE funds is small when compared to developed countries, even considering the proportionality of GDPs (Fig. 3).

Other important issue is the mature of Brazilian capital market. Jeng and Wells (2000) conclude that the volume of market IPOs has a high correlation with the existing investment in VC/PE, especially in more mature stages of investment and

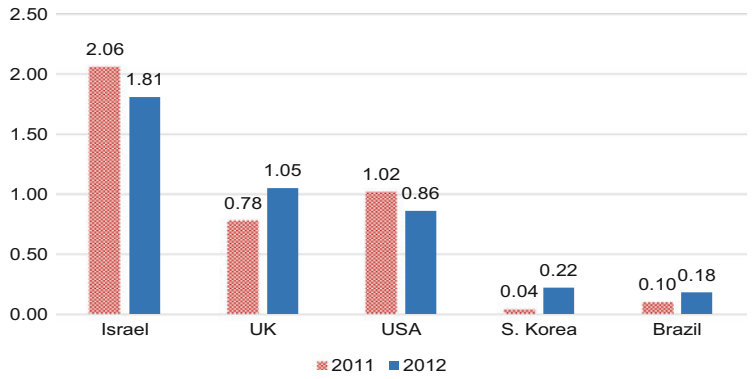

Fig. 3 VC & PE investments – as % of GDP (Emerging Markets Private Equity Association 2013)

when it comes to non-governmental investments.[2] In fact, one of the main risks faced by venture capitalists is not having the return of their investment.

Israel example illustrates it. In addition to the opening of capital in its own stock exchange (TASE), there were incentives for companies also do IPO in American and European stock exchanges. From 1992 to 2012, the number of companies listed on TASE grew from 378 to 549, with 50 of them today being also listed in international stock exchanges.

In Brazil, despite recent drivers to boost the capital market, as the reduction of the basic interest rate and the country investment grade, the amount of IPOs on the main stock market (BM&FBOVESPA) is yet small. As a result, the number of listed companies is low, being the smallest among emerging countries. Despite having the 7th largest global GDP, in 2011 Brazil was the 17th country in number of listed companies, and its stock market was at 26th position. This scenario can be explained because just large companies can access the capital market in the country. Only 50 % of the listed companies have revenues of less than US$ 500 million. The average volume of offers in 2011 remained at approximately US$ 400 million, amongst the largest in the world (Fig. 4).

BOVESPA MAIS is the listing segment of BM&FBOVESPA to companies wishing to enter the capital market gradually, seeking the enlargement of the shareholder base. Despite having been conceived to permit the access of a greater number of companies to the Brazilian stock market, this segment has only nine companies.

Finally, according to Bonawitz et al. (2013), Brazil must suppress legal and regulatory issues to boost its venture capital industry. Brazilian start-ups face a complex tax regime, a restrictive business regulatory system, extreme labour market rigidity and pervasive bureaucracy.

[2] It is important to point out that Jeng and Wells (2000) did not consider in their empirical study the trade sales as exit of the VC/PE funds. Data from Preqin (2013) show that this is the most recurrent exit of investments made in the world, both in VC funds as in PE. From 2008 to 2012, trade sales accounted for 66 %, while exits via IPO just 13 %.

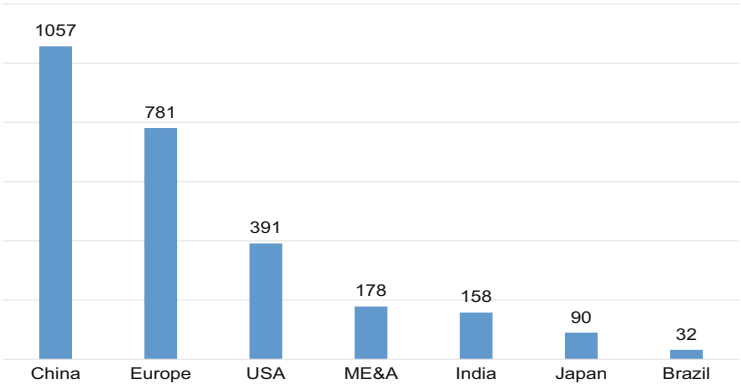

Fig. 4 Number of IPOs – 2008–2011 (Prepared by the authors based on compiled information by BNDES)

4.2 New Financing Mechanisms of the Brazilian Government

The Brazilian Government has been developing new financing mechanisms to broaden and make more effective their participation in financing innovation, as well as stimulate private investment. Some initiatives are presented below, in particular those with direct participation of BNDES and FINEP.

4.2.1 Innovate Company Plan

The various instruments and Government incentives aimed at financing innovation in Brazil indicate a need for greater coordination between the organs of Government, seeking to avoid overlapping of efforts and improve communication with the business community.

BNDES and FINEP sought a form of joint action through the BNDES-FINEP Joint Plan to Support Industrial Technological Innovation of Sugar Energy and Sugar chemical sectors – PAISS, released in 2011. The plan aimed to adopt a model of federal public resources management for the technological development of the sectors mentioned, and integrated financial instruments of support to innovation, contemplating non-reimbursable and reimbursable resources and equity participation.

In addition to avoiding overlapping of public resources applications and creating a single gateway to businessmen, the coordinated efforts among Government, companies and science and technological institutions (ICTs) around a central challenge leveraged cooperation between companies and company-ICT. These relationships maximise the contact of firms with no history of innovation projects

with innovation and development institutions, besides the attraction of new players, acceleration of strategies, skill complementarities and eventually the creation of new Brazilian companies.

In 2012, BNDES and FINEP released INOVA PETRO, along the same lines of PAISS, focusing on the development of Brazilian suppliers for the productive chain of the oil and gas industry.

The success of PAISS and INOVA PETRO made the Federal Government launch in March 2013 the "Plano Inova Empresa" (Innovate Company Plan), expanding previous plans scope and coverage. New strategic sectors were considered: agriculture and cattle farming, energy, health, aerospace and defence, technology information, and social and environmental sustainability.

The Table 2 summarises the conjunction plans already released and their current stages. It is important to notice that the initial resources demand from the private sector surpassed a lot the initial budget allocation.

4.2.2 Embrapii and Tecnova

In 2012, MCTI, in partnership with the National Confederation of Industry (CNI) and FINEP, created the Brazilian Research and Industrial Innovation Company (Embrapii).

Embrapii aims to promote projects of cooperation between domestic companies and ICTs to the development of new products and processes aligned to industry interests, particularly in projects in pre-competitive phase of the innovation process, in which risks are higher.

Through public tenders, Embrapii will select ICTs that will receive funds to develop innovative projects in conjunction with the business environment, with a focus on SMEs. At first, the Federal Government's contribution to Embrapii will be of R$ 1 billion in non-reimbursable resources until 2014.

The model seeks to increase the link between academia and business, with greater institutional articulation between public and private sectors, and foresees technical and economic risk sharing. Part of investments will be made with government resources and part by companies, in addition to the contribution of research institutions for infrastructure and human resources.

Embrapii was inspired by Brazilian Agricultural Research Corporation (Embrapa), which researches are consecrated even internationally. The main difference is that Embrapii will not possess an own research structure, but will use the network of existing laboratories in the country instead.

Another initiative of the Government is Tecnova, launch by FINEP in 2012. This programme will provide R$ 190 million in economic subvention resources directed to technological innovation projects of micro and small companies (annual revenue up to R$ 3.6 million), through partners in the States, besides R$ 19 million for support and training. There will also be support of Sebrae, with supplementary resources of R$ 50 million.

Table 2 "Plano Inova Empresa" (Innovate Company Plan)

			Public tender phases (January 15, 2014)			
Public tender	Total forecast value (R$ billion)	Partnerships	Submission of interest	Companies selection	Submission of business plan (BP)	Business plan selection
PAISS	1	BNDES and Finep	57 companies	39 companies	25 companies	PAISS
			R$ 10 bi	R$ 6 bi	35 BPs	
					R$ 3.1 bi	
Inova Petro	3 (in several public tenders)	BNDES, Finep and Petrobras	38 companies	23 companies	16 companies	11 companies
			62 BPs	35 BPs	25 BPs	16 BPs
			R$ 2.7 bi	R$ 850 mi	R$ 496 mi	R$ 353 mi
Inova Energia	3	BNDES, Finep and ANEEL	373 companies	127 companies	160 companies	102 companies
			R$ 12.3 bi	R$ 9.8 bi	138 BPs	109 BPs
					R$ 8.7 bi	R$ 7.1 bi
Inova Saude[a]	0.6	BNDES, Finep and MS	145 companies	79 companies	72 BPs	45 BPs
			R$ 1.3 bi	R$ 0.9 bi	R$ 0.8 bi	R$ 0.5 bi
Inova Saude[b]	1.3	Finep, MS and CNPq	63 companies	26 companies	26 BPs	21 BPs
			R$ 3.6 bi	R$ 3 bi	R$ 3.5 bi	R$ 2.4 bi
Inova Aerodefesa	2.9	BNDES, Finep, MD and AEB	285 companies	77 companies	70 companies	64 companies
			R$ 13 bi	R$ 12.8 bi	98 BPs	91 BPs
					R$ 10 bi	R$ 8.7 bi
Inova Agro	1	BNDES and Finep	372 companies	132 companies	83 companies	Until 31 January 2014
			R$ 5.7 bi	R$ 3.5 bi	R$ 2.9 bi	
Inova Sustentabilidade	2	BNDES and Finep	Until 17 January 2014	–	–	–
Inova Telecom	1.5	BNDES, Finep and MS	Until 24 January 2014	–	–	–

Total	**16.3**	**–**	**1.333 companies**	**503 companies**	**452 companies**	**265 companies**
			R$ 48.6 bi	**R$ 37.0 bi**	**477 BPs**	**314 BPs**
					R$ 29.5 bi	**R$ 22.2 bi**

BNDES-FINEP conjunction plans already released and their current stages (Prepared by the authors bases on information of BNDES)
The Federal Government estimates R$ 32.9 billion will be invested in innovation projects, being R$ 28.5 billion directly from the Government and R$ 4.4 billion via partner institutions such as ANEEL and National Small Business Support Agency (Sebrae)
ANEEL Brazilian Electricity Regulatory Agency, *MS* Ministry of Health, *MD* Ministry of Defense, *AEB* Brazilian Space Agency, *CNPq* National Council for Scientific and Technological Development
[a]Medical equipment
[b]Biodrugs, pharmacochemicals and medicines

Partners will be regional banks and funding agencies, responsible for the organisation and publication of public notice for companies' selection in their respective States, as well as for projects approval and monitoring.

The new initiatives seem to incorporate successful characteristics of the Government programmes SBIR, from the U.S., and START, from Russia: decentralised actions; shared costs between Government and industry; and focus on SMEs, minimizing crowding out risk.

Apple, Compaq and Intel are examples originally considered by SBIR. Since the beginning of the programme, 15,000 companies were benefited, with a total of US$ 21 billion in disbursements and 50,000 patents generated. Only in 2012, SBIR provided US$ 1.9 billion in financial support. The UNECE (2009) points out that one of the main factors of success is the decentralization of the eligibility of projects to be considered, being this responsibility divided between 11 federal agencies.

SBIR also has another important issue: a continuous evaluation of the effectiveness of its resources' application. Luna et al. (2008) say that in the U.S. this monitoring is done with large accuracy. The U.S Government controls not only the initial phases of the project but also the evolution of companies over time. Siegel et al. (2003) concludes that this is one of the main reasons for the success of SBIR. In Brazil, however, this practice is still incipient, and should be implemented in its financial mechanisms.

4.2.3 Startup Brasil

Seeking to promote the creation and development of start-ups as well as making these companies closer to potential BAs, MCTI launched in 2012 the Startup Brasil programme. Private accelerator companies were chosen to house start-ups which will receive R$ 200,000 each in public funds, in addition to other supports such as a collaborative space in Silicon Valley.

Startup Brasil total investment is in the order of US$ 40 million, aiming to boost at least 150 start-ups until 2016. Accelerator companies will become partners of the investee companies. This initiative resembles programmes recently launched by American and Chilean Governments: the Startup America and Start-up Chile.

In an interview, one of BNDES managers argues that the advantage of Government support via equity in relation to grants is that the first stimulates the complementation of the investment with the private sector, primarily by start-up accelerators, and in following stages by BAs and VC funds. In addition, the new companies may, from the beginning, receive guidance from more experienced investors and management support. Jensen (1993) claims that start-ups need a more active financial performance monitoring, normally made by the funds through positions in Boards of Directors and financial departments. Another advantage is the contact network of companies and investors to which the new firm is exposed, facilitating its integration on the market.

4.2.4 Criatec 2 and 3

In 2012, seeking to help attending the lack of venture funding in Brazil, especially for the early stages, BNDES Board approved the release of Criatec Funds 2 and 3, as a continuation of its work in seed capital. Based on the same model of Criatec 1, the Bank also seeks to contribute to reducing the existing barrier between academy and market.

The expectation is that each of the funds invests in at least 36 companies, pre-operating or not, with annual revenue of up to R$ 10 million. Twenty-five per cent of the resources will be allocated to companies with revenue of up to R$ 2.5 million. Support for each company can reach up to R$ 6 million. Both funds should have R$ 170 million of committed capital each and start investing in 2014 and 2015 respectively. BNDES estimates that these resources will leverage approximately R$ 5 billion in investments in the economy.

As in Criatec 1, the new funds will have, besides a national manager, some regional managers in order to be connected to local innovation ecosystems.

Relevant international experiences show the importance of the VC industry to attract private investment to boost innovation. Nonetheless, above all, each of the successful cases is endowed with its own characteristics, not only regarding the model adopted, but also in relation to some countries peculiarities.

Some of the most successful examples of this industry are found in the U.S., whose first VC fund was created in 1946, after the II World War. In 1958, the "Small Business Act" gave an important impulsion to create incentives for investment in SMEs, such as granting tax incentives for limited partnership and permission for pension funds to invest in high risk assets. In the 90s, Silicon Valley was the largest pole of generation of scientific and technological innovations, and venture capitalists had already provided successful companies like Google, Netscape, Apple and Intel.

Isenberg (2010) argues that Silicon Valley ecosystem evolved under a unique set of circumstances that brings it into a successful model: a strong local aerospace industry; the open California culture; Stanford University's supportive relationship with the industry; the development of semiconductors; a liberal immigration policy towards doctoral students; a massive and continuous investment in education in the U.S. and its ability to develop intellectual property.

Founded in 1993 by the Government of Israel, the Yozma Programme also deserves attention. During the first 3 years, the fund constituted by the Government with US$ 100 million made investments in ten private funds of VC, in addition to direct equity participation in business start-ups. With this investment, the Government sought to attract experienced international venture capitalists which, in turn, should invest about US$ 12 million and act in conjunction with local companies. Yozma then would invest up to US$ 8 million in each fund, subject to a top limit for return on investment, attracting even more private investors. In addition, the shareholders had a call option for Government shares for a period of 5 years.

Among other main achievements of Yozma is the fact that investments have been made in several small funds, reaching a greater number of companies and consequently extending the externalities, such as job creation and dissemination of learning in the VC processes. Another advantage was the promotion of the relationship of local companies with international venture capitalists. As companies grow, new investments become necessary, and contact with potential global investors were fundamental. Most investee companies managed to make IPO, not only in Israel but also in American and European stock exchange markets. Other companies were acquired by strategic investors, including major international groups such as Johnson & Johnson, Microsoft and Intel.

It is important to note, however, that there were other conjuncture factors contributing to Yozma success. Among them, the major investments of Israel Defence Forces for decades, spurring R&D and ensuring government purchases. In addition, the country already had skilled labour force at the time, as a result of compulsory military service that leveraged on young people skills in exact sciences, as well as by the immigration character of the country, which received skilled labour force from other countries. In recent years, Israel maintains one of the largest global investment rates in R&D and in VC funds, as a percentage of GDP. In 2012, Tel Aviv was considered the second city in the world with the best ecosystem of innovation and entrepreneurship, second only to the Silicon Valley.[3]

4.2.5 Incentives for the Use of Capital Markets by SMEs

Seeking to boost the use of capital markets by SMEs, BNDES has been active both institutionally and in its own investment portfolio.

Together with ABDI, BM&FBOVESPA, CVM and FINEP, BNDES is part of a working group that has been studying rules and practices of access markets in other countries. On a visit to several countries, successful stories were evaluated, in which SMEs had been able to issue shares to finance the development of its activities.

Based on the survey made, some initiatives were proposed, and are still under study, among which: cost reduction and simplification of the procedure of shares public offering; reduction of maintenance costs of publicly-held companies; direct tax incentives to specific investors and investment funds; investment limit elevation of private pension plans to the high-risk companies; initiatives for investors and Brazilian businessmen education; formatting of specific vehicles for investments in SMEs.

BNDES has also been trying to bring more companies of its portfolio to market, developing conditions for growth and good corporate governance practices of these

[3] Research conducted by the company Startup Genome, published in *Exame* Magazine of August 7, 2013. In this ranking, the city of São Paulo (Brazil) appears in 13th place.

companies, with a focus on listing and IPO. Of the nine companies listed on BOVESPA MAIS, six have shareholding of BNDESPAR.

Another initiative under consideration by the institution is to assist the demand of future IPOs, supporting public offerings on BOVESPA MAIS with firm guarantee subscription.

4.2.6 Investment Support Programme and BNDES Card

Given the characteristics of investment in innovation, the granting of reimbursable funding is basically made by public bodies, which offer specific lines for companies' innovation with more attractive conditions. In Brazil, the dependence on the development agencies and Government banks are even greater, since private banks do not usually grant long-term financing. In this way, BNDES and FINEP appear as the main financiers.

In 2009, BNDES created the "Programa de Sustentação ao Investimento – PSI" (Investment Support Programme), being innovation one of the focus. The goal was to stimulate companies to not postpone or cancel investments, as a result of economic crisis. Part of BNDES existing innovation lines and programmes turned to have better conditions due to PSI, currently with 4 % of annual interest, with total time of up to 120 months, and loan of up to 100 % of financeable investments. There is also the possibility, on a case-by-case study, of waiver of real guarantees.

Disbursement in 2010 was R$ 136 million, having reached R$ 1,136 million in 2012. In 2010, FINEP also started to transfer BNDES resources relating to PSI, and reimbursable resources disbursed by FINEP jumped from R$ 880 million in 2009 to R$ 1,765 million in 2012.

Another important instrument is the BNDES Card, whose operation resembles the one from traditional credit cards. SMEs wishing to invest in innovation can request the card to fund hiring of services of applied research, development and innovation, and also the purchase of domestic machinery and equipment, and other items. Each company has a pre-approved revolving credit, term of amortization of 3–48 monthly installments, fixed and equal, and interest around 0.9 % per month. In 2012, through this instrument R$ 9.5 billion have been disbursed, with 707,000 operations performed and 206,000 companies attended in 4,689 different municipalities of the country.

Reimbursable funding for innovation investments with more attractive conditions are also offered by several public bodies in the world, such as the European Investment Bank and KFW, a German government-owned development bank.

However, what is important to point out is the loan guarantee schemes, which seek to minimise the difficulty of SMEs in structuring of guarantees. Just in Europe, around 2.8 million of SMEs are using that benefit, with an amount of EUR 79 billion of guaranteed loans. Small Firms Loan Guarantee Scheme is a success example in UK, that guarantees to SMEs up to 75 % of the loan's value.

BNDES has a similar and recent initiative, called "Fundo Garantidor para Investimentos – FGI" (Guarantee Fund for Investments), which guarantees up to

80 % of the credit risk of transfer operations from BNDES to SMEs. However, FGI does not guarantees innovation investments.

Another way to mitigate the obstacle of the guarantees is the use of "semi-equity" financial instruments, where the lender may waive the requirement of collaterals in exchange for being a partner in the project, such as the model of "launch aid", used by the European Union for funding Air Bus innovations in the aviation industry.

Conclusions

Based on presented results and discussion, it can be concluded that recent actions of the Brazilian Government has sought to fill some existing gaps, and broaden and make more effective its participation in funding for innovation, as well as stimulate private investment.

Initiatives analysed in this study have four main characteristics, and seems to consider some successful characteristics of foreign mechanisms: (i) greater alignment with the interests of the market; (ii) greater focus on SMEs, with new non-reimbursable instruments and actions to stimulate the venture capital market; (iii) stimulus to increase the link between academia and business; and (iv) the unification of efforts among government agencies.

The "Plano Inova Empresa" foresees the articulated use of BNDES and FINEP financing instruments, in addition to the involvement of other public bodies. In this way, a greater efficiency in the allocation of resources and quality of public spending is wanted, in addition to facilitate communication with the business community. The analysis of jointed business plans, and not isolated projects, aims cooperation between players and complementarities of competences.

Greater focus on SMEs and market orientation with shared costs between Government and industry have been identified in Embrapii and Tecnova non-reimbursable instruments, and in actions directed to venture capital. These mechanisms, as well as Criatec, has also decentralised actions, in order to be connected to local innovation ecosystems.

Initiatives for the venture capital industry aim to encourage the creation and development of start-ups, through "Startup Brasil" and new venture capital funds, such as Criatec 2 and 3. Despite recent advances in the latest years, investments in funds of VC/PE in Brazil are still low and do not meet the necessary demand. Relevant experiences like Israel and the U.S. showed the importance of this industry to attract private investment for innovation and increase the country's competitiveness. The ideal model for Brazil, however, needs to consider the country current stage of development and peculiarities, as well as present opportunities of investment.

A greater use of capital market by SMEs is also being sought, with initiatives in study ranging from IPO process simplification and cost

(continued)

reduction to keep the company opened to fiscal incentives to increase demand and initiatives for educating investors and companies. In addition to being an alternative source for resources to companies, a developed capital market increases the attractiveness of VC/PE funds since investors see higher chances of exit.

The Government has also tried to facilitate the acquisition of reimbursable resources for innovation by companies through granting better financial conditions, being the main example PSI and BNDES card.

Some improvements, however, still seem to be important, and have been already used by some countries in successful mechanisms. Among them, the development of tools to assess public resources application effectiveness through monitoring the early stages of the project supported and also the subsequent evolution of companies.

Despite the progress mentioned, a greater focus should be given to SMEs. They have more difficulty to obtain funds, but are the biggest generators of jobs and tend to be the most productive and innovative companies. In this way, it would be important to expand the use of loan guarantee schemes, such as FGI, including in its scope the guarantee on innovation investments. Financial instruments characterized as "semi-equity" can also be an alternative way to mitigate the problems of insufficient guarantees.

Finally, extrapolating the issue of funding mechanisms, it is important to emphasise the urgent need for Brazil to make the business regulatory system less bureaucratic and simplify the tax structure, as well as reduce labour market rigidity, so that innovative small businesses can grow. Additionally, besides the need to solve Brazilian lagging educational system, it is also necessary to further business training for innovation management. Studies have shown that the effectiveness in turning good ideas into businesses is not related only to the amounts invested in R&D, but also to how the innovation strategy is carried out by the company.

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