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# Brazil: Democracy and the 'Innovation Dividend'

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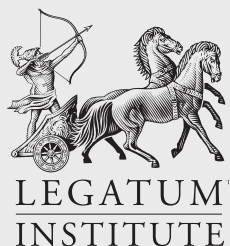
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## Executive Summary

Brazil has developed a very stable democratic system since the end of the last authoritarian period, almost 30 years ago. Innovation during this time has a mixed track record: democracy seems to have had a very positive effect on social and community life innovation, but much less impact on its scientific and technological aspects.

Income transfer programmes have already enjoyed a decade-long history of development, with notable results. The main initiative is the *Bolsa Família* programme, which makes available a monthly stipend for families below a certain income level. The Gini coefficient of income distribution—which had increased continuously for more than four decades since 1950, in spite of a period of fast economic growth leading up to and during 1980—has declined constantly since the mid 1990s. The number of people living in poverty has also declined steadily and Brazil reached the United Nation's Millennium Development goal of halving its level of indigence (from the level in the year 2000) almost a decade before the 2015 deadline.

Education is another area where democratic rule seems to have had a positive impact, having become a central concern of society at large and recognised by politicians as a relevant issue. However, much-needed changes in the management of schools face opposition from teachers' unions, and governments, regional or local, have not been able to challenge the status quo.

Scientific innovation, as measured by scientific output and citations, has evolved positively in the last two decades, but there is little evidence of the effect it has had on democracy except, possibly, for the more positive climate on academic campuses. Regarding technological innovation (products and processes), the indication is that, despite consistent action by government, little has changed and results are very disappointing. The causes for this are likely to lie in economic structures that have little relation to government systems: the complex tax structure and the heavy bureaucracy involved in opening businesses, as well as a long-running propensity for protectionist policies in foreign trade. Democracy may eventually prove decisive in changing these characteristics, as more actors get involved in the decision process.

Information Technology (IT) has had an enormous impact on Brazilian politics and helped to create more transparency of public organisations and their practices. The results are quite visible: public-interest laws have been developed and approved with support from social networks, transparency sites are very active, consumer-protection organisations are using IT more frequently, and so on. Recently there have been extensive public demonstrations calling for better public services that were organised mostly via social networks. The consequences of these protests are only beginning to be seen, but they should have an extensive impact on future Brazilian political life.

## Innovation and Democracy in Brazil: Initial Overview

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Brazil has been through deep changes in almost every aspect of its social, economic and political life since moving from a military-led authoritarian regime to democracy and civilian rule during the late 1980s. In 1988, that process resulted in a new federal constitution that included extensive provisions guaranteeing social rights, many of them not entirely in accord with the country's economic and institutional stage of development. Those provisions have been at the centre of Brazilian politics and policies since then. The Constitution also re-established open and free elections at all levels. The first free presidential elections in almost 30 years were held in 1989. Since then, Brazil has enjoyed its longest period of political stability and democratic rule in almost 100 years.

Despite Brazil's relatively high level of political instability during most of the twentieth century (there were two authoritarian periods, 1930–45 and 1964–84), Brazil's social and economic indicators have shown constant progress. The country has developed a broad industrial base, with farming and cattle-raising sectors having their share of the economy reduced to 11 percent in 2000, from 29 percent in 1940 (Bonelli 2006), despite the continuous growth and high levels of productivity of the primary sector. Per capita gross national income increased almost six fold from 1940–2000, attaining US\$11,630 in 2012 (World Bank 2013). Life expectancy grew from 43 years in 1940, to 67 years in 2000 (Silva & Barbosa 2006), to 73 years in 2010 (IBGE 2010). The infant mortality rate decreased from 150 out of 1000 births in 1940, to 48 out of 1000 in 1990 (IBGE 1999), to 16 out of 1000 in 2010 (IBGE 2010).

Still, Brazil faces enormous challenges. In spite of various programmes, new laws and other initiatives, Brazilian industrial and service sectors have not developed many innovative products or processes. In 1980 Brazil's per capita purchasing power parity was around 42 percent of that of OECD countries, while in 2005 it had fallen to under 29 percent (Rodriguez et al. 2008). Productivity of labour showed its highest value ever in 1980, and has declined or stayed stagnant since then. In a later section of this paper, we will present data showing the low levels of innovation in industry that seem certain to relate to the difficulty Brazil faces in increasing productivity.

It seems that in the case of Brazil, a return to democracy has had a more positive impact on social innovation, especially regarding income distribution, than on technological and other economic aspects of innovation. On the impact of innovation on democracy, this paper will show that there is growing evidence that the use of information technology is becoming central to new forms of political participation by the general population. We will see how this has led to petitions that became laws, the organisation of new parties and the advent of online campaigning, that, very recently, rocked Brazil's political establishment by encouraging a wave of large street demonstrations calling for better public services, more diligence by the judiciary in dealing with corruption charges against politicians, and for action on many other issues.

In summary, a number of questions emerge: How do we assess the relationship between democracy and innovation in Brazil? Are these two aspects of the country's life directly and productively related? Or is the relationship more indirect and nuanced? If the latter is the case, are there differences in that relationship when different aspects of innovation are considered?

We argue that, in Brazil, democracy and innovation in social programmes are more directly connected, while the links between democracy and technological and scientific innovation in the recent (and relatively short) democratic period of Brazilian politics seem to be significantly weaker. On the other hand, it is increasingly clear that technological innovation, especially in communications, is impacting political life and the way democracy is structured in Brazil, in mostly positive ways.

This paper is structured in five sections, including this introduction. The next section presents a summary of the institutional development related to innovation in Brazil leading up to the most recent interventions. The third section shows an overview of the current innovation landscape in Brazil, both underlining the limited results obtained after decades of building up important institutions to promote innovation and presenting some interesting (and mostly successful) cases where innovation has been relevant. This section will also include evidence of positive results related to innovation in social programmes. The fourth section presents our main argument regarding the weak link between democracy and technological innovation, and it also explores some ways democracy promotes or hampers innovation. We conclude with some comments on current initiatives and how they may develop.

## Historical Remarks on Science, Technology and Innovation in Brazil

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Brazil was very late in developing a system of universities that included research among its activities, even when comparison is restricted to other Latin-American countries. The main reason for that was that Portugal did not allow colonies to develop higher education. In comparison, Mexico, Peru, and Argentina all had important universities in their colonial period, before 1800.

Portugal's attitude to higher education in Brazil changed when Napoleon's army, commanded by General Junot, approached Lisbon in late 1807, and the Portuguese royal family and the seat of government moved to Rio de Janeiro. Soon after that the first Brazilian law school was founded but despite this, between independence from Portugal in 1822 and Brazil becoming a republic in 1889, only a few professionally oriented institutions (law, medicine, engineering) were established. Under the republican regime many higher-education institutions were set up, but all followed either the Portuguese (law or medicine) or the French (engineering or agriculture) professional school models. The first comprehensive university, the University of São Paulo (USP), that had research inscribed as a relevant activity in its statutes and academic autonomy as one of its founding pillars wasn't established until 1934.

Its community was strengthened, initially, by a group of European scientists and intellectuals, of which Claude Lévi-Strauss and Fernand Braudel were important representatives. The founding of USP has been called “the most important event in the history of education and science in Brazil” (Schwartzman 2001, p. 164).<sup>1</sup>

USP was founded by the initiative of the leaders of the 1932 liberal revolt that pitched São Paulo against the federal administration led by Getúlio Vargas, who had taken power in 1930 but had not delivered their promised democratic reforms (Fausto 1997, Pedrosa 2013). The leading character in the enterprise was Júlio de Mesquita Filho, the publisher of the main newspaper in the state, which was an important vehicle for gathering public support for the 1932 revolt. Thus it may be said that both a free press and liberal democratic values played an important role in the beginnings of the Brazilian university and scientific systems.

With the federalisation of many other state-run universities in the 1950s, which followed a more centrally controlled model than that of USP's, and the establishment of federal research funding agencies in 1951, the National Council for Scientific and Technological Development (CNPq) and the Co-ordination for the Improvement of Higher Level Personnel (CAPES), basic research and, slowly, the development of graduate education, began to take hold. The funding agencies had, from the start, a somewhat complementary role, with CNPq funding (basic) research and CAPES funding graduate education and, since the 1970s, progressively developing an evaluation and accreditation system of graduate programmes in Brazil.

It is interesting to note the involvement of the Brazilian military in the founding of CNPq, which had as some of its main objectives the development of nuclear technology (Schwartzman 2001, p. 260), as well as the establishment in 1949 of the Aeronautical Institute of Technology (ITA), modelled after the Massachusetts Institute of Technology. ITA was organised with the idea of developing a Brazilian aircraft and space industry. EMBRAER, the Brazilian aircraft company, and brainchild of the ITA, has, after being privatised in the 1990s, developed into a very successful and internationally competitive aircraft manufacturer. The original nuclear energy project never materialised, although in the late 1970s, under military rule, Brazil started a commercial nuclear energy programme using German technology (this also never fully developed as planned).

In 1967, during the military regime (1964–84), the Studies and Projects Funding Agency (FINEP) was the third federal agency created. Its purpose was to fund technology research and development projects. It received financial support from the National Economic Development Bank (BNDE)<sup>2</sup> through the National Technology Fund. These developments reflected a state-oriented ‘Big Science’ policy that the military had had in mind since after World War II. FINEP funded many major scientific projects during the late 1960s and 1970s, such as a Pelletron accelerator at USP, aircraft-engine technology at the Aeronautics Technological Centre (which houses the Aeronautics Institute of Technology), the development of a Brazilian computer by a consortium of institutions, as well as many other projects at public universities, research centres and even a few industry projects. It was an interesting period where many left-wing academics would participate in large projects supported by the right-wing military regime (Schwartzman 2001, pp. 276ff).

Even though the military followed liberal monetary policies and implemented many reforms in that direction, especially in their first years of power, they also promoted strong state intervention in many sectors, extensively developed transportation, electrical and communications infrastructure, and kept the imports substitution policy that had been the mainstay of Brazilian industrial policy since the end of World War II (Fishlow 1972, 2013).

Given the federative structure of the Brazilian political system, formed by 26 states and the Federal District (site of the Brazilian capital, Brasília), states have gradually developed their own research funding agencies. The first one was established in the state of São Paulo, the São Paulo Research Foundation (FAPESP), in 1962. São Paulo is the most developed and populous among the 26 states, home of 22 percent of the country's population and the source of about a third of its gross domestic product (GDP). FAPESP's governance system has had enormous influence with three very important characteristics being central to its success: a fixed share (1%) of sales tax revenues was established in law to form FAPESP's budget; it has a limitation, by statute, of how much it can spend on personnel and administration (5 percent of the total budget); and it enjoys full autonomy to decide how to manage its funds. The federal constitution of 1988 included an article that allows states to dedicate fixed percentages of their revenues to research-funding purposes, based on FAPESP's model. Today all but one state have developed research-funding agencies accordingly.

These efforts were important to build up the Brazilian science and technology (S&T) system, along with the proper institutions to finance and develop research, and to generate a growing contingent of qualified human resources. However, gradually the focus began to change towards innovation, to the results the effort in S&T should produce. By the end of the 1990s, an important shift in the national policy for S&T occurred as it began to incorporate the need of translating knowledge into innovative products and processes.

Given all the relatively successful policies regarding science and higher-education development, it is somewhat surprising to observe that the quality of basic education had not been under debate until the late 1990s. When the results of educational performance assessments were made public in Cardoso's first term (1995–98), it was immediately clear that both primary and secondary education performance in Brazil were at levels well below international standards, even when compared to countries at similar levels of economic development. The cause was easy to detect: the levels of investment in basic education ranged from 100 times (primary) to 12 times (secondary) less per student than that in higher education, during the 1950s and '60s. Even as late as the year 2000, public expenditure on higher education was 15 times that of basic education on a per student basis (Barbosa & Pessôa 2012).



## Recent Trends

### SCIENCE AND TECHNOLOGY

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Brazil has presented relatively fast growth rates in basic scientific indicators during the last 20 years, such as internationally published scientific papers and citations. This is due to the existence of a qualified system of public universities and research centres and a relatively stable (in relation to GDP) public investment in S&T since at least the mid 1990s. Brazilian participation in the world's scientific production has grown steadily from as low as 0.2 percent in 1981 (below that of Argentina), to 0.7 percent in 1995, 1.2 percent in 1998, 1.6 percent in 2002, reaching 1.9 percent in 2006.<sup>3</sup> In absolute numbers, Brazil was the source of almost 20,000 indexed papers in 2006, the largest number in Latin America (Mexico was second that year with about half that number, and Argentina achieved a little over a quarter of the Brazilian output). The current number has topped 30,000 articles (about 2.6 percent of the world's output).

The US led all countries in 2006, with a 31 percent share of all indexed publications, followed by the UK (8.7%), Japan (8.1%), Germany (7.8%), China (6.3%) and France (5.6%). China deserves some special attention, since it had already reached the 5 percent share level in 2003, already up from a share of 2.4 percent in 1998. This pace of growth has been maintained, and China is now the second largest source of indexed scientific articles, with some predicting it will surpass the US in the next two years. Another country that deserves special attention is South Korea, which had a similar level of scientific output as Brazil in the mid 1990s, but had reached a 2.7 percent share by 2006 (compared to Brazil's 1.9 percent share at the time). Regarding the impact of publications (measured by citations), Brazil has fared similarly to other emerging economies, such as South Africa, Turkey, Mexico, China, and India, but lower than some Latin-American countries, for example, Chile (Frischtak et al. 2013, Figure 17).

In terms of expenditure (share of GDP) on research and development (R&D), Brazil has shown very little change over the last decade, staying close to the 1 percent level. Of that, a little above half comes from public investment and the rest from private R&D. In most advanced and emerging economies private investment tends to be larger. South Korea has been one of the most active countries in that respect, with expenditure of more than 3 percent of GDP for the year 2010, and 75 percent of that performed by businesses (Adams et al. 2013). China has more than doubled its R&D expenditures, from being the lowest among the BRICS at the end of the 1990s to being the highest in 2010, at 1.7 percent, and again shows a higher percentage of this expenditure by the private sector, at 75 percent. Taking into account the size of China's economy, its R&D expenditure is second only to the US. Russia has a similar share of expenditure to GDP as Brazil, with 61 percent performed by business, India shows lower figures, at about 0.8 percent (data on the split between public and private not available). Like Brazil, India and Russia's R&D expenditure has not changed, as a share of GDP, for the last decade.

The relatively low share of business and industry in R&D expenditure in Brazil is related to the very low level of patent filing in the country, compared to most developed, and even to some emerging, economies. This is reflected by the position Brazil occupies in the list of countries ranked by patent filing in the US (USPTO). In 1974, Brazil was 28th in the world, it moved up to 25th in 1982, then fell to 27th in 1990 and has been in the 29th place for the last decade (Fapesp 2010). The Thomson Reuters study (Adams et al. 2013) shows that Brazil's overall patent filing has not changed in absolute figures in the last decade, and has been surpassed by India, leaving it last in the BRICS group. China's performance has again been phenomenal; it has almost tied with the US with close to 500,000 patents filed in 2011. South Korea's growth has slowed in the last few years, but it still has a very high level of more than 150,000 patents filed per year. Brazil, Russia and India have filed less than 40,000 patents per year since 2001, with Brazil filing only a little over 20,000 for 2010. We will discuss the issue of low private investment in innovation in the next section. Before that we will comment on Chinese programmes to accelerate innovation via talent recruiting and what Brazil is trying in that same area.

### China's challenge

Even though China's patent filing activity surpassed that of South Korea in the mid 2000s, a Thomson Reuters report observes that South Korean firms appear to be some of the most innovative in the world, while no Chinese firm shows up in their top-100 list. Thus it seems that the quality of innovation in China has not followed the increase in the number of patents filed, at least at this point. This has been acknowledged by the Chinese government, which has developed plans to make China's top universities more innovative. One of these plans was to launch the Thousand Talents Programme in 2008, to try to attract 2,000 leading Chinese scholars and scientists under the age of 55, who hold professorships or equivalent positions in renowned foreign universities, back to China, over a period of five to ten years. That is not an over ambitious objective, since estimates hold that about 200,000 Chinese citizens are working in developed countries, of which a third are under 45 and hold at least an assistant professorship or equivalent position (Wei & Sun 2012). A similar programme to find young talents has also been started. Altbach and Salmi (2011) make the case for such acceleration programmes, citing the successful policy developed by South Korea (Pohang University of Science and Technology—POSTECH) and Hong Kong (Hong Kong University of Science and Technology—HKUST) in attracting back national scholars living abroad.

### Brazil's response: Science without borders

Brazil, unlike China, South Korea and Taiwan, does not enjoy the possibility of developing such a programme immediately, since the numbers of Brazilian scholars working abroad is nowhere near what one finds in these other countries. Therefore, the way to start was to implement a broad policy of funding Brazilian students and scholars to go abroad to study or to develop research in academic institutions. The federal government launched the Science Without Borders (SWB) programme in 2011. Its objective is to send 100,000 students (undergraduate and

graduate) and scholars (postdoctoral positions) abroad until 2015 (SWB 2011). The initiative also includes funding for bringing scholars from other countries to Brazil, so it contemplates internationalisation in both ways, fostering outward and inward mobility. The plan is under way and approximately 20,000 students have already taken part in the programme and another 17,000 have had applications approved.

The results are not yet in, since no assessment has been developed, inside or outside the government agencies involved (CAPES and CNPq). An early criticism of the programme is that it is only for STEM areas, leaving out all human and social sciences, including economics and administration, two of the least developed academic areas in Brazil (Frischtak et al. 2013, Table 4). A second criticism is that many participants lack the foreign-language skills required to make the most of the programme. As of the first semester of 2013, more than 10 percent of the participants had gone to Portugal, which was not a goal of SWB. The government has since decided to leave out Portugal as a possible destination for students for the remaining period of the programme, and also to start a programme called English Without Borders, to help prospective participants develop the required language skills to travel to English-speaking countries (a main objective of the original project). Another aspect of the original plan was for private funding to account for close to a 25 percent share of the cost of the SWB programme. This particular goal is yet to be reached. A final criticism, pointed out by many, is the absence of qualification requirements for participation in the programme. This has resulted in it becoming not much more than a generic 'internationalisation' experience, without there being much impact on the scientific skills of the students, especially at the undergraduate level.

Despite such problems, SWB is widely recognised as a valid effort to increment internationalisation and qualifications in higher education in Brazil, with lasting effects expected to be felt in the coming years and decades.

## BUSINESS INNOVATION

In 1999, the federal government created the sectorial fund system to support innovation in strategic areas. Initially, 11 such funds were put in place, as well as two horizontal ones, which focused on university–enterprise collaboration (*Fundo Verde-Amarelo*) and infrastructure. The Innovation Law of 2004 established the framework for innovation initiatives, making it easier to develop cooperation between industry and academia (Pacheco & Corder 2010). It established incentives for scientific and technological research and innovation (through PI regulation, participation of academic researchers in innovation projects, etc.). Since then, a significant number of states have developed their own innovation initiatives. The new laws have helped increase collaboration between public and private institutions and allowed for mechanisms of state support to business technological development.

Still, results have been disappointing. We have already seen that the role of business in R&D in Brazil is quite limited, both in terms of expenditure, which has not grown as a percentage of the country's GDP in the last decade and is

low compared to developed and emerging economies, and of patents filed. Even though Brazil has good property rights protection legislation, innovation is not widespread in the local business sector since most patents filed within the Brazilian patent-filing system are generated in local branches of international corporations.

In fact, patent filing data from 1999–2011 (MCTI 2013) not only indicate that the number of patents filed by residents have increased very little during that period (from 6,157 to 7,764), but that the non-residents' share increased from 69 percent to 74 percent of all patents filed in the period. And if one looks only at the patents filed via the Patent Cooperation Treaty (PCT), which involves patents that will likely have international impact, then non-residents account for almost all filings (99.7%). For example, Brazil is the source of most patents in the area of components for ethanol engines, but many of the patents were developed by Bosch, in their Brazilian plant, and by other international companies. Detailing further the split between residents and non-residents, it is clear that the sectors where residents lead are those in agriculture-related or low-tech areas, like family consumption, construction, and agriculture and food machinery. Non-residents have an 80 percent or higher share in high-tech sectors and those of a recent vintage, such as pharmaceuticals, biotechnology, telecommunications, semiconductors, and others. In organic chemistry, non-residents filed 98 percent of all invention patents for the period (Fapesp 2010). Of patents filed by residents, we see that public universities and research institutes play a much bigger role than in any other industrialised or emerging economy. For example, in the period 1980–2005, the University of Campinas filed 408 patents, second only to Petrobrás, with 804 filed. Among the top 20 institutions, six of them were public universities, research institutes, or public-research funding agencies.

Another recent report, this one from Thomson Reuters (Adams et al. 2013) shows that Brazil patents more than the world average in certain areas—for example, polymers, pharmaceuticals, agricultural chemicals, food, detergents, general chemicals, textiles, printing, petroleum, mechanical engineering, and metallurgy; but lags in the areas of materials, instrumentation, computing, semiconductors, electronic components, communications, and electric-power engineering. This again shows that Brazil's industry, now including the branches of multinational corporations, has a slant towards the areas of agriculture, food, chemicals, metallurgy, and petroleum. These areas are strongly linked to commodities, a sector where Brazil is one of the world leaders. But it also shows a definite weakness in areas related to innovation and technology-intensive consumer goods, especially in electronics, communications, and information technology.

## A FEW INTERESTING CASES

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In spite of a general picture that is not so bright in terms of business innovation, Brazil has developed some innovative companies in areas like agriculture and seed technology (Embrapa), deep-sea oil drilling (Petrobrás), mining (Vale), pharmaceuticals (Natura) and aircraft manufacturing (Embraer). These companies, with the exception of Natura, have one common characteristic: their activities do not involve selling mass-market products or services, but commodities or products

that other companies and investors buy and then use in further enterprises, for example, aeroplanes that airline companies purchase or seeds that farmers use to grow their crops. Each company deserves further comments. Embraer is a very successful and interesting case, whereas Vale and Petrobrás, with their closer ties to government, have experienced rather different results. Embrapa has suffered from having stayed a public company and has lost much of its influence in seed technology and markets, while Natura is a relatively young company with many innovative initiatives. Both Embraer and Natura were among the winners of the National Innovation Prize 2013, granted by the National Confederation of Industries. A recent government initiative directly related to innovation will also be discussed: Embrapii (Brazilian Innovative Research Company).

### A successful case: Embraer

Embraer—the Empresa Brasileira de Aeronáutica—was created in 1969 as a state company, with support from the military government, two decades after the Aeronautics Institute of Technology (ITA) was established to prepare engineers in the aeronautics field. After a relatively slow but successful start, the company suffered through the turbulent period from 1980–1994, when it was privatised. Since then, with strong initial support from government, including subsidies for exports, Embraer has become a world leader in small to midsized jets. Today it is very common to fly on their EMB 145, 170 and 190 models in shorter routes all over Brazil, South and North America, Europe, and Asia. The geographic area around São José dos Campos is gradually becoming a hub for industries that furnish products and services to Embraer, though it is not yet comparable to Everett in Washington (Boeing) or to Bombardier's production centres.

### A global player sees innovation as the path for progress: Vale

Companhia Vale do Rio Doce, or Vale as it is internationally known, is one of the world's giant mining corporations. Founded in 1942, as Brazil was starting a programme of industrialisation, it benefitted strongly from an increase in commodities prices during the last decade, including that of iron ore, which is Vale's main product. It was privatised in 1997 and since then has expanded worldwide, with activities in 30 countries, covering all continents. The latest slump in commodities prices has reduced its revenues, but they recently received permission to start the exploration of a large new area in the Carajás region in the state of Pará that has excellent potential (predicted investments reach US\$19.6 billion). In a recent interview,<sup>4</sup> their logistics director, Humberto Freitas, was very explicit in observing that future gains for mining companies worldwide would come from innovation. Vale operates a large port and logistics complex on the coast of the state of Espírito Santo, where they have developed many innovative environmental initiatives. Even so, mining is one of the most difficult areas regarding sustainable technologies and policies, and in spite of many efforts, Vale achieved top place in the Greenpeace–Berne Declaration's public vote for companies with poor human rights and environment records in 2012.

## An innovative oil giant and a big political player: Petrobrás

Petróleo Brasileiro SA, better known as Petrobrás, is the oil company that has had a huge role in both Brazil's economy and its politics, for the last half century. Founded in 1953 as a state company, it is now a semi-public corporation with shares traded both in Brazil and on Wall Street. It operates in 18 countries and its assets are worth over US\$130 billion. Most of Brazil's oil comes from deep-sea drilling, and the company has developed competitive technology in that segment, with production growing steadily during the decades since the first deep-sea reserves were discovered in the mid 1970s. In 2006, it announced the discovery of reserves located in 'pre-salt' areas, also known as 'ultra-deep' sea reserves. The announcement made big news and was used extensively during Lula's re-election campaign and again four years later to help elect Rousseff. So far, these new reserves have proven a mixed bag, with production having reached almost 400,000 barrels a day, about 20 percent of the total national oil output. But there is a catch: due to the slowing down of production by older wells and platforms, Brazil's oil output in 2013 is about 5 percent below that of 2012, and the promise of self-sufficiency, again a major campaign item, has not materialised so far. In fact, Petrobrás loses money daily since it has to import oil and gasoline to make up for demand, and because prices have been held down artificially by government intervention to help curb rising inflation. In the second quarter of 2012, Petrobrás posted their first losses since 1999. For the whole of 2012, profits were down by a third compared to 2011. Profits for the first quarter of 2013 were about 17 percent below those of one year earlier. There is widespread criticism of how the company has been run in the last decade, which is under strong political control from government. To help finance the huge investment plan to develop the pre-salt areas, Petrobrás issued a secondary offering in 2010 that reached US\$70 billion, the largest ever worldwide. It became one of the largest companies in the world in the following months, but its shares value has plummeted recently, by about 70 percent from its peak, causing a huge loss in market value for the company. Petrobrás will certainly survive the current situation, but it may be a good lesson of how excessive government influence can hamper industrial development in a crucial sector.

## A former brilliant innovative enterprise: Embrapa

Embrapa—the Empresa Brasileira de Pesquisa Agropecuária—was behind one of the most successful technological innovations in Brazil's history: it developed soybean seeds that were adapted to tropical weather, the dominant system in Brazil. Not only did it develop the many varieties of seed for the various crops, but it had a hold on the market for them, at one point having a 60 percent share. Today that lead has evaporated and Embrapa holds only about 10 percent of the soybean-seed market in Brazil.

How did it happen? The turning point was the introduction of genetically modified varieties in the late 1990s and early 2000s. Embrapa had not moved in that direction and foreign companies quickly dominated the sector. For a while there was intense political debate over whether the use of transgenic varieties would be allowed in Brazil, but, even before that decision was taken, it was clear that producers were already using them extensively. Embrapa is still a relevant player

in agro-industry research in Brazil, but they have paid dearly for having waited too long to adopt modern biotechnology in its R&D processes. Politics, too, may have had a role in this case. As a fully public company Embrapa would suffer from the many restrictions related to the hiring of personnel and making purchases (they are required to follow the national tender laws) that also affect Brazilian public-research institutes and universities. Even so, the increase in agricultural productivity in Brazil is an indication that this is one area of activity that has been very successful. From 1975–2011, agricultural production rose by almost four times, while the total costs rose by only 10 percent, with growth in labour productivity of 4.7 percent per year (Gasques et al. 2012).

### A new model for Brazilian innovative companies: Natura

Since its start in 1969, Natura has become the leader in the cosmetics and personal-care sector in Brazil (the third biggest market in the world, behind the US and Japan), competing in good terms with international giants. It opened its capital in 2004 and has become a very innovative actor in many areas, including sustainable technologies. It has offices in most of South America and in the US, Australia, and the UK and its products have been exported in growing volumes. Following the direct-sales model, it took over the leading position from Avon in the Brazilian market in 2006. They have a strong positive image of environmental responsibility, with many programmes focused on sustainability. According to the Forbes rankings of 2011, Natura was the eighth most innovative company in the world, right below Google. It was one of only two Brazilian companies listed (AB InBev, the Belgian–Brazilian beverage conglomerate was ranked 53rd). This innovation and influence was reflected in the participation of its CEO, Guilherme Leal, as vice-presidential candidate on the ticket of Marina Silva, the former Amazon extractive-industry union leader, who is considered the main advocate for environmentally safe development policies in Brazil. Ms Silva will likely be a contender in the 2014 election, with recent polls placing her a competitive second (to Rousseff), having had her share of intended voters raised after the recent massive street demonstrations that called for better public services and changes in Brazilian politics.

### More statism? Embrapii

The federal government recently launched a new public company, the Empresa Brasileira de Pesquisa e Inovação Industrial,<sup>5</sup> or Embrapii. It is part of a larger initiative involving federal ministries (education and science, technology and innovation) and the National Confederation of Industries (Plano Inova Empresa), the association for the industrial sector, with promised investments of about US\$15 billion for 2013 and 2014 to support innovative R&D in all sectors—industry, agriculture and services. Most of the money will be available as subsidised low-interest credit and there will also be fiscal-waiver incentives for companies that have projects. Criticism has already appeared due to the programme's focus on subsidised credit, which is the main instrument government has already used to try to foster investments and which has had mixed results. In fact, industrial investment has dropped since 2010 and productivity is at an all-time low. It is too early to tell, but it



could be just one more of the 'plans' that are announced with grand fanfare but used mainly as photo opportunities for the next electoral campaign.

## INFORMATION TECHNOLOGY

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Brazil's IT sector was heavily controlled for some period, due to a very restrictive law called Lei da Informática (Informatics Act) that protected the national IT businesses and that was approved in 1984 by Congress, during the last year of military rule. The law was even more restrictive than earlier ones, as it not only imposed severe restriction on imports, but also barred foreign investment in the sector. Even though the early results of the legislation were seen as positive, it became clear that it had a very negative impact in the long run, restricting access by business and government to the latest IT available. The restrictions were dropped in 1991 in conjunction with incentives for production in the Manaus' free economic zone that allowed for foreign capital investment. However, since the entire telecommunications system in Brazil was in the hands of federal and state companies, it would take another half decade before the system was privatised and IT, in a broader sense, began to develop in earnest in Brazil.

Congress passed a new IT law in 2004. It keeps incentives for national content and requires that 5 percent of revenues must be dedicated to R&D. It is fair to say that, currently, Brazilian businesses, public offices and homes, use IT in a very intensive way. Coupled with the expansion of the telecommunications system after its privatisation in the late 1990s, Brazil now enjoys fast growth rates of Internet and smartphone use. Still, as a recent study has shown (Frischtak et al. 2013), Brazil is well behind fast-developing Asian countries like South Korea in broadband internet use, and also behind Argentina, China, and Mexico. In 2011, the index of broadband subscriptions per 100 inhabitants was 8.6 for Brazil, 10.5 for Argentina, 10.6 for Mexico, 11.6 for China, 28.8 for the US and 37.0 for South Korea. The study also presents various other IT indexes that show that Brazil still has a long way to go to get near the faster developing Asian countries in those areas.

However, the use of IT has had a big impact in many spheres of Brazilian life. The Information Access Act, passed by Congress in 2011, requires every public institution to publish detailed information about its activities, including budgetary data. It has allowed individuals and organisations to follow the activities of all levels of government much more closely than before. There are also government sites with detailed information of expenditures, like SIAFI,<sup>6</sup> the federal government's financial administration system. These initiatives have already had an impact on the ability of society as a whole to gain access to information about how government works at local, state and national levels. Businesses have also increased their IT use, specifically for advertising purposes, but also, gradually, to connect with customers in new ways. The availability of IT resources also makes it possible for young entrepreneurs to start their businesses. It is very hard to believe that such a law would be in place if the regime was not following democratic principles and politicians were left to rule at will.



Regarding more direct political effects, there is growing use of the internet by political parties, NGOs and individuals for various purposes. For example, the Internet was essential for the submission to Congress of a popular petition, which became law in 2010 (Lei da Ficha Limpa, the Clean Records Act), barring politicians with past legal problems, whatever the cause, to be elected to office. More than 1.3 million people signed the petition, most of them via the Internet. It had a very important impact in the 2012 elections, with more than 1,000 candidates having their electoral registration cancelled.

In 2012, the case of the *mensalão*,<sup>7</sup> involving various politicians, including the former chief of staff of the Lula administration, José Dirceu, was judged by the Federal Supreme Court, with live coverage by TV networks and the internet. During this time, constitutional and other legal issues became everyday themes of discussion, with a clear sense of participation by the population. Many credited TV and Internet exposure and massive popular participation as part of the reason the Supreme Court judges decided to heed the call for justice (many defendants received long jail terms), a first at that level for Brazil.

Recently more than 1.4 million signatures were collected for a petition to recall the election of the Senate's president, who is under investigation by the Supreme Court for corruption. In another example, a new political party, led by Marina Silva, the former union leader, senator and nature-conservation activist, is being formed, and the internet is being used extensively to collect the minimum of 500,000 signatures needed for the party's registration with the electoral justice system.

All these events and actions pale beside the huge demonstrations that were organised via social networks such as Facebook and Twitter during the month of June in 2013. They were triggered when small groups organised protests demanding that the recent hikes in public transportation fares in São Paulo and Rio de Janeiro be revoked. After being ignored by politicians and suppressed by the police, with some excessive violence in a few cases, these small groups sparked a national wave of protests that demanded change in almost every aspect of Brazilian life, from education and health to corruption and transparency. It is clear that the experiences of using IT to encourage participation, as mentioned above, and the frustration regarding better public services that never materialised, compounded by evidence that politicians were not paying attention to the public's demands and continuing to use public means for private purposes (for example, the case of using air-force jets for personal travel during the Football Confederations Cup at the same time the masses were protesting in the streets), were major factors influencing millions to take the streets. Another relevant factor is that the more-organised groups were very adamant about the non-partisan character of the demonstrations, going to the point of asking people with parties' banners to put them down. Another clear sign of the anti-establishment character of the movement was the failure of the major union organisations to get people to participate in their 'national day of demonstrations', a failure noted by many political analysts as evidence that the recent wave of street action is actually directed against the established political system.

A recent poll (Datafolha 2013b) among São Paulo residents showed that the three branches of government are at an all-time low in terms of prestige among the population. From 2003–13, the group of people that said they had a positive view of them dropped from 51 percent to only 19 percent. Interestingly, this negative view of democratic institutions has not significantly reduced the support for democracy. The same institute showed that 53 percent of the same population think that democracy is the best system of government, a similar percentage as a poll ten years early and only 4pp below the share of 57 percent supporting democracy in 2003 (Datafolha 2013a). Today, 19 percent responded that a dictatorship was the best system, compared to 16 percent in 2003, with about 20 percent in both polls saying they do not have a preference. The first poll also showed that a large majority (77%) of the general population supported the recent street demonstrations. Another poll<sup>8</sup> conducted among participants of the largest demonstration in São Paulo (June 6, 2013), showed that 87 percent of them supported democracy and only 5 percent said that a dictatorship would be preferable in some circumstances. Thus, despite refusing to identify themselves with existing political parties, the poll shows that demonstrators see democracy as the best political system.

These are just some of the many cases where IT is being used to foster public participation in the political process in Brazil, and it is evident that this influence is just starting to reach its potential and will become much more relevant in the coming years. So far, there is little evidence that the Internet, or any other aspect of IT, has been used in Brazil to hinder political participation, or to persecute individuals or organisations. Therefore it is fair to conclude that, in Brazil, the growing use of IT at all levels of society has been a positive force for democracy. And, to reiterate, it is very hard to see that kind of momentum occurring without generating a political crisis, in countries where the political system does not follow democratic principles.

## SOCIAL AND POLICY INNOVATION

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It is easy to see the effects of democracy on social innovation, starting with government programmes. The best known and most effective one has been the Bolsa Família programme developed by the federal government.<sup>9</sup> The present form involves direct transfers to poor families via a monthly stipend. More than 13 million families are beneficiaries of the programme (out of 16 million families that are known to qualify, which are those with a per capita income below R\$70, about US\$30). The programme was established when Lula took power, as an extension of an earlier programme, *Bolsa Escola*, started by Cardoso a few years earlier. The most direct effect of this latest programme has been the reduction of the number of people living in extreme poverty: Brazil reached the UN Millennium Goal (established in 2000) of halving its population already living below the indigence level in 2006, almost a decade before the 2015 deadline. The programme, in part because of its relatively low cost (current total expenditure is less than 0.5 percent of the GDP), has been cited by international specialists as a model for poverty reduction in developing countries. There are various similar programmes at state and municipal levels.

The public sector has been involved in supporting what has been called the 'creative economy', which includes various activities that are driven by new ideas, and not necessarily using much capital to be developed. For example, the federal Programme for Growth Acceleration (PAC) has a sub-area for small and midsize businesses (PAC-PME)<sup>10</sup> that has supported some activities of that type. Taking part is the Instituto da Economia Criativa, which has developed a programme for crowd funding that has shown some interesting characteristics, including a very low fraud incidence.

The federal and state research-funding agencies also support many policy initiatives, especially FINEP, the federal Project Funding Agency. For example, they have a programme called PRONINC,<sup>11</sup> the National Programme of Popular Cooperative Incubators, started in 1997, that supports initiatives to bring management expertise to small and local cooperatives, within the Solidary Economy programme. Another such programme is called Habitare:<sup>12</sup> it supports the development of technology to modernise construction systems, with the purpose of helping reduce the chronic Brazilian housing deficit. Presently, Habitare boasts approximately R\$21 million (US\$9 million) of investment in the programme, involving 33 projects and 42 research groups across Brazil, mostly from public universities.

In São Paulo, the state research-funding agency (FAPESP) has various such programmes as well, like the CEPID (Research, Innovation and Diffusion Centres)<sup>13</sup> programme, which supports the development of research and technology under a partnership between universities and research institutes and public organs or private businesses. The results of this programme are expected to have applications in terms of public policies and new technologies (for the corresponding partners). Some of the institutes involved are: the Centre of Metropolitan Studies, the Centre of Violence Studies, and the Centre of Research in Optic and Photonics.

## EDUCATION: MORE AND MORE A CENTRAL ISSUE

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Education, which is a social and policy theme, deserves a special section. In spite of very mixed results in terms of learning outcomes, and also because of that, education has been an area where Brazil has developed consistently innovative initiatives, during the past two decades.

Brazil had completed the universalisation of primary education (grades 1–8) during the 1990s, but there were serious doubts about the quality of the system. When Cardoso took power in 1995, his administration decided to have Brazilian youngsters take part in the OECD's Programme for International Student Assessment (PISA), which assesses proficiency in language, mathematics and science skills of 15-year-olds every three years. The performance of its youngsters in all fields, usually ranking last or near last among countries participating in the test, showed that Brazilian basic education was a total failure. At the same time, a national assessment system for all schooling levels, including primary (grades 1–4), middle (grades 5–8) and high school (grades 9–11), was developed and

showed that quality issues were prevalent and problems were already present even at the end of primary school, with many children reaching fifth grade without having learned to read or write. Even though less than 50 percent of those starting primary school were finishing high school, their preparation also showed enormous deficits in expected proficiency. More recently, the Ministry of Education has developed a school's 'score', based on students' results in tests and other criteria, and targets for each level for individual systems and schools.

Slowly but steadily, information on the state of schooling reached parents and students, and politicians realised that education was becoming an important political issue. For example, there have been reports of local systems that, despite having similar levels of per-student investment as others, show much better learning-outcomes results. Calls for using better practice examples such as benchmarks for widespread policy and reform are becoming more common. Along those lines, there have been NGOs like the Ayrton Senna Institute<sup>14</sup> that develops and supports projects to make basic education better by means of partnerships with municipalities and other local educational systems, especially in poorer neighbourhoods. Another such organisation is Todos pela Educação (All for Education), an advocacy group founded in 2006 that has been very active in educational policy. They have established five targets for Brazilian education: all those aged four to 17 in school, all children literate by eight, all children in the correct grade according to age, all 19-year-olds to have a secondary degree, and more and better managed investment in education. Recently, Congress has passed the new oil-and-gas royalties system that proposes that 75 percent of all royalties of the pre-salt reserves should go to education, and there is debate to make law that 10 percent of GDP should also be invested in education.

In spite of these initiatives, there is still much resistance, especially on the part of teachers and school principals, to adopt more efficient school management standards, based on the best-performing systems. Politicians are usually reluctant to fight teachers' unions, which tend to reject any system that involves performance criteria for assessing teachers and schools.

Higher education, after the stagnation of the 1980s, started to show expansion at very fast rates, with enrolment more than doubling during the Cardoso years. By 2003, a new demand began to take centre stage in political and academic circles: the need to provide wider access to higher education for low-income and minority high-school graduates. Governments at the federal and state levels acted accordingly, as did many universities, with various forms of affirmative-action initiatives being developed to increase participation of disadvantaged groups. The continuing fast expansion of enrolment, in particular in the private for-profit system, also brought issues of quality to the fore. Calls for bettering the whole system are now common, from both students and employers, as the recent period of economic growth has demonstrated the need for a highly qualified workforce. Lula's Ministry of Education, building upon an earlier assessment system developed in the Cardoso administration, has developed a fully-fledged quality-assurance system that involves a learning-outcomes test and institutional evaluation. This has impacted on the accreditation process for colleges and universities, especially

in the private sector. Earlier we commented on the Science without Borders programme, yet another indication of how relevant education has become in the last years from a general political perspective.

## Does Democracy Promote or Hamper Innovation?

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As shown in the previous sections, Brazil managed to build up an impressive complex of institutions that are important to the national system of innovation. High-quality universities, significant numbers of PhDs granted yearly and several—state and federal—governmental schemes of incentives for business innovation are all currently in place. However, so far the results regarding technological innovation are disappointing. How can this be explained?

First, it is important to better understand the difficulty in getting firms involved in R&D activities in Brazil. As shown in section 3, R&D expenditures, as a percentage of GDP, have not increased for the last decade or so, and the share of business, unlike in most countries, is lower than that of the public sector. Despite government incentives, the level of business expenditure in R&D (BERD) remains stagnant around 0.5 percent of GDP, as well as every PINTEC<sup>15</sup> survey continuing to report disappointing results in terms of innovation.

One reason for that is the fact that many companies, in many sectors, have no need to innovate to compete in the Brazilian economy. In spite of a growing liberalisation of commerce in the last 20 years or so, the economy still remains rather closed by international standards. Even today, the economic openness of its economy, measured by total foreign trade (imports and exports) as a percentage share of GDP, is only about 20 percent (2011), one of the lowest in the world. It has been like that for decades; the highest figure since 1950 was 27 percent, in 1954 (MDIC 2013). The International Chamber of Commerce's Open Market Index ranks Brazil last among G20 countries, behind Mexico, China, Russia, Argentina, and India (ICC OMI 2013). It is ranked 67th in the overall list of 75 countries.

The protectionist policies of the past that were important to stimulate industrial development, especially through imports substitution, generated an inward-looking bias that deeply affected Brazilian entrepreneurial culture. These protectionist schemes were not really ever dismantled. In fact, the current government recreated some of them as defensive measures against foreign competition, especially from China, and saw them as a necessary step to avoid the decline of industrial output. The results of this action have not gone in the desired direction, since there has been no growth in the national industrial sector or an increase in exports of finished goods. One clear consequence is the continuation of high differentials in prices of imported goods, even of those intermediary goods used in productive chains (Frischtak et al. 2013). It is no wonder that the stores in Miami and New York are filled with Brazilians buying everything from underwear to electronic goods. Typically, a camera or a smartphone costs two to three times more in Brazil than in most countries.

This lack of competition continues to hamper business R&D efforts in Brazil. As the experience of many Asian countries shows, protectionism must be accompanied by export-orientation and competitiveness goals being attained by beneficiary firms. Except for a few cases (for example, that of EMBRAER), Brazil seems to be forever repeating the “frivolous protectionism”, as Fernando Fajnzylber (1983) would put it, that does not foster the technological learning and development that is important to innovation.

The international debate between protectionist and liberal policies in foreign trade and how that relates to growth is an old and intense one.<sup>16</sup> It is reasonable to expect that broad protectionist policies could make innovation less interesting and rewarding to local industry, since it reduces competition. In his overview on the subject, Winters (2004) includes evidence that trade favours productivity that is strongly influenced by innovation. He cites the work of Ferreira and Rossi (2001) that shows that foreign competition due to more open trade had a positive impact on productivity in Brazil during the 1990s. As for the opposite view, Rodrik (2011) has continuously argued that trade barriers have been used extensively and successfully by most countries along their development path, including the US in the nineteenth century and, more recently, by South Korea, to make their industry more competitive during their ‘catch-up’ periods. He cites the very positive results, at least for some time, from implementing imports-substitution policies in both Brazil and India.

The links between specific trade policies and democracy are quite weak, as many historical examples around the world could attest to. In the case of Brazil, it is clear that protectionism has endured, no matter the political system. In recent times we can say that the period from 1990 until the end of Cardoso’s second term (2002) showed a more liberal stance towards foreign trade. But during Lula’s terms it gradually changed and, more recently, in Rousseff’s first term, we have seen increasing protectionist policies being established. It is too early to assess the consequences of these measures, especially since the international economic situation is still affected by the crisis that started in 2008. It is important to observe that both Lula’s and Rousseff’s presidential campaigns had strong nationalistic overtones, promising protection for national industry and attacking (very effectively) the privatisation and liberalisation policies of the Cardoso period, so it is no surprise that their policy choices went the way they went. We will discuss this point further in the section on how democracy may impede innovation.

The weak competitive environment is not the only explanation for Brazilian companies being so reluctant to invest in R&D. Another reason relates to the industrial structure. The participation of technology-intensive sectors in industrial output is small. Except for aeronautics, other high-technology industries such as pharmaceuticals or electronics have little presence in Brazil. Another relevant aspect is that recent trends in innovation have moved from a mostly endogenous model, with a vertical structure where all or most components used to be developed within a country’s border (possibly South Korea was the last such example of industrialisation that was developed mostly within a country), to one where innovation and components are developed and made in various parts of

the world, eventually being assembled in possibly another.<sup>17</sup> EMBRAER uses that system very successfully, but other such examples are lacking in Brazil.

The Brazilian tax system is another factor that does not help companies' efforts to innovate. A recent study by the Inter-American Development Bank (Corbacho et al. 2013, p. 26) showed that, typically, Brazilian business uses over 2,600 hours to prepare and file a tax report, more than five times the average in Latin America (503 hours), nine times the world average (276 hours) and almost 13 times longer than their Colombian counterparts take (208 hours). Brazil not only has a very inefficient and impossible-to-track tax system, but government tax income is one of the highest among the emerging economies, at about 36 percent of GDP, close to that of the developed countries in Europe. Tax reform proposals have been advanced during the last decades, but the only consequence has been the increase in the number of rules that individuals and businesses have to follow in order to be up-to-date with the system.

Finally, Brazilian rules for opening business are very cumbersome and make investments in innovation very expensive. Red tape and complicated rules make opening and closing a business a nightmare in Brazil. This affects both national and foreign entrepreneurs, who think twice before investing money to open new enterprises. Data from a World Bank report from 2012 shows that it takes, on average, 119 days to open a new business in Brazil, compared to 38 in China, 30 in Russia, 29 in India and 19 in South Africa. In Canada it takes five days and, in New Zealand, just one. Brazil ranked 179th among 183 countries in the World Bank report. The cost to start a business is also much higher in Brazil, compared to the other BRICS countries: it is twice as expensive as in India, five times more than in Russia or South Africa, and almost seven times more than in China. And compared to developed countries: it is two-and-a-half times cheaper in Germany, five times cheaper in the US, six times in Canada, and nine times in New Zealand. Certainly, Brazil is not a very friendly environment for new businesses to be established.

## HOW DOES DEMOCRACY AFFECT THIS PICTURE?

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We argue that there is no clear link between changes in the picture presented above and democracy. In addition to the historical lessons, where we could witness the most different combinations of political regimes and economic performances, we point out that protectionism does not depend on more or less democracy. As examples, we could mention the cases of Brazil and Chile: both endured military-led dictatorships during the 1970s. Chile's military opted for a very open economic model, with clear inspiration from the University of Chicago's Economics school, where many of the young economists in charge of policies had gone to study. Brazilian military rulers first (1964–68) followed a similar path, but by the mid 1970s the model was largely relying on heavy protectionist policies and developing further state-oriented systems in most areas, for example in telecommunications and energy. Today we see that Chile, under democratic rule for some time already, has kept to their more liberal model and Brazil has kept to its protectionist tradition, despite flirting briefly with more liberal policies during the 1990s.



Looking into the Brazilian political development in more detail, we see that there were two important turning points since democracy was re-established in 1988: the stabilisation of the economy in 1994, with the consequent election of Fernando H. Cardoso in the same year (he was the Minister of Finances during the development of the stabilisation plan), and then the election of Luis I. da Silva (Lula) eight years later. The Cardoso years (1995–2002) were marked by various liberalising reforms, as we have seen, and he could have had his candidate elected in 2002 if not for one major issue: the electric-power shortages of 2001, which were caused by a severe drought (the Brazilian electric-power generation system was, and still is, heavily dependent on hydroelectric power) and which had enormous impact on both politics and the economy. Lula was very successful in campaigning against the liberal reforms, in particular against the privatisation programme of Cardoso, by associating it with the electric-power shortages (even though only part of the power system had been privatised). Lula again campaigned against any liberalisation policies when seeking re-election in 2006, as did Rouseff four years later. As we have already commented, it was more than expected that the previous ten years would show to have not been very conducive to more open and liberal policies, in all areas.

### **BUT THEN, WHAT MAY BE SAID ABOUT THE POSITIVE IMPACTS OF DEMOCRACY?**

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Responding to their core constituency, both Lula and Rouseff made social and economic inclusion their main political choice and the success of their policies are responsible for the continuing popular support they have enjoyed, especially from many business leaders (since the policies meant fast growth in consumption during their terms) and even from people in the middle class. As we have already described how they did it, we will move on and mention some other aspects where we see democracy as having had a positive impact in areas related to innovation.

The better economic environment during the Lula years also caused some shifts in investment and economic growth. For example: wages have grown faster at the lower levels, reducing the historic disparities and inequalities in Brazilian society (this growth had already started during the Cardoso period); and there has been a geographic shift in growth, with the Northeastern region enjoying higher growth than other regions, something that had not happened since before the nineteenth century. Gradually, states in that region, like Pernambuco and Bahia, have started developing their own innovation agenda. This is a positive trend and it has had some explicit help from the federal government, in terms of funds for certain projects. And it follows the fact that Lula (and Dilma Rouseff) had strong support from both politicians in that region and from the population in terms of votes. This is another aspect of how politics and democracy play a role in determining how administrations prioritise and allocate funds and investments.

A second point we observe is that one of the most affected institutions during Brazil's early military rule (1964–70) was the system of public universities. Scientists from all areas were forcibly retired, including future president Fernando H. Cardoso, then a prominent sociologist at the University of São Paulo. Innovative



academic experiments like that of the University of Brasília were stopped in their tracks. Many scientists and politicians fled the country, staying away until a general amnesty in 1979 made their return possible. That certainly retarded a faster development of science and education in Brazil, in spite of some support for 'Big Science' initiatives by the federal government. There was also the fact that in some situations the actions by the military were mitigated by those of academic leaders that protected those in danger of persecution, as was the case at the nascent University of Campinas, today one of the most active research universities in the country (Schwartzman 1991, pp. 288-292). The recent fast pace of growth in the numbers of internationally published scientific papers and of graduate degrees are certainly related to the much freer climates on Brazilian campuses that have developed since democracy was restored.

A clear example of how democracy impacts on support for basic science was in 1982 in São Paulo. With the election of Franco Montoro as governor by popular vote,<sup>18</sup> there was a change in policy and the transfer of funds to FAPESP became regular, monthly payments, which had not been the case before then. Then, in 1989, the São Paulo state universities were granted administrative and financial autonomy, which established a fixed share of the state's revenues as their budget. Both measures have been considered the main reasons why those universities have acquired a relatively high status in international comparisons, being the source of about half the indexed scientific papers in Brazil during the last two decades.

Another important point that shows the relevance of democracy in Brazil has been the fact that education, finally, has become an important issue in Brazilian politics: it is a constant item in political advertising and has been debated during campaigns, as it was recently in São Paulo when Fernando Haddad, a newcomer to electoral politics, defeated José Serra, a long-time leader of the main opposition party, a former mayor of the city and governor of the state of São Paulo, and a two-time presidential candidate. Haddad's campaign ads relied heavily on the federal government's educational policies (Haddad had been the minister of education during most of Lula's two terms). The fact that Brazil has performed very poorly in international and national learning-outcomes exams (like PISA) has also been constantly in the news. A recent article by some of the leading Brazilian specialists on the impact of education in the economy (Barbosa & Pessôa 2012) had as the title of its first section: "Basic education: the great collective error of our society in the 20th century". The present political agenda, especially after the recent massive street demonstrations calling for better public services, has definitely included basic education as a major policy issue.

## STILL, SHORT-TERMISM HAS BEEN A MAJOR ISSUE

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One can see examples of short-termism in some recent policies advanced by the federal government, like the very confusing change in the electrical power-generating contracts in late 2012. The administration argued that the changes were needed to reduce prices for consumers and industry. The negative impact on many of the largest public and private companies in that sector has been significant, with losses in revenues that reach billions of dollars. As a consequence, shares of Eletrobrás, the main

public holding of electric-power generating companies, has lost 60 percent of its value since August 2012. Another area one sees short-term, mostly politically motivated, action, is in the various fiscal-waiving and subsidies policies that have been used for selected industry sectors (again with the purpose of helping reduce prices and increase consumption), although it is clear that Brazil needs a much more serious and broader fiscal reform. Innovation, for example, is much less important to some sectors than applying for fiscal waivers from states or from the federal government because for many industrial sectors, those waivers have an immediate impact on costs, unlike long-term commitment to innovation investment.

Renato Ribeiro (Ribeiro 2013), a former director at CAPES, has commented on electoral research that shows that voting in Brazil tends to follow the availability of funds for consumers (consumer credit). He mentions various deleterious consequences of that "rational choice" by voters, including policies that in the end impede industrial development, because of the emphasis on immediate consumer interests. He also mentions that these policies reduce the incentives for savings by the population, which is an essential source of funds for investment, and which has been falling in the last couple of years. He says, "Consumer-electors vote in a specific way. They will prize the government that allows for immediate consuming of goods and services. To propose long-term policies becomes very hard." One may add, more specifically, that innovation, which requires long-term commitment by government and business, will certainly suffer in that environment.

Moving to another area, the federal system of universities have undergone a fast pace of expansion in the last five or six years, starting in 2006, under a programme called REUNI, which provides funds for the expansion of undergraduate programmes. The whole higher-education system adopted the programme, doubling the numbers of admitted students, but now they are facing some tight budgetary restrictions, since the promised funds were enough to start expanding, but not enough for the system's long-term funding needs. The Lula administration also created a scholarship programme for poor students to study via a fiscal-waiver system that applied only to for-profit institutions. This caused a boom in enrolment at those institutions, helping some large international corporate groups to enter the Brazilian higher-education system, with very little control over quality of service. Both programmes have been used extensively in advertisements during the last few elections, even though there has been serious questioning by specialists over the way they were developed and if this was the proper way to expand the higher-education system in Brazil.

Continuing with higher education, recent changes in the rules governing how the faculty of federal universities progress in their careers, where fewer and fewer academic qualifications are required, are a clear concession to faculty unions. On another front, there is a law under discussion in Congress (again supported by the federal government) that makes provisions for direct elections of higher positions in universities, including those of rectors (presidents). If one looks for best-practice examples of how to choose academic leaders around the world, endogenous electoral models are not the ones that will be found frequently, since they tend to help special interests to dictate results. And, in the Brazilian case, that usually

means cronyism and less competition in all aspects. As a consequence, one may fear that the federal system could see lower academic productivity, which could prove to be disastrous for the country's competitive future and may frustrate the federal government's (explicit) desire of having a few Brazilian universities ranked among the world's elite institutions.

Thus, in spite of the expected long-term positive effects of democracy on innovation and economic development, in a short, electoral perspective, democracy may cause restrictions in some areas, with some definite negative results for the development of reforms and initiatives that could foster innovation in all aspects of Brazilian society.

## Conclusions and Final Comments

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From our paper it is clear that innovation and democracy interact in various ways. The areas where we see direct (and positive) connections are: social programmes developed by both government and civil society (NGOs and foundations); academic freedom and stable funding for research and instruction in (public) universities; and calls for making basic education better in all aspects. Basic science has benefitted more indirectly from the return to democracy, but has shown signs of progress in recent years. Technological innovation (products and processes) has not shown signs of reacting positively to recent policies, no matter how hard government has tried to create a more positive environment to its development. As we argued, the reasons do not seem to be related to government systems, but to deeper structures that affect business competitiveness, like the persistent protectionist traditions that have been in place for so long in Brazil.

This last issue has been under public debate lately, since the current policies are producing neither more growth nor more innovation. Given the current political arrangement, with the strong presence of union interests in government and also support for some of these innovation policies from business leaders, it seems difficult to foresee a change of direction in the short term. The only way change might occur is if these policies start negatively affecting areas such as employment. If they did, they could cause the current administration to lose large-scale support.<sup>19</sup>

The business environment also suffers from chronic and excessive bureaucratic structures involving both the tax system and the rules for opening new businesses. The national and state tax systems are so complicated that many businesses, of all sizes, need to sustain large financial departments just to understand and work through the convoluted systems of myriad items, laws and rules. There are constant calls for tax reforms and also for reducing the incredible amount of red tape involved in opening (and closing) businesses, but they seem to fall on deaf ears.

Education is one area where democratic rule seems to have had a positive impact. It has become a central concern of society at large and is recognised by politicians as a relevant issue. One clear piece of evidence for this is the

on-going debate involving Congress and federal and state governments about increasing the share of the GDP dedicated to education, from the current 5 percent level to about 10 percent, which has support from the population as well. On the other hand, much needed changes in the management of schools face opposition from teachers' unions, and neither regional nor local governments have been able to challenge the status quo.

Regarding the impact of innovation on democracy, we saw that information and communication technologies have had an enormous impact on Brazilian politics, and there is every reason to believe that this will continue to be the case. From public-interest laws to transparency sites to demonstrations calling for better public services, electronic communication systems and social networks have become very present in the function of Brazilian politics and the evolution of democracy in the country.

We may conclude by saying that the last 18 years in Brazil have shown steady gains in relevant aspects of democracy, social and economic inclusion, and innovation. There has been: a growing economic inclusion of large groups of people, coming mostly from higher wages, lower unemployment and also some social programmes to fight extreme poverty; a growing political participation, with strong signs that IT will play a bigger and bigger role in that area; and an acknowledgement that some of the very basic structures that hinder progress and innovation need reform. The agenda for the near future also seems clear, at least regarding some basic reforms that could make Brazil friendlier to innovation and business activities, although what is less obvious is how to get the political system to start acting on them more effectively. We believe that as the number of actors in the political arena grows, with more sectors of Brazilian society represented, the conflicting interests of politicians will be resolved in favour of a more open and innovative society. The coming 2014 general election may bring some news on those fronts.

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2. After civil rule returned, the bank's mission was expanded to include investment in social projects, today it has an S (for social) appended to its acronym—BNDES.
3. Here and below, source for Brazilian data: and CNPq/MCTI online data.
4. Valor Econômico, June 3rd, 2013.
5. Brazilian Company of Industrial Research and Innovation.
6. Sistema integrado de administração financeira do governo federal—SIAFI, [www3.tesouro.fazenda.gov.br/siafi/](http://www3.tesouro.fazenda.gov.br/siafi/)
7. 'Mensalão' refers to the scandal that hit Lula's first term, when his administration was accused of paying monthly dues to congressmen and parties in order to get their support regarding crucial votes in Congress.
8. <http://www1.folha.uol.com.br/cotidiano/2013/06/1299800-onibus-e-metro-sao-os-transportes-mais-utilizados-por-manifestantes-em-sp>.  
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13. <http://cepid.fapesp.br/home/> CEPID – Centros de Pesquisa, Inovação e Difusão
14. Founded and run by Ayrton Senna's family. Senna was a Formula-One driver who was enormously popular in Brazil. The institute was founded in 1994, soon after Senna died in an accident during an F1 race.
15. The innovation survey developed by the Brazilian statistics bureau: [www.pintec.ibge.gov.br/](http://www.pintec.ibge.gov.br/)
16. See references in Winters 2004. See also Rodrik 2008, Rodrik 2011, Greenwald and Stieglitz 2006, Baldwin 2012a.
17. Richard Baldwin (Baldwin 2012, Baldwin 2013) has been one of the most active thinkers in that area. Frischak et al. (2013) have also called attention to that point and have called for a new policy that they call Innovation without Borders.
18. During the military regime and up to that year, state assemblies elected governors under strict control by the military.
19. There is some evidence that the recent selective fiscal incentives and 'national content' policies are not producing the desired results, with Brazilian industry showing low investment and even negative growth rates. After an already poor showing in 2011, Brazil's industry had negative growth (–2.7%) in 2012, with a steady decrease in investment along the year. This has caused many specialists to talk about a "deindustrialisation" of the Brazilian economy (Bacha & Bolle 2013). Growth is yet to improve in 2013 and employment is also beginning to show some weakness.

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