Brazil: Cooperative Development of a Software Industry

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Nearly 10 years ago, the research arm of Brazil's Ministry of Science and Technology, CNPq, assembled a community of professors, entrepreneurs, and policy makers. Their goal was to define a strategic program that would eventually replace Brazil's existing information technology policy. At that time, a strict policy regulated the internal market, protecting the local IT industry[1] by imposing many restrictions on importing goods from abroad similar to those produced domestically. Partnerships that existed between local groups and global producers supported this hardware production, whereas software was treated as an accessory. The community proposed specific interrelated actions aimed at improving the country's computing and human resource information infrastructure, fostering cooperative basic research and development and developing an indigenous IT industry focused on software and exports. Our previous work details the community's implementation of those actions.[2] Here, we analyze the program's results.

Development barriers

Although CNPq's initiative generated plans to develop a world-class IT industry focused on software and exports, it gradually became clear that this would not be an easy task (similar to the efforts in other less developed countries).[3] Geographical, cultural, and strategic barriers raised many difficulties.

Brazilian software companies have a tangible disadvantage when competing for external markets because of their isolated geographic location. Moreover, until recently, the country's entrepreneurial culture dictated that the internal market should always receive business preference because of its considerable size. To modify this culture and deal with the external market, the community initially believed that producing packaged software would be a good strategy. However, Brazilian software entrepreneurs have not developed effective distribution channels to circulate their products internationally.

Some local companies with innovative products and services believed that they only had to open branches in mainstream locations to start doing business, but the reality turned out to be tougher than expected: many of these efforts simply did not produce the expected results, whereas in other cases sales and revenues appeared only after marketing actions reduced any emphasis on the company's origin. Brazilian companies operating in the external market tend to not stress their origin. These difficulties were alleviated in 1996 when the first ISPs and portals began operating, helping break down cultural, physical, and logistical barriers.

Macro-economic national policies that are sometimes dissociated from public efforts to promote economic growth have also hindered Brazil's software industry growth. Previously, the country had serious problems with exponentially increasing inflation, but the introduction of a new national currency nearly 10 years ago helped solved them. The high value of the local currency in relation to the American dollar for most of the past decade, combined with continuing high in-

terest rates diverting investment from production and export, have contributed to reduce the local industry's external competitiveness.

Perhaps as a consequence of these and other difficulties, the IT sector's national accounts balance has had negative and worsening results. According to the Central Bank of Brazil (BCB) and other sources, software and service sales to external markets totaled US$50 million in 2000, compared to US$1.1 billion contracted abroad. In the same year, the hardware segment results were a deficit of US$1.5 billion, mostly caused by the import of electronic components.

The Brazilian IT industry

Nevertheless, beginning in 1992, the Brazilian IT industry recorded positive growth, even receiving external recognition. According to the BCB, in 2000, this sector attracted direct foreign investment of approximately US$1.8 billion, 5.4 percent of the country's total investment and an increase of 50 percent from the previous year. For the first time, investments in software and related services were higher than in hardware, maintaining a ratio of 17 to 10. This phenomenon, together with a strong internal demand, helped fuel the domestic software industry's growth.

Clearly, 2000 was a positive year for the IT sector worldwide, and the Brazilian industry was no exception. According to the Brazilian Devlopment Bank's (BNDES) estimates based on many data sources,[4] the Brazilian IT industry had revenues of US$30.5 billion and a growth rate of 20 percent in the fiscal year ending December 2000. Those revenues were almost equally shared between companies dealing with either hardware or software and related services. The revenue balance between company types has been stable since 1996, when hardware companies lost ground. Since 1996, the average market growth rate has been 15 percent per year. Software companies' revenues were around US$2.5 billion in 2000, which we do not consider fully representative of the Brazilian software market because of associated sales of related services.

Aware of this good performance, the country's economic authorities have publicly recognized how the sector's positive contribution increased Brazil's gross domestic product. This correlation seems to be true in years of expansion, such as 1998, in which at least 4.6 percent of the growth rate could be attributed to the IT industry's performance (we did our calculations similarly to the way the US Department of Commerce did when studying the US market).[5]

The Brazilian IT industry's positive performance was not limited to the financial domain. Our estimates also indicate that the number of employment posts grew threefold between 1996 and 2000, reaching over 200,000. At the end of this period, software and service companies employed nearly 65 percent of IT workers; the same proportion of international employers placed their jobs in locally owned companies. In 2000, the number of IT workers with a PhD exceeded 2,000 (1 out of 100), with most degrees held in software-related fields.

The indigenous software industry

The local software industry's current structure is quite peculiar. More than 40,000 companies are affiliated with the National Federation of Data Processing, Software, and Service Companies (Fenadados). Most of these companies are single-person entities, although many small- and middle-size enterprises also exist. These companies usually offer the most innovative products and services, but their contribution to the segment's total revenue has decreased by half since 1996. Public and foreign companies are the segment's largest contributors, as illustrated by the fiscal year 2000 revenues in Table 1.

Among private companies, there is a clear preference for offering services such as outsourcing, data processing, and, more recently, so-called software factory production, which complies with controlled, sometimes certified software development processes. Software is normally commercialized in packages or components for segments such as enterprise resource planning, logistics, security, electronic commerce, commercial and industrial au-

Table 1
Year 2000 revenues of top software companies

Foreign	Annual revenues (US$)	Local public	Annual revenues (US$)
Microsoft	364,741,000	Serpro	295,508,000
EDS	253,500,000	Dataprev	176,265,000
Computer Associates	216,216,000	Prodesp	72,041,000
Oracle	188,903,000	Prodam	60,247,000
EMC	110,644,000	Prodergs	41,516,000

Useful URLs

Association of Brazilian Software and Computing Service Providers: www.assespro.org.br

Brazilian Development Bank: www.bndes.gov.br

Brazilian Micro and Small Business Support Service: www.sebrae.com.br

Brazilian Research Council: www.cnpq.br (in Portuguese)

Brazilian Studies and Projects Financing Agency: www.finep.gov.br (in Portuguese)

Central Bank of Brazil: www.bacen.gov.br

Ministry of Development, Industry, and Commerce: www.mdic.gov.br

Ministry of Science and Technology: www.mct.gov.br (in Portuguese)

Softex: www.softex.br

Table 2
Revenues of top private software companies

Local private	Annual revenues (US$)	Main segment
Datamec	79,518,000	Privatized bureau
Humaitá	69,624,000	Outsourcing
Politec	68,926,000	Bureau and outsourcing
Microsiga	33,678,000	Enterprise Resource Planning
Datasul	32,083,000	Enterprise Resource Planning

tomation, and document publishing and management. The adopted sales models usually consider usage licenses for packages or components and vary substantially for services (from man-hour and function point supply to closed projects regulated by financial terms, quality assurances, and the transference of intellectual property). Table 2 shows the top private companies' revenues.

Unfortunately, even with the software industry's growth, Brazil has not been able to retain a noticeable amount of its young software talent. Many Brazilians find their first jobs abroad, which seems to be a result of better working conditions elsewhere (not always financial ones).

On the other hand, local companies have adopted many strategies to maintain a low turnover rate. These strategies include offering stock options and continuous training and certification. Software workers who become certified in using multinational software companies' products are considered valuable. Another strategy has been to create a qualifying working environment by investing heavily in software quality and development technologies.

Toward a national software policy

Underlying the Brazilian software industry's improved performance during the past decade was a strategy consisting of many specific cooperative supporting actions. Although this strategy is not a national policy, it covers directed scientific research, research and development, and development agencies' partnership with venture capitalists and private companies.

In this strategy, the Ministry of Sci-ence and Technology has been mainly responsible for human resource formation, long-term research programs, technology development and transfer initiatives, and early company development. Since 1996, CNPq has provided funds to help more than 600 Brazilians obtain PhDs in IT at home and abroad and invested more than US$90 million in academic programs and cooperative research projects. It invested another US$200 million not only establishing a distributed computing infrastructure throughout Brazil, which gave rise to the local commercial Internet, but also in creating the Softex program, which fosters indigenous software and services.

CNPq launched the Softex program as a strategic action in 1992, but in 1996, it became a nonprofit society managed by software entrepreneurs. Representatives from numerous public and private institutions, committed to the idea of an IT industry with excellent software and real perspectives of exports, created the Softex Society. Currently, Softex has 20 domestic offices and nearly 1,000 affiliated companies. The organization supports software quality efforts such as ISO and CMM adoption, organizes trade meetings and other commercial events, and offers services such as business plan consulting, market research, legal advice, and identification of possible investors or investment opportunities.

Softex and other related IT initiatives have helped technology parks, company incubators, and entrepreneurship promotion activities obtain support from Brazilian public and private institutions. Since 1996, Softex has 19 software incubators in local universities, so that students and pro-fessors with promising ideas can constitute their companies and implement their business plans. In addition, Softex supports the Softstart project, which trains lecturers to teach entrepreneurship courses in local universities' computing departments. Studies are now underway to include such courses in high school curricula. Entrepreneurship has achieved such an importance in Brazil that the country received higher scores in the Global Entrepreneurship Monitor 2000 when compared to 21 other developed and less developed countries.

With the existing pre-operational support in place, software companies in Brazil can contract technology development grants from public institutions, such as CNPq and the Studies and Projects Financing Agency of the Ministry of Science and Technology (FINEP); marketing and managerial consulting from SEBRAE, the Brazilian Service for the Support of Small and Medium-sized Companies; and even angel investors from private venture capital or public funds.

Development incentives

More mature companies installed in Brazil can use incentives to support their operations and new investments. In fact, these incentives exist not only to support the existing industry but also to attract potential investors and companies wishing to establish themselves domestically. Such incentives may be of financial or fiscal nature.

Two public institutions are responsible for the long-term financial incentives offered to the software industry: FINEP and BNDES. Table 3 presents these incentives. Offering loan guarantees to IT companies derives from the difficulties these companies have maintaining tangible assets such as buildings or capital goods. Offering equalization of external interest rates is equally important for Brazilian companies and their exports because the rates available for loans within the country are usually higher than those found in the external market (which are not accessible by local companies). Although not planned as a specific action in the beginning of the reported

period, these incentives have become increasingly relevant. BNDES, for instance, has lent more than US$500 million to IT companies since 1996.

The fiscal incentives are not as structured as the financial ones but are an important mechanism to support this sector's development. The Secretariat for Information Technology and Automation Policy (SEPIN), in partnership with other institutions, grants most of these incentives:

- Rebate of manufacturing taxes for information and communication technology (ICT) goods in exchange for applying 5 percent of the corporate revenues in partnerships with institutions connected to the national science and technology system, such as universities and research centers
- Income tax credit to be used acquiring IT company shares

All the financial and fiscal incentives described earlier are offered assuming that benefited companies already maintain or will develop social and economic public accountability measures proportional to the received incentives. This is in fact a way of attempting to reduce the regional, social, and economic inequalities that still exist in Brazil, perhaps the most serious current national problem.

Development opportunities

The reported plans, strategies, and incentives seem to have produced the proper environment for performing nationwide ICT experiments of success. The 2000 general election happened entirely with the support of voting machines that had locally designed hardware, software, and security. The delivery of more than 10 million annual income statements to the central government was carried out through the Internet in the first quarter of 2001. Although we do not have information of other similar electronic government experiments of this scale, the number of people involved is still just a fraction of the whole population. There are many initiatives to promote e-government and reduce digital exclusion in the country, with strong support from nongovernmental social organizations.

Our experience in supporting an industry with a focus on software and exports also appears to have produced positive results. The initial concentration on hardware decreased. More importantly, partnerships among public and private institutions, academia, and nongovernmental social organizations created a complete and operational cycle of generation and maintenance of software businesses. This unique experience is important because most startup institutions do not remain operational for more than two years and those that resist often have difficulties in financing their growth.

Despite this situation, the challenges appear to be too big for the local government, industry, and academia to address alone. To start exporting software effectively and still meet local market demands, it's fundamental to be capable of developing and producing internally complete solutions in which hardware, software, and services are intertwined. But, this appears to be possible only if we control the production cycle of electronic components as well. Unfortunately, local production has been reduced nearly to zero, which seems to be important for the local economy as a whole, being that it's a high-value-added segment that can affect the productivity of many other production chains. Supporting the internal production of electronic components requires substantial investments and cannot be developed from scratch without partnerships with current global producers. The Ministry of Development, Industry, and Commerce is currently in charge of attracting external partners and negotiating agreements for this kind of initiative.

In the end, we hope to achieve a more mature and professional internal market that has more business and scientific connections with external institutions, maintaining relationships of true exchange not just of single dependence, with all the involved organizations committed to the country's social and economic development. 🕸

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Table 3

Financial incentives to the local industry

Incentive	BNDES	FINEP
Loan guarantees	To companies with annual revenues of US$20 million or less; paid via increased interest rates	To any company; paid via increased interest rates
Long term loans	Small- to medium-sized software companies: risk loans with variable interest rates and no collateral. All companies: fixed-interest-rate low-risk loans backed up with real collateral	All companies: loans with fixed or variable interest rates and flexible guarantees
Investment	Investment through revenue bonds or share emissions (BNDES participates only as minor investor)	Investment through revenue bonds or share emissions
Export financing	Buyer or supplier credit with equalization of interest rates, backed up with letters of credit and other securities	