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INFORMATION TECHNOLOGY (IT) AND BRAZIL'S ECONOMIC REVIVAL

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Abstract

Brazil has a large domestic IT market compared to many developing countries. The IT market has been growing steadily in the last many years. Brazil is an interesting case for other countries because it provides a study of the effects of a major shift in its import substitution strategy of pre-1990, to its open market policies of the nineties. The Brazilian software exports have grown from a mere \$1 million in 1991 to \$100 million in 2001. Despite some success, the dream that IT sector, particularly software industry, will help Brazil's economic revival has not materialized. Brazil has great potential to show progress in the software technology sector, but it needs to put its act together in terms of maintaining consistent policies for technology promotion, replacing bureaucratic malaise with private sector agility, and identifying specific niche areas of the market to target for economic gains. Establishing autonomous and effective implementing bodies like SOFTEX, tapping into its international linkages, and focusing on measures to expand the domestic private market are only some of the many specific steps that may be taken by the government to gain real economic benefits from information technology growth.

Introduction

The dawn of the twenty-first century came in the wake of a new era of globalization---one dominated by knowledge and information. Knowledge is now a recognized driver of productivity and economic growth, with a new emphasis on information, technology and learning in the economy of a country.¹ *The Human Development Report (HDR) 2001* stresses that in the new economy, any country that “fails to make effective use of technology is likely to find itself falling

¹ OECD. *Science, Technology, and Industry Outlook*. Paris: OECD; 1996.

behind in human development and marginalized in the global economy.”² Although IT industries account for only 8% of the total US economic output, they contributed nearly a third of real US economic growth between 1995 and 1999. On the global level, office and telecom equipment accounted for 5% of the world trade in the early 1980s (one third of the share of agricultural products); by 1995, the share had increased to 12% (slightly higher than the share of all agricultural products).³

Globalization has challenged all countries to rethink their economic policies to adjust to the uncertainty and competitiveness of global markets. Developing countries find themselves at a great disadvantage in an environment where not only the established players have many years head-start but also an extraordinary influence on setting the rules of the game. In 1998, OECD countries spent \$520 billion on research and development—more than the combined output of the world’s 30 poorest countries. With 19% of the world’s population OECD countries accounted for 91% of the 347,000 new patents issued in 1998.⁴ While trailing in most sectors of this global economy, one sector where developing countries have some hope to make remarkable progress is in the field of information technology (IT).

The reason that information technology sector is a potentially viable area for growth for many developing countries is based on the very nature of this industry. Barring hardware manufacturing, most of IT industry relies mainly on human capital and not physical capital. The industrial revolution and colonial era provided the advanced economies the opportunity to monopolize the

² United Nations Development Program (UNDP). *Human Development Report: Making new technologies work for human development 2001*. New York: Oxford University Press.

³ Quandt C, Spinosa LM, Pacheco F. *Fostering the Growth of Innovation Clusters for Regional Development: Building a network of software clusters in Paraná, Brazil*.

⁴ UNDP, 2001.

production of machinery and equipment. Human capital has some characteristics that are different from physical capital. There are differences in their capability for modernization, productivity lifecycle, and need for accompanying infrastructure to perform complex tasks. Developing countries do not lack talent in human resources and are therefore well equipped to enter the race for IT skills. Software industry, in particular, does not require vast investments thus giving hope to resource-constrained economies. Finally, progress in IT not only helps the economy through its own revenue generation but through its positive influences in all other sectors of the economy. It allows swift public service delivery mechanisms, decrease in transaction costs for businesses, and increased linkages and coordination among different sectors of the economy.

The Development of Brazilian IT Policy

Brazil presents a very interesting study in the developing world with reference to the issue of globalization. While most countries of the world can only talk about the potential hazards or the promised benefits of free trade and globalization, few have tried two vastly different approaches in such a short period of time as Brazil. The history of Brazilian trade and technology policy can easily be divided into pre-1990 and post-1990.

The pre-1990 Brazil presented the old school of thought that at one time, particularly in the sixties and seventies, was also the mantra of organizations like the World Bank. It was the policy of “import substitution.” The argument was that poor countries have to spend their meager foreign exchange reserves in importing machinery and other products, which if they could produce indigenously will save them all this expenditure. They could then use this saving to invest into further improving their indigenous markets and manufacturing capacities. Brazil, with a fairly competent industrial sector as compared to most other poor developing countries, relied on the

capability and ingenuity of its indigenous industry to pursue self-sufficiency and self-reliance in the industrial sector. It provided an environment to its industry to grow and to cater to the demands of the internal market. The entry of foreign firms was restricted through legislation, providing an opportunity for local industry to stand up on its own without fear of external competition by the larger and more resourceful multinational giants.

The industrial policies followed before the 1990s in the area of information technology basically focused on hardware production. The computer and telecommunication industry was being revolutionized with newer and more powerful semiconductor chips, providing ever more powerful components for telephony and programming. IBM and Apple were making huge inroads into the American and world economy. Brazilian policy makers encouraged local production of this machinery, so that their country did not have to rely on imports of high tech products from the industrialized world. To allow its smaller and less sophisticated hardware industries to grow and develop and not be crushed by competition from the more advanced IBMs of the world, the policy adopted in Brazil before 1990 was that of “protectionism.” Brazilian hardware industry was protected from global competition through policies making it almost impossible for foreign companies and multinationals to invest and incorporate in Brazil. The local production of the hardware industry grew from less than \$200 million in 1979 to over \$4 billion in 1990.⁵ The software industry had not taken off internationally till that time and was thus treated more like a part of the hardware industry. Despite this policy, in 1991 the Brazilian software market was estimated at about \$1.1 billion, approximately one third of the total information technology industry domestically.⁶

⁵ MIT & SOFTEX. “The software Industry in Brazil – 2002 – Strengthening the Economy of Knowledge”. 2002. www.softex.br. Retrieved: December 15, 2003.

⁶ MIT & SOFTEX, 2002.

Early nineties was also the time for increased acceptance of the WTO free trade philosophy internationally, where countries could get penalized in terms of trade sanctions and reciprocal tariffs if found violating the basic principles of free trade. Brazil, which had been one of the key voices of the developing world against the hegemony of the few in international trade, could not stand up to the forces of globalization. The Brazilian economy also needed international support, which was hard to come by in the presence of protectionist policies. Some Brazilian scholars also opine that a change in the pre-1990 policy was also the result of the realization that despite the protection and support that the industry in Brazil had been given, the isolation had made it more and more non-competitive in the international market.⁷ The speed of innovation and growth of the worldwide computer industry, for instance, was much greater than what the Brazilian hardware industry could achieve on its own.

Around 1992, the country took a turn in its information technology policy and opened itself to international players. Being a huge country with a relatively well-developed industrial sector, it did not take long for Brazil to attract the top companies in the world in the field of IT. The local IT industry went through a painful and drastic change in business practices and in product development processes. Government policies tried to cushion the shock by implementing laws to continue some preferential treatment for local hardware companies through tax incentives and other such measures.⁸

Despite years of protection and the development of a fairly large pool of high-skilled labor domestically, most Brazilian companies could not survive the fierce competition from multinational

⁷ MIT & SOFTEX, 2002.

corporations. Rapid advances in technology and international linkages that most large multinational IT companies enjoyed left the local industry players at a great disadvantage. The computer industry prices were falling very sharply since early 1990 internationally. Recent studies have shown that a considerable part of this price fall can be attributed to the falling prices of the semiconductor products used in the manufacturing of computer and communication hardware.⁹ At the same time, as per Moore's Law, the functionality and computing power of chips was increasing exponentially. This meant that economies of scale kicked in quite early in hardware production and the market concentrated on a few big players rather than many small ones.¹⁰ The hardware industry in Brazil was, therefore, destined to be taken over by multinational manufacturers.

The early 1990s also saw a change in the international IT market where software was increasingly becoming a big industry in itself. Companies like Microsoft and Oracle were acquiring stature of software giants. The change in the international scene also affected the local policy in Brazil. In addition to the Strategic Computerization Development Project (DESI)¹¹ of 1992 for the promotion of its computer industry, Brazil also launched a National Software Export Program to develop its software exports. This was a key policy instrument, since it recognized the need to look beyond the domestic market and forage into the rapidly expanding global software market.

Brazilian IT Industry Today

⁸ Law 8.248/91 which was later updated through Law 10.176/01 in 2001.

⁹ Aizcorbe A, Flamm K, Khurshid A. 2002. "The Role of Semiconductor Inputs in IT Hardware Price Decline: Computers vs. Communications". *Finance and Economics Discussion Series*. Federal Reserve Board, Washington, DC, 2002.

¹⁰ Flamm K. *Mismanaged Trade? Strategic Policy and the Semiconductor Industry*. Washington DC: Brookings Institution. 1996

¹¹ Desenvolvimento Estratégico da Informática.

IT industry is the fastest growing industry in the history of mankind. Of the global IT market, the software industry has revenues of over \$300 billion.¹² Even traditionally hardware- focused companies such as IBM are increasingly integrating software in their products and developing their software and services businesses. In 2001, software accounted for 17% of IBM sales but 28% of its pretax profits.¹³ IBM estimates that 58% of IT industry profits in 2005 will come from software services and consulting, up from 42% in 2000.

Brazil is the seventh largest software market in the world, growing at an annual rate of 11%.¹⁴ This rate of growth is in spite of the slow overall economic growth. The share of the software market in GNP has almost tripled between 1991 to 2001 – from 0.27% of GNP to 0.71%. The total IT share of GNP was 2.9% in 2001.¹⁵ On the basis of various surveys conducted by SEPIN (Secretariat for Informatics Policy and Technology) and MCT (Ministry of Science and Technology), the size of the Brazilian IT industry has been estimated at \$18 billion in the year 2001. Of the total, hardware industry has a 40% share (about \$7.2 billion), services sector is 17.5% (about \$3 billion) and the software industry is the largest share of about 43% or \$7.7 billion.¹⁶ Within the software industry, one could further divide the activities into software products such as customized and packaged software, and software services such as business outsourcing and consulting. The Brazilian software industry is pretty much equally divided between products and services, in terms of revenues.

There are certain regions such as southeast where software companies have tended to concentrate. Geographically most of the software companies are in the Southeast and South Regions. The vast

¹² OECD. *IT Outlook 2002*.

¹³ *Businessweek*. October 28, 2002. “The Big Blue: Big Enchilada”

¹⁴ MIT & SOFTEX, 2002.

¹⁵ *ibid.*

¹⁶ *ibid.*

majority is located in Southeast (64.4%), whilst 23.6% are in the South, according to a survey by IEES – Instituto de Estudos Econômicos em Software (Institute for Economic Studies on Software).¹⁷ Analyzing a sample of 2,725 software companies, the Institute concludes that São Paulo State hosts 41.1% of the software companies, followed by Rio de Janeiro (11.7%), Minas Gerais (9.3%), all three in Southeast Region, and Rio Grande do Sul (9.1%), Santa Catarina (8.1%) and Paraná (6.4%), in the South. The Northeast Region of Brazil has 7.6% of the software companies, while the Midwest Region has only 4.1% including those in Distrito Federal (which includes Brasília, the federal capital that corresponds to 2.8% of the total). The North Region accounts for less than 1% of the companies.

TABLE 1

Brazil
Software companies by unit of federation

Unit of federation	Region	Number of companies (n = 2,725)	%
(SP) São Paulo	SE	1,121	41.1
(RJ) Rio de Janeiro	SE	320	11.7
(MG) Minas Gerais	SE	253	9.3
(RS) Rio Grande do Sul	S	248	9.1
(SC) Santa Catarina	S	221	8.1
(PR) Paraná	S	174	6.4
(DF) Distrito Federal	MW	76	2.8
(CE) Ceará	NE	71	2.6
(ES) Espírito Santo	SE	61	2.2
(PE) Pernambuco	NE	51	1.9
(BA) Bahia	NE	48	1.8
(GO) Goiás	MW	19	0.7
(SE) Sergipe	NE	12	0.4
(RN) Rio Grande do Norte	NE	10	0.4
(MS) Mato Grosso do Sul	MW	10	0.4
(PB) Paraíba	NE	9	0.3
(MT) Mato Grosso	MW	6	0.2
Other	---	15	0.6
Total		2,725	100

Source: IEES (2003b), based on IEES's database and considering a sample composed by 2,725 software companies.

¹⁷IEES. "Distribuição geográfica das empresas de software e áreas de aplicação dos produtos". 2003. www.iees.org.br. Retrieved: January 7, 2004.

Companies' trading figures show an even more concentrated picture. According to another IEES study on the software companies' billing per state, the total sales in São Paulo State represent 49.1% of the total billing of the sample of 304 software companies. Distrito Federal, which besides bearing only about 2% of the companies in the study, was responsible for a share of 16% of the total billing.¹⁸

TABLE 2

Brazil
Software companies' billing by unit of federation

Unit of federation	Region	Number of companies		Billing (%)
		(n = 304)	%	
(SP) São Paulo	SE	138	45.4	49.1
(RJ) Rio de Janeiro	SE	27	8.9	16.5
(DF) Distrito Federal	MW	6	2.0	16.3
(PR) Paraná	S	15	4.9	4.3
(SC) Santa Catarina	S	30	9.9	3.8
(RS) Rio Grande do Sul	S	27	8.9	3.7
(MG) Minas Gerais	SE	23	7.6	3.4
(ES) Espírito Santo	SE	2	0.7	1.3
(PE) Pernambuco	NE	10	3.3	0.5
(BA) Bahia	NE	8	2.6	0.5
(GO) Goiás	MW	6	2.0	0.2
(CE) Ceará	NE	7	2.3	0.2
Other	---	5	1.6	0.1
Total		304	100	100

Source: IEES (2003a), based on IEES's database and considering a sample composed by 304 software companies.

Only a third of these companies are more than twenty years old while another third are less than ten years old. When looking at the different kinds of business activities within the software industry, majority of companies is involved in software services delivery. However, it is the software product market that ends up exporting more than three quarters of the total software exports from the country.¹⁹ Most of the software exports taking place in the year 2001, for instance, were through

¹⁸ IEES. "Faturamento e número de colaboradores das empresas brasileiras de software, em 2002, por estado". *Economia e Tecnologia*, v. 6, n. 6, Nov/Dec 2003. www.iees.org.br. Retrieved: January 7, 2004.

¹⁹ MIT & SOFTEX, 2002.

internal channels of foreign owned companies. At the same time almost a third of the exports were through foreign branches of locally owned companies. The main destination country for Brazilian software exports was the United States (almost 80%).

According to another estimate, the number of software companies in Brazil today stand at around 5,500 while those using software in their processes are over 10,000.²⁰ While these numbers look impressive when compared to many other countries of the world, more than 80% of these companies are really small businesses.

The quality of data for the industry is based mostly on one-time surveys conducted by different public and private sources. According to figures quoted in a country report on Brazil, more than 40,000 companies are affiliated with the National Federation of Data Processing Software, and Service Companies (Fenadados). Again, many of these were single-person entities. Foreign companies, like Microsoft and EDS have the largest shares in the Brazilian software market. Annual revenues of Microsoft reported by IEEE Country Report to be about \$365 million dollars while Serpro which is the largest domestic software company having less than \$300 million annual revenues. The next three companies in total revenues are EDS, Computer Associates and Oracle, all foreign owned.

TABLE 3

Revenues of top software companies in Brazil, 2000

Foreign	Annual Revenues (US\$ billion)	Local public	Annual Revenues (US\$ billion)
Microsoft	364.7	Serpro	295.5
EDS	253.5	Dataprev	176.3
Computer Associates	216.2	Prodesp	72.0
Oracle	188.9	Prodam	60.3
EMC	110.6	Prodergs	41.5

Source: IEEE Software. "Country Report." May/June 2002.

Public-owned companies like Serpro, which get most of the Federal Government business, are the only entities from the local software market that compete with foreign companies in terms of revenues. A look at the domestic private software companies during the same time period shows that their revenues are far less, not even reaching \$100 million annually.

TABLE 4

Revenues of top private software companies in Brazil, 2000

Local private company	Annual Revenues (US\$ billion)	Main segment
Datamec	79.5	Privatized bureau
Humaita	69.6	Outsourcing
Politec	68.9	Bureau and outsourcing
Microsiga	33.7	Enterprise resource planning
Datasul	32.1	Enterprise resource planning

Source: Country Report. IEEE Software. May/June 2002.

Data compiled by the Ministry of Labor in Brazil estimates that the number of workers in software industry has increased by almost 30% between 1994 and 2000. There are upwards of 160,000 IT professionals working in the software industry. Sixty percent of these jobs are in the largest 2% companies.²¹ The Brazilian Development Bank estimates that total employment in the IT industry by the year 2000 was about 200,000, which was a threefold increase from 1996. Software companies employed about 65% of IT workers, with more than 2,000 of them with PhDs in software-related fields.²² While national origin software companies employ over 90% of employees, they are responsible for only 55% of the total exports, the rest being done by foreign owned companies. Almost three quarters of the employment, 90% of the revenues and two thirds of exports were being done by large companies (over R\$ 60 billion gross operating income).²³

²⁰ MIT & SOFTEX, 2002.

²¹ Largest companies are those with gross operating income in excess of R\$ 60 billion.

²² Duarte, C.H.C. Brazil: Cooperative Development of a Software Industry. *IEEE Software*, 2002.

²³ MIT & SOFTEX, 2002.

Today Brazil has developed globally competitive software in the fields of banking, telecommunications, energy sector, and electronic government. Due to the size of its domestic market its companies have had the opportunity to develop top quality software for local needs. The Brazilian Payment System (SPB-Sistema de Pagamentos Brasileiro) is a local innovation that has worked successfully in the financial sector. Under electronic government the income tax computerization and similarly automation of the election system is very impressive. The small companies have learnt through experimentation and experience to customize software for local companies and for shipped software products. Brazil held electronic elections in September 2000 for almost 109 million voters and thanks to the system 90% of the votes were counted in a single day! Similarly, Brazil has developed an elaborate income tax filing system over the Internet where more than 11 million filings were done electronically starting in April 2001.²⁴ All of this has been made possible due to telecommunications expansion and the rapid growth of the Internet in recent years with over 10 million Internet users in 2002.²⁵

TABLE 5

Internet Banking Worldwide

Position	Group	Country	Users (in millions)
1	Bank of America	USA	2.1
2	Wells Fargo	USA	1.8
3	Bradesco	Brazil	1.5
4	MeritaNord Banken	Finland	1.2
5	EKG	England	1.0
6	Royal Bank of Canada	Canada	1.0
7	Banco do Brasil	Brazil	0.9
8	Citigroup	USA	0.8
9	Chase	USA	0.7
10	Itaú	Brazil	0.6

Source: www.softex.br.

²⁴ Softex. www.softex.br.

²⁵ *Ibid.*

A look at the Brazilian economy shows that the total Brazilian goods exported can be divided into three large categories, which are basic products, semi-manufactured goods and manufactured goods. In 2002, basic products were responsible for 28.08% (in sales) of total good exports, and their most relevant items are derivatives of iron ore, soy and petroleum. Among the semi-manufactured exported goods (14.85%), the most important items were again derivatives of iron ore and soy, also cellulose, sugar and leather. Airplanes, automobiles and motors, sugar, shoes, orange juice were among the manufactured goods exports, which stood for 54.67% of total good exported by the country in 2002.²⁶

Brazil's economic authorities recognize the importance of IT in increasing Brazil's GDP.²⁷ In 1998, for instance, 4.6% of the growth rate of the Brazilian economy could be attributed to the IT industry's performance.²⁸ Brazil has had several successful policies for the development of software industry. Two of the key measures include the establishment of Softex, and Prosoft (in partnership with BNDES, the Brazilian Development Bank).

Softex

The National Program for Software Export-2000 was started as one of three new programs by CNPq (National Scientific and Technological Development Council) in 1992 at the end of the market reserve system. The goals of Softex 2000 were:

- Capture 1% of world software market by 2000
- Help local firms attain 50% share of the domestic market

It was proposed to achieve these goals by the following main policies:

- Create an estimated 50,000 skilled jobs in IT

²⁶ BANCO CENTRAL DO BRASIL. "Relatório 2002". Boletim do Banco Central do Brasil, v. 38. www.bcb.gov.br.

²⁷ MCT & SEPIN. "Pesquisa Qualidade e Produtividade no Setor de Software Brasileiro – 2001". www.mct.gov.br.

²⁸ Duarte, 2002.

- Build regional centers to stimulate cooperation among small software firms
- Establish marketing offices abroad (China, Germany, USA, Argentina) to help in exports
- Provide incentives for in-house training of IT professionals

Initially, funded by the government, Softex 2000 was transformed into a non-governmental autonomous organization, Softex Society in 1996. The Softex Program, as it was known after 1996, has been a success story. It has set up a network of “Agents” (22 cities and 12 states) and companies associated with the Softex Program represent about 37% of the total software companies in Brazil. Eighteen Softex Genesis Centers²⁹ provide almost two hundred companies with access to business ideas and capital.³⁰ It has also been a key contributor to increased software exports from \$1 million in 1990 to \$72 million in 2000 and finally \$100 million in 2001.³¹ It organizes trade missions and commercial meetings of software vendors, helps companies attain ISO and CMM status, and facilitates matching investors with software companies. It has created incubators in local universities to promote generation of new ideas. It also supports a Softstart Program, which is a train-the-trainer program in computer education.

TABLE 6

Brazil: Software internationally traded, per destination, according to official custom registration: From January 1999 to July 2001 (US \$ thousands)

Package Software					
Destination	Exports	%	Imports	%	Balance
North America	5,003	59.00	1,851,150	72.40	-1,846,147
Mercosur	1,677	19.78	20,484	0.80	-18,807
European Union	985	11.62	591,006	23.11	-590,021
Asia	7	0.08	46,440	1.82	-46,433
Others	808	9.53	47,884	1.87	-47,076
Total	8,480	100.00	2,556,964	100.00	-2,548,484

*Source: Pereira (2002), based on Banco Central do Brasil's statistics.
Table compiled by the authors.*

Prosoft

²⁹ Genesis stands for Generation of New Enterprise in Software Information and Services (www.softex.br).

³⁰ Pagani, F. “Brazilian Software Industry” presentation. www.softex.br. Retrieved: January 10, 2004.

³¹ MIT & SOFTEX, 2002.

The Ministry of Science and Technology (MCT) has also supported other programs to promote education and training of IT professionals plus providing financial assistance to small and medium companies. The PROSOFT program is a specific financing line for software companies. In the traditional banking system physical assets are required as collaterals to get foreign exchange or loan advances. It is easier for traditional businesses that deal in goods to provide such collaterals. Small and medium-sized software companies rely on the skills and expertise of their employees to create value and usually operate with modest assets and capital at their disposal. Therefore developing financing arrangements for software companies is an important policy measure for promoting software businesses in expanding their capacities and Prosoft program is a step in that direction.

International Comparisons

As the IT business has grown globally, some countries have specialized in providing software products and services to the rest of the world, particularly the large markets of North America and Western Europe. China, India, Israel, and Ireland are the most well known examples. Brazil joins them as one of the top software producers in the world. But a closer look at each country shows that each of them adopted a slightly different approach from a policy perspective to achieve success in the software industry. However, given the relatively short period of time in which IT industry has grown enormously, best practices of how to develop software industry are not easily identifiable.

The growth of the IT industry in the western countries took place in a free market, open competition environment, led largely by the private entrepreneurship and capital availability. Developing countries cannot mimic the development of the Silicon Valley in their economies in the absence of abundant capital (particularly venture capital), skilled manpower, research and development activities, entrepreneurship, and domestic demand. Hence, there was a need for a national policy to

promote or facilitate the development and growth of IT industry in most developing countries.

Today, different countries have adopted different kinds of policies to accomplish the objective of achieving success in the software industry.

In analyzing policies adopted by various countries, there are some things that appear to be common to all and at the same time there are others that are special to specific countries. For instance, it is recognized by all that the agility of the private sector needs to be supported and facilitated by the more resourceful and often vast public sector. While government agencies and ministries should not be trying to “control” and “over-legislate”, their support is essential in removing barriers to growth and smooth working of the software companies. Such measures would include making sensible fiscal requirements for taxes on revenues, income, and trade of software; promoting development of skilled, semi-skilled, and highly skilled manpower through appropriate education in government-controlled educational institutions; adopting trade and industrial policies that take into account the special nature of the “new” or knowledge economy. Consequently, this would also mean not having policies of the industrial age being applied to the information age economy. Government policy can also play a key role in developing mechanisms to provide capital for starting up or expanding software business.

Policy Issues

Despite having so many factors going in favor of Brazil, it still trails behind many other countries in the field of software. The Central Bank of Brazil estimated that in 2000, \$1.1 billion worth of software was imported into Brazil while only \$50 million exported out of the country.³² More importantly there is little doubt that the software industry in Brazil has not performed to its

³² Duarte, 2002.

potential. Based on the experience of other developing countries that have done well in software and the specific conditions in Brazil, there are issues that need policy interventions.

While the Brazilian domestic IT market is quite impressive, the structure of the market leaves a lot to be desired. A look at the domestic software companies shows that the big payers are the ones that have a captive public entity thus leaving little to spare for open competition. The private software companies are still relatively small in terms of revenues from other sectors of the economy.

Arrangements at the federal government where state-owned companies like Serpro get most of the projects or in commercialized banks that do most of software development in-house, cannot provide a conducive environment for promoting small and medium-sized companies. .

There have been calls by some experts to provide some preferential treatment to software companies to allow them to grow. The argument uses the historical regulatory regime that provided special treatment to hardware companies in Brazil as a reason to follow the same treatment for software firms. While such preferential treatment will give small and medium-sized firms the much needed space to survive and stabilize their business processes, it has the potential of making them less competitive and innovative. Government projects that give preferential treatment to domestic companies can play a key role in giving small and medium-sized companies the necessary experience to hone their business processes and give experience to their IT manpower to compete internationally.

The Indian software industry's success in international markets emphasizes the need for companies, large and small, to have an elaborate international experience. The development of business relationships in foreign markets, adopting business processes that bridge cultural or linguistic gaps,

and finally having name recognition for the quality of software delivered are the key strategies for increasing software exports. According to Gartner Group and International Data Corporation studies, the cost of labor in software programming in Brazil is lower than India and China (\$10-20 vs. \$24 & \$12-25 respectively).³³ Similarly, Brazil not only has many expatriates working in businesses and IT industry abroad³⁴ (shown by Kapur to be an important strategy for technology transfer and development of international linkages³⁵), it also has large immigrant populations from countries like Japan, Italy, and Germany which can be used to help in establishing links with the markets in these countries.

Several government programs claim to support startups in the software industry but unless the private sector develops a mechanism to share or finance the risk involved in developing new products of quality, the software industry will not be competitive globally. Young programmers need small projects in the domestic market before they can get the experience and skills to work on internationally competitive projects. Small software companies also need such financing opportunities to sustain themselves through the process of developing and refining their business models that will allow them to compete in the open market. Financing mechanisms in the private sector also allow entrepreneurs to convert their ideas into realities by getting help from such financing arrangements. Public funding eventually has to give way to private funding sources in order to ensure sustainability of capital creation and creativity to work efficiently in the market.

Conclusion

³³ MIT & SOFTEX, 2002.

³⁴ Softex. www.softex.br.

³⁵ Kapur D. Diasporas and Technology Transfer. *Journal of Human Development*. 2001;2(2):265-285.

Brazil is a country that has been a leader in the developing world for its stand on many issues of international trade and economic development. Over the years it has also experimented with bold policy initiatives and through the hard work and talent of its people developed a fairly diverse portfolio of economic activities. It is therefore no surprise that ever since entering the global market Brazil has increased its share in the world software market. There have also been several innovative policy interventions to help in the growth of the software industry. Softex Program has had a major impact on the overall growth and continues to be focus of many capacity building measures. However, as pointed out above, there are many areas where more innovative solutions need to be implemented. It is not possible to discuss in detail all aspects of the situation. We have mentioned problems such as market fragmentation, financing mechanisms, and export strategy. There are other issues related such as software piracy that have multidimensional and, at times, debatable implications on promotion of software development and investment. There is little doubt that Brazilian industry has the potential to capture an even greater share of the world market but that requires a commitment by policy makers to be responsive to rather rapid changes in the international IT market and to adopt policy regimes that help in growth of their domestic and export markets.

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