

MOVING SOFTWARE TO A GLOBAL PLATFORM

Government programs assist software firms with the goal of seeing them export \$2 billion worth in the year 2000

The present decade has already brought enormous change to the computer industry in Brazil. But the greatest change of all is expected in the area of software. By the end of 2000, Brazil is out to capture 1 percent of a US \$ 200 billion international software market, according to the federal government's National Program of Software for Export, or Softex 2000. For Brazil, this could mean \$2 billion in revenues from sales of application programs, programming tools, and multimedia entertainment and educational systems on compact-disk (CD) ROMs.

That \$2 billion figure represents quite a jump. Based on figures from the Secretariat for Information Technology and Automation Policy (or Sepin), of the Ministry of Science and Technology (MCT), that hoped-for \$2 billion is a 250 000 percent increase (or 265 percent compounded annually) from 1992, when software exports came to but \$800 000 [see table].

So far, the local industry has done well. Exports in 1995 reached \$100 million, about half going to the United States, again according to Softex. This occurred even though most of the Softex-supported companies still have to make their mark overseas. In 1994, Brazilian companies sold a total of \$1.1 billion worth of software, which puts the industry on a par with that of India's far better-known software industry, though exports account for about half of India's revenues. Brazil's software industry grew by about 25 percent over the year before. Revenues from information technology (hardware, software, and services) in 1994 were around 2 percent of Brazil's gross domestic product (GDP) of about \$552 billion.

Brazil's software sector began to change in 1990. That year was the start of the dismantling of the market reserve system, which for some 13 years had shielded the informatics sector from competition with imports.

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The early days

Protection against imports of products and services similar to those provided inside the country started in 1977, with an informal agreement between the military government and hardware makers. A 1984 law to the same effect, the so-called Market Reserve for Informatics, sheltered local makers of small and medium-sized computers. (Informatics is the term used in Brazil for any kind of information technology that relies on computers.)

As a consequence, local makers did not have to face the competition of imported IBM PCs, Apple computers, or Unix workstations. But Brazilians were allowed to import software not found in the country, though import tariffs could reach 100 percent. With poor software distribution channels in the country, many chose to make pirated software copies. Now, with better distribution, and lower tariffs, Brazil imports almost every kind of software, especially operating systems, database management systems, and anything else that requires a large investment to develop.

The market reserve policy distorted the software sector's development. The 50 largest informatics companies concentrated on hardware and services; software was a poor relation. For example, sales of hardware and services inside Brazil came to \$8.2 billion in 1990, while software totaled an anemic \$350 million. Since then, the country has had a large base of imported mainframes.

To meet its particular needs, however, Brazil continued to develop software of its own. A small and highly competent industry arose whose members gained expertise in almost all kinds of hardware platforms and software tools. Change was a constant as developers moved quickly to satisfy customers' requirements.

Particularly well advanced is Brazil's software for banking. Fairly frequent changes in the basic monetary unit of the country, propelled by galloping inflation during the past decade, demanded sophisticated bank-automation systems. For example, checks had to clear overnight. Presently, as is now becoming common in the United States, account balances and all kinds of transactions are processed on-line over private bank networks, enabling customers to deal instantly with their

Annual Revenue of the Brazilian Informatics Industry, in millions of US\$ dollars

Year	1990		1991		1992		2000 (estimated)	
	Domestic	Export	Domestic	Export	Domestic	Export	Domestic	Export
Hardware	6000	250	5300	250	5900	250	12000	3000
Software	350	0.5	600	0.6	700	0.8	4000	2000
Services	2200	N.A.	1800	N.A.	1900	N.A.	4000	1000
Sub-Totals	8550	250.5	7700	250.6	8500	250.8	20000	6000
Totals	8800.5		7950.6		8750.8		26000	

N.A.: not available

Source: "Research, development and human resources formation: Basis for and Informatics policy", a 1993 report from the Secretariat for Information Technology and Automation (SEPIN) of the Ministry of Science and Technology.

accounts from bank branches or from home via phone, fax, or computer anywhere in the country.

With an eye on the indigenous software capability, and on the projected growth of the worldwide market, the federal government decided to strengthen the software industry and to promote its export of products and services. The means to this end is the aforementioned National Program of Software for Export. Inaugurated in 1992, Softex 2000 helps companies sell products abroad, as well as establish strategic partnerships with overseas organizations. In 1993, a marketing office was opened in the United States, in Pembroke Pines, Fla.

Softex also promotes the use of quality assurance programs for products and processes to ensure that Brazilian software, and the companies developing it, adhere to international standards. And it is strengthening the informatics base of the country by investing in R&D and training programs, and by setting up a regional network of technology incubators in more than a dozen Brazilian cities.

Most "native" software houses in Brazil are small, with annual revenues of, at most, \$5 million. Softex 2000 puts the number of locally owned software companies at 10 000, about 100 of which, generally the largest, are foreign owned. Often, the Brazilian firms rely on the marketing and managerial support provided by Sebrae, the Brazilian Service for the Support of Small and Medium-sized Companies, with branches throughout the country.

The largest software companies, Consist Consultoria e Representação Ltda. and Oracle do Brasil Sistemas Ltda., a subsidiary of the U.S. company, Oracle Corp., offer consulting services and sell software. Both are in the city of São Paulo. In 1994, Consist Consultoria had revenues of \$90 million, while Oracle's were \$57 million. Microsoft Corp., Redmond, Wash., which sells more software in Brazil than any other firm, works through distributors.

The development in Brazil of software for export began with interpreters for programming languages in the mid-'80s. By now, the nation's export portfolio includes object-oriented programming languages, operating systems, data- and network-security systems, software development tools, and multimedia educational applications, as well as vertical products such as process industry automation tools and feed formulation programs for livestock.

Just about any mainstream product, including operating systems, word processors, spread sheets, communications software, and database management systems, is sold in Brazil, either in joint ventures between Brazilian and foreign companies, or through distribution agreements. Mainstream accounting software is not sold in Brazil, however. Because of the country's laws and requirements, almost all of it is produced internally. Brazilian-owned companies have also set up branches in the United States. And they have even won contracts to supply software to the U.S. Government.

Microbase of São Paulo has met with unusual success. It sold about 3000 copies of its MS-DOS compatible VirtuOS, a multi-tasking,

network operating system to the U.S. Department of Defense. And in a technical alliance, Microbase and Santa Cruz Operation, of Santa Cruz, Calif., are jointly developing solutions so their products will interoperate in a Posix environment.

As another example, planning and operations systems software for electric utilities and power producers has been sold to enterprises in the Americas, Europe, and New Zealand by Power Systems Research Inc., Rio de Janeiro

Toward a competitive industry

Softex 2000 is part of a larger national effort to equip Brazil with a competitive and enhanced computer industry. Known as DESI, from the Portuguese for Strategic Development of Informatics, the program was conceived by the National Council for Scientific and Technological Development (or CNPq for short). It was launched in February 1993 with funds from both the United Nations Development Program and Brazil's Ministry of Science and Technology (MCT). (CNPq is the ministry's research arm.) DESI also supports the National Research Network [see "Going on-line with the Internet"], and cooperative projects in computer science.

DESI was developed with the help of industry through the 1000-member Assespro (the Association of Software and Computing Services Providers), in Rio de Janeiro, and of academia, as well as various federal and state government entities, which assist in running the program. Sepin in Brasília coordinates strategic planning and individual projects.

By the year 2000, Softex expects that half of Brazil's software market will be controlled by Brazilian companies. According to some estimates, this means that 50 000 new jobs must be created, as well as 1000 medium-size companies. Presently, Brazil employs over 100 000 people in computer-related jobs, one third of whom hold an advanced degree. Ten thousand, including nearly 500 Ph.D.s, are involved in R&D, much of it software-related. But the number of end-users who program in Brazil may be as many as three times the number of software engineers and programmers, a fact that underlines the existence of a strong software culture.

Around the country there are 20 postgraduate programs and 80 undergraduate programs in information technology. The government also supports about 150 Ph.D. candidates studying abroad. Some 50 Ph.D.s are absorbed by industry, government, and academia each year, a figure deemed insufficient to meet needs.

Coordinated by CNPq, the DESI Softex program, headquartered in Campinas, São Paulo, is under way at 17 regional centers. Many of the cities also host prominent academic institutions likely to be working on innovations of interest to industry.

Each center, run by a nonprofit organization, includes a laboratory and support group that can be hired by local companies. Calls for projects are released by the center based on its region's technical capabilities and needs. Proposals are examined by ad hoc consultants,

together with the center's staff members, and funds are awarded to the most promising with the largest market potential. Government grants are used for salaries, and performance on a project is monitored periodically. Since 1993, DESI has supplied about \$10 million for Softex; in 1995, it funded projects at about 600 companies, many already exporting software.

A project may originate in industry or it may involve transferring technology from academia. As a product is developed, so is a business strategy for pricing, marketing, sales, and support. People of many different abilities are involved, including lawyers, graphics designers, and marketing consultants. Softex will also support the training of employees either in Brazil or overseas in technical and managerial talents that may be needed.

For companies wishing to do business in the United States, the Softex 2000 office in Pembroke Pines assists in such tasks as market research, product distribution and support, and legal services. It will also publish the software, and it coordinates the participation of Brazilian companies in trade fairs, such as Comdex. The office may also be the first point of contact between Brazilian companies and their customers, partners-to-be, and resellers. Softex 2000 has another office in Bonn, Germany.

Of course, individual companies are also pursuing sales around the world, in China, Europe, Israel, Japan, North America, and elsewhere, and in South America through Mercosul. Inside the country, trade fairs and conferences put entrepreneurs in contact with overseas organizations and their representatives.

Co-operative R&D

Another CNPq initiative is the Multi-Institutional Thematic Program in Computer Science (ProTEM-CC, from its initials in Portuguese). Taking the long view, it hopes to encourage and leverage Brazilian R&D in ways that would lead to sustained development in information technology. It does this by funding basic and applied research projects, and by encouraging cooperation between institutions and technology transfer between universities and industry. In this, the initiative resembles the European Programme for Research and Information Technology (Esprit). Eighty companies are currently involved. Also, many university laboratories have been re-equipped with Unix workstations and software.

In the next five years, the goal is to set up 10 large computer science departments in as many leading research institutions. Each will employ around 60 Ph.D.s, an equal number of research assistants, plus technicians and administrative assistants. In addition, 40 similar groups, 20 medium-size and 20 small, will be installed at other institutions. Once in place, these departments will help train more of the human resources that will be needed for industrial and research purposes.

Institutions throughout the country support the program, joined by way of the Internet and the National Research Network. They include government agencies, nonprofit associations, federal and state academic centers, private universities, and software companies. Among these are such public organizations as Telebrás, the government's telecommunications monopoly, and Embrapa, the government's farming and cattle-breeding research company, through their research centers in Campinas. Also involved are the IBM scientific center in Rio de Janeiro and Equitel SA, the Siemens subsidiary in São Paulo.

Frequent calls for project proposals are issued by CNPq in 13 technical areas, 10 of which are software related. Included are software development environments, databases, multimedia, operating systems, and neural networks. Projects often treat problems of social, national, or strategic interest. Here, too, proposals are evaluated by ad hoc consultants in accordance with several criteria: their presentation, adequacy, relevance to state-of-the-art advances (for a basic research

project) or to information technology, industrial potential, social and economic impact, and qualifications of the bidder. Projects are funded by the government through fellowships at the computer science research centers.

An important source of ideas for R&D projects has been the Brazilian Computing Society (SBC) in Rio de Janeiro. With some 1000 members, it is the major national association of professionals in computer science. It sponsors at least a dozen symposia a year. International events are also held with the support of the IEEE.

In another phase of the ProTEM-CC program, research partnerships are being established between Brazilian and overseas groups. Several are in place with institutions in France, Germany, Portugal, the United Kingdom, and the United States. Similar initiatives are under way with Brazil's Mercosul partners and with the European Union. In parallel, the program seeks to establish solid academia-industry partnerships. From August 1995 on, two-thirds of the proposals approved by CNPq had to involve industrial partners. Further, each proposal must involve one of the new computer science research centers.

Also maintained by CNPq is a continuing education program, a Course on Advanced Software Technologies (CATS). The course focuses on technologies needed for such activities as compiler and database systems construction, and ensuring software quality skills. Instructors come from universities supported by ProTEM-CC. Courses are available at these institutions and students can receive tutoring at their workplaces by e-mail.

Companies themselves spent \$300 million on informatics R&D in 1994, or nearly 20 percent of the national investment. They are encouraged to do so by a recent law that lets them invest in R&D in lieu of paying some taxes. At least 5 percent of a company's annual revenues may be invested in R&D projects--3 percent applied to projects of their own and 2 percent in work performed at other organizations.

Optimistic scenarios envision this source of funding ultimately underwriting as much as 70 percent of the national R&D program in informatics in the year 2000. This development would also help increase the national annual investment in R&D, currently at 0.7 percent of the gross domestic product, to 1.5 percent by the start of the new century.

Supplementary efforts

To be as competitive as possible, the Brazilian software industry considers quality assurance a key factor. The Technological Foundation for Information Technology (CTI), a CNPq research center in Campinas, developed a method and the infrastructure for evaluating software products based on the ISO 9126 standard. Each characteristic of the product is examined--its price, presentation, user interface, documentation, and support. The software is assessed according to its functionality, efficiency, usability, maintainability, reliability, and portability. Several products already on the market are evaluated by CTI each year.

To recognize outstanding software meeting ISO criteria, annual awards have been established by Assespro, the software providers association. Among recent winners are Microbase's VirtuOS, DIC, an electronic dictionary produced by Opção Informática in Belo Horizonte, Minas Gerais State, and Hércules, the accounting package of WK Sistemas, Blumenau, in Santa Catarina. With the award widely recognized in Brazil, winning companies use the achievement in promoting their products.

Companies bent on improving how they develop, maintain, and re-engineer their products so as to obtain ISO 9001 certification are offered help by CTI and Sebrae, the organization that supports small and mid-sized companies, as well as by the International Center for Software Technology (CITS), an R&D center maintained by private

companies, government, and academia in Curitiba, Paraná. A recent survey of 217 companies by Sepin found that 5 percent already had an ISO certificate for software development, while another 7 percent were working on the certification process.

Implementing recommendations for improving quality may, of course, take money for such things as training employees, acquiring new equipment, or restructuring a company's manufacturing process. To support these needs, the informatics industry can count upon low-interest loans from the National Program of Competitiveness and Quality, supervised by the National Bank of Social and Economic Development (BNDES) of the Ministry of Economics. This program is typical of those supported by the bank with a view to making companies stronger competitors and thus improving the country's economy. The bank will also fund approaches to total quality management and benchmarking against known high-quality processes.

BNDES and Assespro together address another "hot" software industry issue: piracy. In the past, pirated software in Brazil could be worth as much as 80 percent of what was actually sold. In attempting to reduce piracy, professional associations of, say, Brazilian doctors and engineers are being offered reduced prices and easier payment terms for hardware with pre-installed software.

Technically, software copyrights are protected in Brazil by specific laws. The country is also signatory to international agreements that regulate the ownership of intellectual property. These agreements include the Cooperative Treaty on Patents and the General Agreement on Tariffs and Trade signed in Uruguay. In spite of this, ever since the protectionist era, the country's inspection mechanisms have not been effective. To counter piracy, then, the Brazilian Association of Software Companies (ABES) in São Paulo, representing hundreds of joint ventures between Brazilian and multinational companies, is advertising the disadvantages of using pirated software and has taken legal action when appropriate. Enforcing the laws and mechanisms already in place has also become a priority of the federal government.

The future

Some may maintain that a development effort so skewed in favor of software is flawed. But Brazil already has a strong and growing hardware industry that produces everything from memory and chip sets to fully assembled PCs and workstations, from monitors and keyboards to high-performance computing modules. In fact, the lessons learned by the government in encouraging software products and services for export may be applicable to the development of other competitive industries.

Many believe that by concentrating now on software, it should be possible to strengthen the strategic area of informatics immeasurably in a relatively short time. To this end, Government strategies, suggested by, among others, Larry Press in his article, "Software Export from Developing Nations" [*Computer*, December 1993, pp. 62-67], have been implemented. This includes reducing trade barriers; coordinating efforts of companies, along with offering them financial incentives; marketing products collectively; enhancing research and education facilities; establishing a communications infrastructure (such as the Internet); and, finally, enforcing copyright laws. The new jobs and technical knowledge to be created and the income generated will benefit the entire country.

As the informatics community matures, the government will reduce its high level of participation, and turn things over to academia and industry. In 1997, it plans to cease being manager of Softex 2000. The federal government will, however, rely more and more on persuading the R&D sector to tackle certain areas, and for industry to develop products appropriate for, say, export. It will also rely on offering incentives to companies and to regions to sustain continuing development. ♦

To Probe Further

Software development and Brazilian opportunities are discussed in "Software as an export product from developing countries: Are there any real chances?" by Eduardo Moreira da Costa, director of special programs at CNPq. An extended abstract printed in English is available at: <http://www-cite.cnpq.br/softex/docs/art-soft>.

Obligatory reading for those intent on grasping the rationale of Brazilian programs for supporting R&D (and who know Portuguese) is "Research, development, and human resources formation: Basis for an informatics policy," by Sílvio Lemos Meira, the current national coordinator of ProTeM-CC. It can be found at <http://www-cite.cnpq.br/protem/docs/fase2>.

The Brazilian journal *Informática Exame* devotes one issue every year to the country's industrial performance and markets, ranking leading companies in each business category (software, hardware, and services).

Statistics describing the first years of the Softex program appear in "Softex 2000: Evaluation of the biennium 1993/94," by Newton Braga Rosa, in Portuguese, January 1995.

For more information about the Softex 2000 program, contact Carlos Augusto Caldas DaSilva, Softex 2000, 9050 Pines Blvd., Suite 210, Pembroke Pines, FL 33024; 954-438-6450; fax, 954-438-1995; e-mail, caldas@us-office.com.

There is also information about Brazilian software efforts at the Softex 2000 Web site at <http://www.softexmall.com>.

For academic cooperation in software matters, contact Sílvio Lemos Meira, ProTeM-CC, Caixa Postal 7851, Cidade Universitaria, Recife, PE, Brazil, 50732-970; tel: (55+81) 271 4281; fax: (55+81) 271 4925; e-mail, protem@di.ufpe.br.

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