Computing in Chile: The Jaguar of the Pacific Rim?

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Introduction

In less-developed countries (LDCs) looking to expand and modernize their economies, there is a growing perception that one of the most desirable means to this end is to export products with substantial added value. The development of software industries looks particularly attractive since software products are essentially pure added value. There are additional advantages to this industry: it is environmentally friendly, it requires less initial investment than other industries, it can leverage competitive advantages for other domestic industries, it helps employ college-educated people, and it provides relatively high income to entrepreneurs and employees.

So far few embryonic software industries in LDCs have done very well either in large export earnings or in having significant impact on national economies. The

more notable aspirants include Hungary, India, Ireland, Israel, and Russia. Each has some successful products and relations in the international software market. Each has had some high profile publicity. In Latin America, Chile is among the leaders in a growing software market of about two dozen countries and 460 million people[9].

In the past, Chile's economy was strongly dependent on copper, whose market fluctuations posed problems to economic stability. In 1975, it adopted an open market economic model, developing additional industries such as fish farms, forestry, agriculture (fruit, vegetables, wine, flowers), processed-foods, and tourism. As a consequence, copper*s export share dropped from 80% to 40%.

The Chilean economy has steadily improved during the last decade, growing roughly 80% over this period. Within Latin America, Chile has the third highest income per capita. Unemployment has declined to 4-6%, and the inflation rate has decreased to 8-9%. Chile has been called the "Sixth Pacific Tiger" (or the America's relative: the jaguar). Despite the impressive record, this is still a developing nation with four of its 14 million people officially considered "poor."

Politics certainly played a role. In 1973, the country's elected government fell to a military coup led by a right wing general, Augusto Pinochet, who ruled until 1990. His government established the basis for a strong economy, based on a free market and export quality production. This transformation did not occur peacefully, but with many human rights violations. In 1990, Pinochet handed power over to elected President Patricio Aylwin and democracy was restored without vengeance.

During his four year term, Aylwin emphasized economic and political stability. His government controlled fiscal expenditures, and eschewed the protection of favored economic sectors. In March 1994, newly elected President Eduardo Frei started a six year term. The forecast for 1995 includes 7% inflation, a positive trade balance, 7% GDP growth, 4-6% unemployment, and a record in foreign investment. As stated recently in _The Economist_, *the Chilean economy is easily Latin America*s star performer.*[4]

The country has shown a capacity for developing and exporting software products, particularly to Latin America[2]. Indeed, Chile has been proposed as a model for the development of information technology (IT) industries regionally[9]. But can this initial success endure, and is this jaguar ready to compete in the international IT industry?

An Overview of IT in Chile

The infusion of computing in Chile began in 1962 (Table 1) but, as is the case with most LDCs, moved slowly until the advent of inexpensive imported microcomputers. The number of personal computers sold since 1989 has increased by a factor of four (Table 2), with the total number installed annually exceeding 400,000 by 1994, when three out of 100 citizens owned a PC. (By contrast, three out of 5000 owned a PC in 1992 India[7].) In 1994, more than 20,000 PCs were assembled in Chile.

Table 1: Main landmarks in Chilean IT history.

Date	Event
1962	First computer (U. of Chile).
1964	First data processing company: ECOM (state owned).
1967	First data processing network: Banco del Estado.
1969	First Computer Science program (U. of Chile).
1974	First Computer Science Dept. & M.Sc. program (U. of Chile). Latin-American Informatics Conference is launched in Chile (Catholic Univ. of Valparaiso).
1981	Governmental research grants program begins. First International Computer Science Conference.
1984	First Unix systems (U. of Chile, U. of Santiago). & Chilean Computer Science Society is born.
1985	International electronic mail (uucp), followed by Bitnet in 1987 (U. of Chile).
1987	First automatic banking teller network (union of banks).
1989	First Unix workstations laboratory (U. of Chile).
1990	First IT industry participation in CEBIT (Germany).
1991	Digital data networks. Internet connectivity (Catholic U. and U. of Chile).
1993	First Ph.D. program in Computer Science (Catholic Univ.). Digital telephone switching system goes from 80% to 100%.
1994	Experimental ISDN service. First ATM network (U. of Chile). Multicarrier system for long distance telephonic calls.

Table 2: Chilean IT and packaged software market (US$ millions). Personal computers sold in Chile (thousands).

Year	IT Market	Growth (%)	Software Market	Growth (%)	Software Exports	Growth (%)	PC Units	Growth (%)
1989	na	--	na	--	1.4	--	30	--
1990	na	--	na	--	3.6	157	40	33
1991	na	--	na	--	6.4	88	60	50
1992	439	--	52	--	13.9	117	83	38
1993	496	13	70	35	22.0	58	110	33
1994	555	12	77	10	na	--	120	9

Initially, the introduction of computers to local enterprises generated a demand for software products, which was initially satisfied by imports and in-house software development. Table 2 shows the total IT and internal packaged software markets during the last few years[10]. About 70% of this is imported, mainly from the US.

In the early 1980s several large companies were hard pressed to improve their operations and rushed abroad to purchase packaged applications. They soon discovered that many required significant modifications or were completely useless, due to local accounting practices, widespread use of indexed currency, and local regulations concerning banking accounts. Support and program updates were needed at reasonable costs. These problems and needs drove the birth of the Chilean software industry.

In 1992, locally produced software sales totaled US$110 million, 12% of which was exported. In 1991, 57% of the known software exports were to Latin American countries, 12% to Asia, and 31% to other countries, mainly the US and Europe. Exports of Chilean-designed software came to roughly US$22 million in 1993, up 58% from 1992 (Table 3). This rate is expected to decline to 40% in the next few years.

Table 3: Chile in the international packaged software market (in US$ millions).

Item	1994	1998 (est.)
Chilean exports	38.8	170.7
World sales	77,492.0	121,489.0
Chilean share of world sales	0.05%	0.14%
Total Latin-American sales (exc. Chile)	1,764.9	3,051.0
Chilean software sales in Latin-America	23.7	102.0
Chilean share of sales in Latin-America	1.3%	3.3%

Exported software products include MIS applications packages (e.g., transactional banking systems, integrated management systems, and statistical analysis), software utilities (anti-virus software, software distribution systems, text retrieval tools), and applications in which Chile has special experience (mining, forestry).

For years, the Chilean software industry faced double taxation on exported products. Exporters had to pay taxes locally and also in the country where the product was sold. As a consequence of this taxation policy, software companies have been hiding their real export revenues, so the figures in Table 3 are

conservative. The problem of double taxation has recently been solved legislatively. Another law, passed in 1991, has enforced software copyrights, thus decreasing piracy and stimulating sales.

Impressive growth rates aside, the Chilean share of the world software industry is very small. These statistics illustrate the position of aspiring LDC software industries in today's global market. Even India and Israel, each with a software sector greater than Chile's by an order of magnitude, barely show up at the world level. Within Latin America, Chile's presence is comparatively more substantial (by a factor of almost 30), but is still small. This reflects the dominance of the advanced industrial countries as both producers and consumers of software, the small markets in developing countries, and the effects of widespread piracy.

IT projects have experienced growth pains in Chile. Some projects have been too ambitious or have been poorly done. For example, one university launched an "informatization" project a few years ago, only to end up with too much batch processing hardware and too little modern functionality. Another embarrassing example is Codelco*s (Chile*s largest mining company) poor computerized futures options system, losing them an estimated US$250 million in late 1993.

The software industry has benefitted from dynamic growth in telecommunications, and local telecommunications companies have become the most developed companies of their kinds in the region. All important cities are wired with fiber optics, all the telephonic switching in the country is digital, ISDN was introduced in 1994, and almost all universities and many companies are connected to the Internet. In the last ten years the number of telephone lines has more than tripled to 1.6 million. Internet traffic into and out of NSFNET from Chile during February-March 1995 was 15.2 Gbytes, compared with 27.4 Gbytes for Brazil, with more than 10 times Chile's population[6]. Another important development was the multicarrier system for long distance calls introduced in 1994. Eight competing companies are offering this service, resulting in major rate reductions.

The Chilean Software Industry

A sampler of some of the more successful software companies in Chile includes:

- AISOFT develops administrative software, and has sold over 3,000 copies on various platforms. Since 1989, it has been exporting to the US, Venezuela, Peru, Brazil, Uruguay, Costa Rica and Argentina.
- Ars Innovandi is a small software company with expertise in text retrieval and document based applications. It currently markets a package for

Windows in several Latin American and European countries, as well as an API for developing customized applications. Like many small companies in LDCs, it is severely short of the resources necessary to market its products abroad.

- Excelsys is another small company specializing in custom hardware/software solutions. Its products include a wood volume measurement system for lumber companies, and an electronic queueing system with flow sensors, light signals, etc. The queueing system is currently used by Citibank in several countries. They are also customizing automatic teller machines in Colombia and Guatemala.
- Sistemas Integrales is a small software and consulting company that has exported its main software product, the Ariel-plus statistical package, to clients in 35 countries, mainly for government agencies needing to process surveys.
- Sonda is the largest national software company, with offices in eight Latin American countries. Its main business is services and consulting, coupled with the distribution of DEC products in the region. Among other products, it has sold banking systems to customers in Latin America, Indonesia, Malaysia, Thailand and Russia. It employs 1500 people, with 1994 sales of US$135 million (22% abroad).

The companies mentioned thus far mainly sell software packages or consulting services. Other companies such as Binaria or DTS provide off-shore programming, while some foreign companies partially develop and fully support their software through local offices in Chile.

Other IT products are encapsulated in larger packages exported mainly to Latin America. One example includes management systems for pension funds, sold separately or contributed as capital investments in foreign pension funds companies. These exports have boomed because some countries, such as Argentina or Peru, have replaced their state-managed retirement funds systems with private schemes modeled after Chile's successful experiment in this area, which began in 1981. A similar turn-key system has been exported by the Chilean Stock Market. Its product is a complete electronic stock exchange system, including know-how, software, and installation. The customers are financial markets in Costa Rica and Colombia.

International Prospects and Problems

Aspiring LDCs often claim to have highly qualified human resources necessary to have a competitive software export industry. Whether true or not for any particular country, more generally human resources make up only one of the

required factors. Other factors include financing, strong marketing capabilities, product quality, physical or electronic proximity to the centers of technological innovation and test sites[2,8]. If the other factors are not present, the creation of a mature software industry is impossible. Latin America notably lacks distribution channels for software.

So the question arises: How is it that Chile developed a software export industry, and other Latin American countries, such as Brazil, Argentina or Mexico, with much larger markets, have not? In Chile, the introduction of a free market economy created the need for efficient and competitive industries. The Chilean banking system learned to deal with exporters, making themselves extremely efficient in order to compete with each other and with foreign banks. Mining, fishery, fruits and forestry, discovered "new" markets. All this meant the introduction of technology to produce at international quality standards and at low costs. This need created a growing market for software products, which initially was satisfied with imports. With qualified manpower and capital available, and a stable economy, indigenous software houses formed.

Table 4 shows the total IT and packaged software market in the principal Latin American countries for 1994[10].

Table 4: Comparative IT and packaged software markets in Latin-America. (Year 1994, Data from CELADE, IDC, Latin Finance and World Bank)

Country	Popul. (mill)	GDP per capita	IT Market	Software Market	Soft/GDP (%)	Soft/capita (US$)
Argentina	34.2	8,317	1,259	140	0.05	4.1
Brazil	159.1	3,298	4,982	1,043	0.20	6.6
Chile	14.0	3,600	555	77	0.15	5.5
Colombia	34.6	1,740	442	43	0.07	1.2
Mexico	89.6	4,321	3,267	401	0.10	4.5
Venezuela	21.4	2,594	509	65	0.12	3.0
Rest LA	108.4		673	74		0.7
Total	461.3		11,687	1,843		4.0

Brazil has not been able to repeat its high GDP growth rates of the 1970s. Economic protection for the national computer hardware industry, hurt software exports. This policy was corrected in 1993 by launching an ambitious plan, SOFTEX 2000, to promote a software industry in the coming years. In 1992, according to a Brazilian government study of 73 companies[3], the total software market was US$384 million. Included in this figure are US$210 million of

imported software. In contrast, software exports amounted to only US$1.1 million.

The Mexican software market is dominated by products developed north of the border. The geographical proximity to the US has apparently hurt the development of a native software export industry. The Mexican computer market, opened to foreign companies in 1990, represents about 28% of the entire Latin American market. The software market in 1994 was approximately US$400 million, with only 30% covered by Mexican companies. Currently, software exports are small[5]. Only in 1994 was a national computer association similar to the ACM created in Mexico, in contrast to Argentina, Brazil and Chile where such organizations existed at least 10 years ago.

Latin America is an obvious market for Chilean software companies. Besides having a common language and traditions, Latin American countries may experience substantial economic growth in the coming years. Furthermore, Chile has recently signed free trade agreements with several Latin American countries, which will increase trade with them.

Markets beyond Latin America are needed, not only as a source of additional income, but also as a quality test for the industry. The Pacific Rim countries are an interesting market for Chilean companies to explore since most have booming economies and their growth eases entry for newcomers. Chile was accepted during 1994 in the APEC (Asia-Pacific Economic Council), which should reduce trade barriers and bureaucratic red tape. Another related factor is Chile's possible incorporation to NAFTA (North-American Free Trade Agreement), currently being negotiated. Near term consequences may include imported IT goods with lower prices (following reduction of the present 11% import tax) and greater foreign investment.

Will Chilean software companies grow in markets beyond Latin America? This is not yet clear. On the positive side, there is an internationally-minded generation of businessmen in the country who are experienced in export ventures, and Chile has the highest per-capita level of published IT-related scientific papers in Latin-America.[1] On the negative side, many Chilean software companies lack the needed capital and know-how to reach mature markets. The higher standards in software quality and rising standards of living will likely increase the cost of Chilean software. There is no strong overall technological environment to foster a large-scale internationally competitive industry. In general, the government fosters exports, but is not inclined to subsidize business and is unlikely to give special treatment to the IT industry.

Chile arguably has the most internationally successful software industry in Latin America. So far, this industry has been as capable as almost any from an LDC in exporting to emerging markets with low entry requirements, i.e., where the local competition is weak, the customers are less demanding and where language and cultural advantages exist against US or European products. The industry is also relatively healthy in that most of it is based on products of domestic origin that have proven value, rather than on cheap, educated, programmers whose time is sold to European, Japanese or US companies.

But where does this industry go from here? The future may be rosy for some companies, but is more questionable at the national level as indicated by the modest numbers in our tables. So far, Chile, and almost all LDCs, have relatively small domestic market shares for domestic software. This is even true for large countries with large domestic markets in most other respects, e.g., Russia, India, Brazil and Mexico. Regionally produced products account for even smaller shares of an LDC*s software market. These markets may have low entry requirements, but there is often little to do once inside. More generally, in comparison with their geographic and demographic bases, there is very little intra-regional IT trade in many parts of the world, notably Latin America, Africa, many parts of Asia, or the Middle East. Although some countries or subregions show high growth rates in certain statistics, the bases are still very small. Except in the dubious domain of providing bodyshopping labor, it is proving very difficult for embryonic software industries in LDCs to be competitive in mature markets.

Domestic software industries should be of more value to an LDC in leveraging greater efficiencies and other competitive advantages for larger infrastructure-building industries, e.g., tourism, than in direct software export sales. Successful systems for demanding, internationally successful domestic customers are what is most likely to lead to the best kind of exports.

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