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World Institute for Development Economics Research

Discussion Paper No. 2002/92

The Software and Information Services Sector in Argentina

Pros and Cons of an Inward-Oriented
Development Strategy

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October 2002

Abstract

The software and information services (SIS) sector is at the heart of the New Economy and has been rapidly growing through the whole world during the last decades. This is also the case in Argentina where in the middle of a deep recession, the turnover of the sector augmented by 40 per cent and employment by 43 per cent between 1998 and 2000.

The objective of this paper is to analyse the evolution, present situation and prospects for the Argentine SIS sector, relying on a detailed survey recently made to 100 firms operating in this developing country. Most of these firms are locally-owned and young SMEs supplying the domestic market but there are also a few large firms accounting for the lion's share of that market. Exports are negligible in terms of the sector's turnover.

Argentina seems to have some advantages to exploit in order to make significant inroads in this sector: it has a relative abundance of high-skilled labour, a sizeable

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Keywords: software information services, developing countries, Argentina

JEL classification: L86, O12

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This is a revised version of the paper originally prepared for the UNU/WIDER Conference on the New Economy in Development, 10-11 May 2002, Helsinki.

domestic market and a cultural influence in Spanish-speaking South America. SIS activities began in the 1970s and the sector has developed so far without any government support.

None the less, SIS firms in Argentina have been basically tied to one particular segment of the domestic market—i.e., software for accountancy, management, etc.—where they enjoy advantages derived from the idiosyncratic feature of the domestic regulations and their knowledge about the business culture and the needs of their local clients. Firms experience problems in competing via costs, while, apart from some isolated exceptions, have never competed through innovation. Besides, they lack marketing capabilities as well as access to investment and working capital. Programming and analysis skills are available but they are relatively expensive in comparison to the situation in other developing and latecomer countries. Furthermore, management skills are imperfect. In turn, networking mechanisms are weak, both among SIS firms as well as with their customers, R&D institutions, etc.

There is then a need both for action aimed at improving the SIS firms capabilities and endowments, as well as for intelligent public policies to foster this sector and dramatically increase its export capacity. The experiences of other developing and latecomer countries should help in finding ways to overcome the problems faced by this promising sector and significantly enhance its prospects.

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Camera-ready typescript prepared by Liisa Roponen at UNU/WIDER
Printed at UNU/WIDER, Helsinki

The views expressed in this publication are those of the author(s). Publication does not imply endorsement by the Institute or the United Nations University, nor by the programme/project sponsors, of any of the views expressed.

ISSN 1609-5774
ISBN 92-9190-308-6 (printed publication)
ISBN 92-9190-309-4 (internet publication)

1 Introduction

The software and information services (SIS) sector has been rapidly growing everywhere in the last decades. This dynamism will persist in the foreseeable future, as long as this sector is at the heart of what has been called the New Economy.

Developed countries are both the main producers and consumers of SIS. In turn, there are several large firms based in these countries that have consolidated dominant positions at world level in different segments of the SIS sector. Nonetheless, there seems to be room for firms from developing countries to enter and grow in this sector, as proven by the experience of India, Brazil, Singapore, Taiwan, Korea, Costa Rica, etc. The highly publicized cases of Ireland and Israel also show the possibilities of latecomer countries to play a significant role in this sector.

In this regard, it is important to take into account that the SIS sector is far from being a mature sector. Its technologies, markets and products are constantly evolving. Furthermore, since the sector is still at a sort of 'handcrafted' stage, there is room to advance in terms of 'process technologies'. In this scenario, some firms from latecomer or developing countries have managed to compete in export markets through truly innovative products aimed at certain niches. In fact, there are several modes of entry for firms from developing countries in the SIS sector, each requiring different endowments and capabilities and each having different consequences in terms of the sectoral dynamics (Heeks 1999).

In this scenario, the objective of this paper is to analyse the strengths, weaknesses and prospects of the Argentine SIS sector relying mainly on the results of a detailed survey made in 2000-1 on nearly 100 SIS firms.

SIS activities began in Argentina in the 1970s and the sector has developed so far without any government support. In the middle of a recent deep recession, the turnover of the sector increased by 40 per cent and employment by 43 per cent between 1998 and 2000. Most of the producers are locally-owned, young SMEs supplying the domestic market but there are also a few large firms accounting for the lion's share of that market.

Despite its recent good performance, perhaps no one in the world has ever heard of Argentine SIS firms making significant inroads in export markets. Argentina is still not seen as a country that may become a significant producer of software and information services.

Nonetheless, the country has some advantages to exploit in order to make significant contributions in this sector. First, it has a relative abundance of high-skilled labour, which is a key factor for competition in this sector. Second, it preserves at least some of its old cultural influence on the rest of the Spanish-speaking South America, a factor that could help Argentine firms penetrate those markets, taking advantage not only of the geographical but also of the cultural proximity with them. Third, Argentina's GDP in 2000 was around US\$ 280 billion with a GDP per capita above US\$ 7,000. Hence, the domestic market, while being far from those of developed countries, offers a relatively adequate development base for local firms. Last but not least, there seems to be an expanding consensus on the need to modify Argentina's trade specialization pattern. In addition to encouraging resources-based activities, the country should foster skilled labour

intensive activities. Unskilled labour based productive branches have almost disappeared due to trade liberalization in the 1990s, while scale intensive activities have to compete with their counterparts in Brazil, a country which is better endowed to compete through scale economies.

Section 2 deals briefly with the experience of the SIS sector in some developing and latecomer countries, and suggests some conceptual hypotheses to be discussed in the Argentine case. Section 3 presents the main results of the mentioned survey. Section 4 discusses the impact of some key institutional and macroeconomic variables on the evolution of the SIS sector. The main conclusions and policy suggestions are presented in section 5.

2 SIS in developing and latecomer countries: a brief review

Which are the main limitations that firms in developing countries usually face when trying to enter the SIS sector? According to Heeks (1999), they are:

- weaknesses in the physical and communications infrastructure of their home countries;
- the fact that their domestic home markets are usually small (and often supplied by illegal copies), which hinders the chances of recovering the costs involved in the development of innovative products;
- access to finance is usually limited and interest rates are often high, while mechanisms such as venture capital are almost unknown;
- local firms rarely have strong marketing capabilities; and
- the diffusion of stringent quality standards is usually very limited.

Furthermore, when trying to enter foreign markets, firms from developing countries must face additional obstacles such as:

- the lack of trust about their technical capabilities and uncertainty about compliance with quality standards, schedules, etc.;
- the lack of detailed knowledge about the requirements of foreign customers; and
- linguistic and cultural barriers, lack of knowledge of the business culture and norms in foreign markets, etc.

In this scenario, developing country firms wishing to engage in this sector must adopt strategies that match their endogenous capabilities, as well as with the endowments and assets of their home country. At the same time, they must try to circumvent the limitations posed both by their own history and lack of certain skills. The state may help this process through different measures, both by trying to strengthen local technological and innovative capabilities and infrastructure, as well as by contributing to solve some market failures which constrain the development of the SIS sector.

In fact, there have been some successful experiences in developing and latecomer countries entering into this sector. Many firms from Asian and Latin American

countries, as well as from some countries of the European periphery, have not only managed to acquire dominant positions in their home countries but have also entered the developed country markets. Besides, some large American and European SIS firms have made outward direct investments in developing as well as in latecomer countries, mostly aimed at adapting their products and services to the cultural, linguistic, institutional, etc. features of the different regional markets.

Different entry strategies can be observed. The first dividing line separates those countries whose firms have mainly followed ‘inward-oriented’ strategies (i.e. Brazil, South Korea, etc.) from those where ‘export-oriented’ strategies have been dominant (i.e. India, Ireland, Israel).¹ The second dividing line depends on whether local firms or affiliates of foreign corporations have played a dominant role in the development of the SIS sector.

Among ‘export-oriented’ strategies, one can find different modes of competition. While Indian firms have mainly competed on the basis of low wages and the provision of information services (including the so-called ‘body-shopping’ activities), Israel’s firms have developed significant innovative capabilities in some niche areas such as anti-virus, software security and protection, encryption technologies, etc. In turn, Ireland has been chosen as the base for serving European markets by several large American—as well as by some European—firms, although some indigenous Irish firms have also made significant inroads in this sector.

Although SIS firms in developing and latecomer countries have been largely oriented towards the export of services, there are cases where the export of software products has been more relevant. In turn, the activity of exporting software products can assume different variants. While in Ireland most exports involve adaptations and ‘localizations’ of American software products to the needs of the different European markets, in Israel domestic firms export locally developed products. In India there has been an upsurge of the activity of ‘offshore’ software development.

With regard to the role played by different types of firms, in Ireland foreign corporations clearly dominate but this is not the case in Israel and India. However, domestic firms in these countries have different arrangements with their counterparts in industrialized countries that include subcontracting arrangements, joint ventures, strategic alliances, etc.

Different strategies require different conditions and/or assets in order to be implemented successfully. For instance, in the case of Ireland, the fact of having an English-speaking population played a major role in the decision of the American software companies to install affiliates in that country, but the public policies aimed at attracting foreign direct investment through tax incentives were also a major driving force for those decisions. In fact, neither of these factors alone would have led to the observed massive arrival of foreign investments in the SIS sector.

While the relatively abundant endowment of skilled personnel with low wages has been a clear precondition for the success of the Indian strategy, strategies such as those

¹ See, among other studies, Weber *et al.* (2000) for Brazil, Zhang (2000) for the cases of the Asian developing countries, Teubal *et al.* (2000) for Israel, Tallon and Kraemer (1999) and Coe (1999) for Ireland and Arora *et al.* (1999), D’Costa (2000) and Heeks (1996) for India.

followed by Israel's firms require high-skilled personnel, domestic research capabilities and sophisticated local customers (in the case of Israel, notably the army).

In turn, the state played a significant role in fostering SIS activities through specific policies in most of the countries that have made significant inroads in this sector (such as India, Ireland, Brazil, etc.) as well as in those that have entered more recently (Uruguay, Costa Rica, etc.).

In spite of the variety of strategies followed by countries with a vigorous SIS sector, Heeks (1999) identifies some of the necessary key factors for developing-country firms to be successful. On the one hand, they include microeconomic or enterprise elements such as:

- identification of demand-growth markets and synergies;
- ability to compete via costs or service innovation;
- good marketing;
- access to investment and working capital;
- access to programming, analysis and management skills
- access to information technology; and
- networking mechanisms, both intra-firm as well as with other software firms, potential or actual clients, etc.

On the other hand, public policies also play a key role in areas such as:

- finance (access to working and venture capital and tax incentives);
- education and training;
- research and development;
- intellectual property rights protection;
- state procurement; and
- infrastructure (telecommunications, etc.).

Last but not least, a sort of 'national vision' is also needed (i.e. determining which is the desired specialization and competitive pattern for the SIS sector in each country).

In the next section, we analyse to what extent these conditions are met in the Argentina's case.

3 The SIS sector in Argentina

There was already an incipient activity in the SIS sector in Argentina in the 1970s during the import substitution industrialization process.

The first study on this sector was undertaken in the mid-1980s (SECYT 1987). At that time, nearly 70 per cent of the domestic market was supplied by imported software, and there were about 300 local firms engaged in the provision of SIS. In conjunction with the access to skilled human, the need to take into account the idiosyncratic features of the fiscal and accountancy local regulations was the main advantage of domestic firms. resources. In contrast, their main limitations were the relatively small size of the domestic market, the lack of capabilities in R&D and marketing, and the obstacles for having access to finance (see also Correa 1990).

Some years later the situation had not changed very much. In the early 1990s—after the so-called ‘lost decade’, when the economy was stagnant and high inflation was the rule—there were around 300 SIS firms, which employed nearly 4500 people. Two-thirds of the local market was supplied by imports. In turn, exports were negligible (Correa 1996).

In view of the significant structural reforms (such as trade liberalization and privatization) that have taken place in Argentina in the early 1990s, the sharp increase in imports of goods and services, the boom in FDI inflows and the rapid economic growth between 1991 and 1998, it was expected that a different, and expectedly more vibrant, SIS sector would have emerged in the country. The analysis made in the next sections will shed light on to what extent this kind of transformation has effectively taken place.

3.1 The Argentina’s SIS sector: size and profile

Between 1998 and 2000, a recessive period in the Argentine economy, the turnover of the SIS sector grew by 40 per cent, and employment levels increased by 43 per cent. This performance is due both to the growing local demand of SIS as well as to the so-called ‘Y2K’ effect.²

Table 1
The SIS sector in Argentina, 2000 (US\$ million and %)

Activity	Surveyed firms	Sectoral turnover	Relative share (%)
	(US\$ million)		
Software products	323.2	973	49
Local products	109.9	346	17
Foreign products	199.3	627	32
Information services	323.4	1,017	51
<i>Total sales</i>	632.6	1,990	100
Employment	6,400	15,000	–
Exports	14.4	35	–

² Although no precise data exist on this issue, available information suggests that the sales of the SIS sector fell significantly during 2001 in the context of a deepening of the economic recession that began in 1998.

Table 2
The SIS sector—an international comparison
(latest available year; US\$ million) ³

	Turnover	Exports	Exports/turnover ratio	Employment	No. of firms
India	5,700	4,000	70%	410,000	1,250
Ireland	6,245	5,907	94%	18,300	679
Israel	1,500	700	47%	20,000	300
Brazil	8,038	40	<1%	na	2,500
Uruguay	180	60	33%	2,500-3,000	150
Argentina	1,340	35	<3%	15,000	500
Costa Rica	na	50	na	3,500-4,000	150
Chile	125	15	12%	na	na
Singapore	1,660	476	29%	na	na
China	3,000	na	na	100,000	2,000
Korea	6,000	96	<2%	na	na

Sources: Weber *et al.* (2000) and Bastos Tigre and Junqueira Botelho (1999) for Brazil, Nasscom for India, Tallon and Kraemer (1999) for Ireland, Israel Association of Software Houses for Israel, Computerworld Chile (1999) and Baeza Yates *et al.* (1995) for Chile, MIEM (1999) for Uruguay, Caprosoft for Costa Rica, Coe (1999) for Singapore, Zhang (2000) for Korea and China and our own estimates for Argentina.

The sales of the surveyed firms amounted to US\$ 630 million in 2000 and their employment reached about 6,400 people in that same year. Taking into account that there are nearly 500 firms in the SIS sector in Argentina, and making certain assumptions about the market structure of the sector, it is possible to estimate that the annual turnover of the Argentine SIS sector will reach around US\$ 2,000 million (0.7 per cent of the GDP) and that the firms of the sector will employ approximately 15,000 people (Table 1).

The SIS firms employ high-skilled personnel; 45 per cent of the employees of the surveyed firms are university graduates, while 37 per cent are technicians and university students. Nearly 70 per cent of the employees with graduate and post-graduate degrees come from informatics-related careers. Nonetheless, the proportion of employees with post-graduate studies is very low (4 per cent, half of which correspond to informatics careers).⁴ In this regard, it must be noted that a recent survey shows that Brazilian firms have on average three employees with post-graduate degrees, a figure more than double that of Argentina.

Nearly half of the sales volume of the surveyed firms consists of software products, while the other half comes from services activities. Local products represent about 36 per cent of the sales of software products. Hence, it can be estimated that the annual sales of local software products reach about US\$ 350 million. However, the share of imported software in

³ The estimates of this table include the provision of information services and the sales of local software. We have tried to exclude, as far as it has been possible using the available data, the sales of foreign software. Nonetheless, given the heterogeneity of the sources, it is possible that the definition of the SIS sector in each country may slightly differ, a fact that may hinder the comparability of the figures to some extent.

⁴ Four firms, of which three are foreign owned, employ 40 per cent of the personnel with post-graduate degrees in the SIS sector.

the domestic market is not very different from what was registered in the past, though the data may not be strictly comparable. Furthermore, the market orientation of the SIS firms has not changed in a significant way.

The Argentine SIS sector is still strongly inward-oriented and exports by a small number of firms⁵ are negligible in terms of the sector's turnover. Just 20 of the almost 100 surveyed firms were involved in exports in 2000, and only six had exports/sales ratios above 10 per cent. Exports totalled more than US\$ 1 million in only three firms. This weak export performance is due both to microeconomic factors (the type of products and services offered by the local firms, their weaknesses in terms of quality and marketing capabilities, etc.) as well as to other elements related to the environment in which they operate (high labour costs, lack of access to finance, the absence of public policies supporting the exports of SIS, etc.). More on these issues below.

How does the Argentinean SIS sector compare with those of other latecomer countries? Table 2 clearly shows that Argentina is well behind countries such as India, Israel, Ireland and Singapore not only in terms of the sector's turnover but also in terms of the weak export performance. The same can be said in a comparison of a neighbour and much smaller country—Uruguay.

In comparison, even if exports are also very low in other countries such as Brazil and Korea, their domestic sales are much higher than in Argentina, a fact that may compensate for the absence of exports to a certain extent.

3.2 Age, size, nationality and recent performance of SIS firms

Most Argentine SIS firms are young: the surveyed firms were, on average, 11 years old. Sixty-five per cent of the surveyed firms were established after 1990, with a few firms created before the 1980s (and most of these are firms whose main activity is the provision of hardware and telecommunications equipment that also sell information services). In spite of being a minority within the sector, firms established before 1990 accounted for more than two-thirds of SIS sales in 2000. Furthermore, while their sales grew by 57 per cent between 1998 and 2000, the sales of firms created after 1990 increased by 48 per cent in the same period.

Locally-owned small and medium-sized enterprises (SMEs) are clearly prevalent in this sector; 80 per cent of the firms that answered our survey were SMEs and 85 per cent were locally owned.

However, foreign firms account for two-thirds, and firms with more than 50 employees account for 86 per cent of the turnover of the SIS sector (Table 3). In turn, only 9 per cent of the surveyed firms had annual sales above US\$ 15 million, while 46 per cent of the firms sold less than US\$ 1 million a year, and 22 per cent of the firms had sales valued between US\$ 1 and 2 million (Table 4).

⁵ Two-thirds of the exports of the surveyed firms were made by the local affiliate of a German transnational corporation.

Hence, the structure of the sector is very heterogeneous, with a small group of big and mostly foreign owned firms having the lion's share of the local market, and many domestic SMEs with very low levels of sales and employment.

Firms whose main activity is the provision of information services account for nearly half of the sector's turnover and employment levels (Table 3). A small group of firms that sell foreign packaged software products contributes 37 per cent of the sector's turnover. Finally, several local software developers account for 18 per cent of the turnover and 33 per cent of the employment within the sector.

The recent performance of the different groups of firms has been heterogeneous. The firms whose sales increased the most were those dedicated to the provision of information services as well as those that sold foreign software products. In turn, the biggest firms grew more than the SMEs, and foreign firms more than local firms (Figures 1, 2 and 3).

Table 3
Sales, employment and exports of the surveyed firms, 2000
(US\$ million, number of employees and %)

	Sales		Employment		Exports	
	US\$ million	Share, %	No. of employees	Share, %	US\$ million	Share, %
By origin of capital						
Foreign firms	415.1	66	2,702	42	10.5	73
Local firms	217.4	34	3,697	58	3.9	27
Total	632.6	100	6,399	100	14.4	100
By size						
Large ⁽¹⁾	544.2	86	4,598	72	10.1	70
Medium ⁽²⁾	74.5	12	1,340	21	3.9	27
Small ⁽³⁾	13.9	2	461	7	0.4	3
Total	632.6	100	6,399	100	14.4	100
By main activity						
Local products ⁽⁴⁾	112.3	18	2,082	33	10.8	75
Foreign products ⁽⁵⁾	231.9	37	1,164	18	0	0
Information services ⁽⁶⁾	288.3	46	3,153	49	3.6	25
Total	632.6	100	6,399	100	14.4	100

Notes: ⁽¹⁾ 50 employees or more.

⁽²⁾ Between 10 and 50 employees.

⁽³⁾ 10 employees or less.

⁽⁴⁾ Local and foreign firms whose main activity in the SIS sector is the development of software products in Argentina.

⁽⁵⁾ Local and foreign firms whose main activity in the SIS sector is the commercialization of foreign software products in Argentina.

⁽⁶⁾ Local and foreign firms whose main activity in the SIS sector is the provision of information services (customized software, implementation of software packages, consultancy, etc.).

Table 4
Turnover levels of the SIS firms in Argentina (%)

	Share, %
Less than US\$ 1 million a year	46
Between US\$ 1 and 2 million a year	22
Between US\$ 2 and 5 million a year	13
Between US\$ 5 and 15 million a year	10
More than US\$ 15 million a year	9

3.3 Customer's profile

As shown in Table 5, the main customers of the Argentine SIS sector are large firms, accounting for two-thirds of the sectoral turnover.

In the case of big and medium-sized SIS firms,⁶ large firms, jointly with the government sector, comprise more than 80 per cent of their sales. These customers acquire mostly foreign software products and information services, that are mostly related to the implementation and customization of complex software packages.

While home users are not relevant as customers for the SIS sector,⁷ the government buys almost exclusively from big and medium-sized firms. Many SMEs have reported that they experience many difficulties in becoming suppliers of the government. Frequently that they cannot even enter tenders for the provision of SIS to the public sector, given the fact that bids are usually open only to 'short-listed' companies composed exclusively of foreign firms.

Table 5
Turnover structure by type of user (%)

	Type of SIS firms						
	Total	Local products	Foreign products	Information services	According to size of firm:		
					Big	Medium-sized	Small
Home users	1	0	6	0	1	0	10
SMEs	16	29	37	3	15	17	55
Large firms	66	55	50	77	66	74	32
Government	16	16	7	19	18	7	2
Others	1	0	1	1	0	2	0
Total	100	100	100	100	100	100	100

⁶ Medium-sized firms were defined as those having between 10 and 50 employees. Firms with less than 10 employees were defined as small, while big or large SIS firms were those with more than 50 employees.

⁷ The low share of home users in the sales of the SIS sector is mainly due to the high piracy levels that exist in that segment of customers. In addition, home customers buy mostly, if not exclusively, foreign software products.

In contrast, the main customers of the small SIS firms are SMEs, which account for 50 per cent of the sales for that group of firms. Hence, given the fact that SMEs in Argentina have been deeply affected by the recession beginning in 1998, it is not surprising to find that the performance of small SIS firms has been worse than that of medium and big firms between 1998 and 2000. It must also be taken into account that the share of SMEs customers is higher for those firms that sell packaged products — both local as well as foreign—than for those that are specialized in professional services (which are mainly oriented towards large customers).

Figure 1
Total turnover by type of firm, 1998-2000

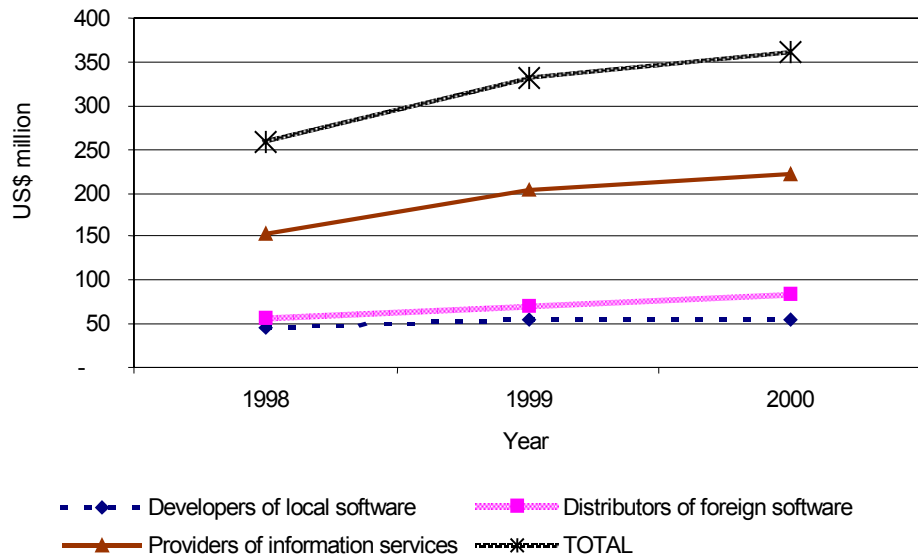


Figure 2
Total turnover by size of firm, 1998-2000

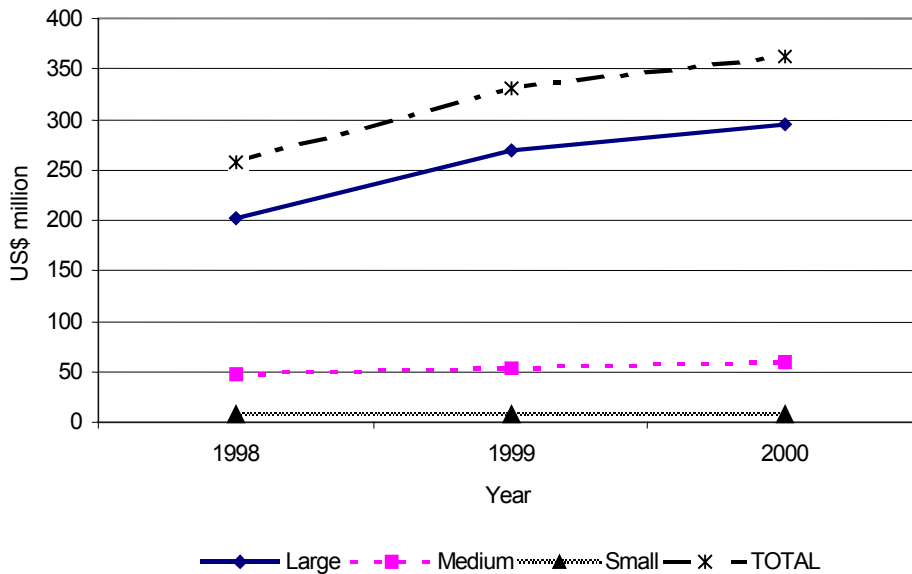
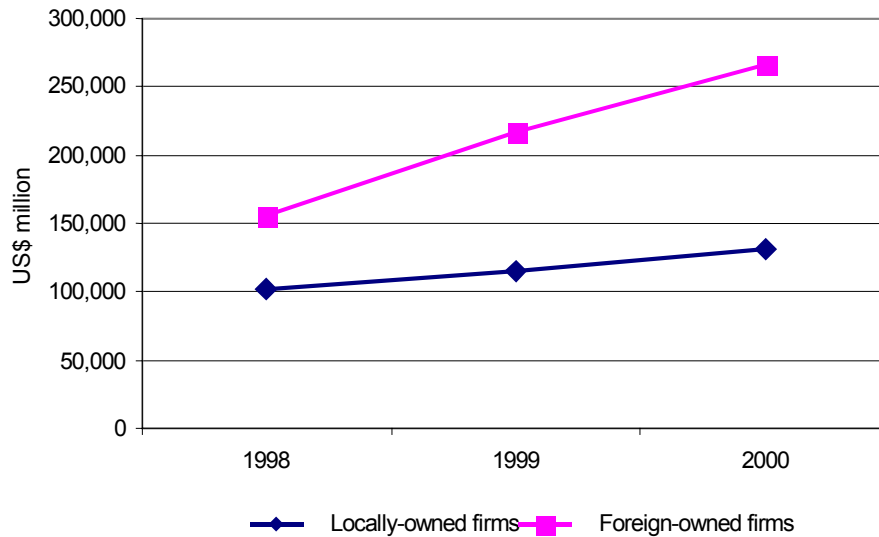


Figure 3
Total turnover by origin of firm



3.4 Programming tools and platforms

Visual Basic is the most common programming language (nearly two-thirds of the surveyed firms use it). HTML and Java, which are mostly oriented towards Internet applications, are also widely used (58 and 48 per cent of the surveyed firms used these languages, respectively). Regarding object-oriented languages, as mentioned before, Java is widely known, while this is not the case with Smalltalk (only 11 per cent of the surveyed firms use this language). C++, which is partially an object-oriented language also, is used by 38 per cent of the firms. The largest SIS firms utilize the most advanced languages. While 21 per cent of the big firms employ Smalltalk for programming, none of the small firm use it. In comparison, Java is utilized by 68 per cent of the big firms and by 29 per cent of the small ones. Usage percentages for C++ are 53 per cent for the big firms versus 21 per cent for the small ones.

Almost all firms develop software products for personal computers, and many of them offer only software products for PCs. In turn, the different versions of Windows (NT/98/95/2000) are clearly dominant. In fact, 88 per cent of the firms develop products for Windows NT, a fact that is consistent with the finding that most SIS firms are oriented towards business customers (see below). Expectedly, large and medium sized firms are the main providers of SIS mainframes, AS/400 and workstations. There are few firms oriented towards less conventional platforms (such as industrial equipment and consumer devices).

Nearly half of the surveyed firms develop software products for UNIX-type operative systems, Linux, Solaris and HP-UX being the most popular. While large and medium sized firms are clearly dominant in the case of Solaris and HP-UX, it is important to highlight the fact that 25 per cent of the firms developing products for Linux are small.

3.5 Quality standards and marketing capabilities

Large firms tend to adopt better quality standards than SMEs. Between 55 and 60 per cent of the large firms under review make strategic plans that are periodically updated, agree on quality goals and measure quality indicators in a systematic way. In contrast, the proportion of SMEs that undertake those practices regularly varies between 20 and 30 per cent.

Only 16 per cent of the surveyed firms have a quality certification, which is very low in comparison with other developing countries (for instance, a survey made in Brazil in 1999 showed that 26 per cent of the Brazilian firms had a quality certification).⁸ Expectedly, 40 per cent of the large firms had a quality certification versus only 9 per cent on the part of the SMEs. In turn, 21 per cent of the local developers had a certification, which in the case of information services providers was only 9 per cent.

With regard to marketing, most firms employ two or more channels, but the preferred channel is direct contact with customers. Consultancy activities are also a way to establish new contracts. In comparison, subcontracting is almost non-existent. The key role played by direct contact with customers is consistent with the fact that local SIS firms are highly inward oriented. Nonetheless, it must be noted that some firms have opened commercial offices abroad, trying to replicate the network of contacts they have developed locally.

3.6 Competitive advantages and disadvantages

Customers of the local software developers are mostly active in sectors such as banking, retail and wholesale trade, health care and telecommunications, as well as in public administration. In any case, the firms that develop local software are mainly concentrated in making products for such fields as accountancy and enterprise management solutions. These products are mostly oriented towards the domestic SMEs that cannot afford to buy expensive software packages provided by the large international software firms (such as SAP, People Soft, etc.). In addition, there are highly 'idiosyncratic' features of the local legislation governing accountancy rules, fiscal and labour regulations, etc., that give some advantage to domestic software providers because even though the software packages offered by large international providers can obviously be adapted to meet local requirements, 'customization' costs are far beyond the available budget of most domestic SMEs.

In turn, this advantage of the local software developers may become a constraint in selling their products abroad. The same factors that prevent local customers from using foreign software packages also act as barriers for Argentine software developers in attempts to penetrate third markets. Furthermore, in these markets Argentinean firms lack information on the 'business culture' and the personal contacts which are the key factors of their survival in the domestic market, but which become handicaps abroad.

In fact, when questioned about their main strengths and weaknesses, local firms mostly answered that their main strength was in their capacity to adapt to the specific

⁸ Weber *et al.* (2000).

requirements of their customers. In turn, their weaknesses seem to consist mostly of the lack of scale of their production and the inadequacy of their marketing channels.

Local SIS firms are highly diversified in terms of the activities they develop and the kind of services/products they offer. While this may reflect, on one hand, great flexibility for adapting to different demands, it may on the other hand be the result of the impossibility of surviving through specialization strategies in a relatively small local market. Especially, the latter may be the case for the small SIS firms that are forced to face diversified demands if they wish to stay in the market. Nonetheless, this can become an obstacle to the future development of the sector, since these firms are losing potential gains which could be derived from business strategies that focus on developing 'core' specialization areas.

Furthermore, the sort of 'natural protection' that the local SIS firms used to enjoy from the 'idiosyncrasies' of the local market is gradually eroding due to:

- The large international software providers are increasingly entering the 'top' of the SMEs market by offering less expensive packages suited to the needs of these firms;
- Many foreign firms (specially from Spain) are competing with prices in the SMEs segment with packaged products;
- Technological changes (software updates through Internet, technical support via call centres, etc.) are eroding advantages enjoyed by local firms;
- Several local firms have been acquired by transnational corporations (TNCs), whose affiliates tend to prefer foreign software packages (see Stamm 2000).

Furthermore, even if the market for local SIS firms expands as a result of domestic SMEs needing to upgrade their informatics structure, doubts remain about the effective volume that can be achieved in the market because over the last decade SMEs have been going through a difficult restructuring process and face severe economic and financial problems.

Thus, in view of the above mentioned difficulties that local SIS firms face in trying to market business software products abroad, the obvious conclusion is that the specialization in the SIS market segment does not look very promising for Argentine firms. At the same time, even though previous studies have noted that Argentina has competitive advantages for developing SIS for certain market niches (entertainment, applications for health care systems, industrial automation, public administration and agricultural production, etc.),⁹ our survey does not show any indication towards the specialization of the local SIS firms in any of these areas.

⁹ According to Perazzo *et al.* (1999) Argentina should have advantages to make inroads in these activities due to: i) a relatively high cultural level, at least by Latin American standards; ii) domestic markets for these activities may reach significant dimensions, especially in agricultural and health applications, as well as in entertainment iii) information technologies are rather well diffused in the public sector—once more, compared to Latin American standards; iv) the lack of linguistic barriers may facilitate the penetration in other Latin American countries.

Nonetheless, some firms work in SIS for telecommunications, and some investments by TNCs have been announced in this area. If these investments materialize, a cluster of sorts could emerge in this area.

Finally, even though we have been reviewing local software ‘developers’, it needs to be noted that local firms rarely make true ‘innovations’. Instead, they are mostly dedicated to improving and adapting their products to new technologies and platforms or to widening the range of applications of their products, though there has been at least one case where a local firm built their market success on its innovation capability.

In this regard, notice must be taken of the fact that local firms have very few linkages with R&D institutions, universities, consultancy firms, etc. Furthermore, the relatively small size of the domestic market poses an obstacle for undertaking innovative activities, since the costs should be difficult to recover. Last but not least, local demand, especially that of SMEs, does not seemingly induce SIS firms to significantly upgrade their innovative and learning capabilities.

4 The impact of the macroeconomic and institutional environment

According to the surveyed firms, the Argentine macroeconomic and institutional environment has both positive and negative impacts on the development of the SIS sector.

Among the positive factors, the quality of domestic human resources is clearly valued the most by the SIS firms, especially by the large and medium-sized enterprises, as well as by those which provide information services and by those that develop local software products.

On the other hand, labour costs are relatively high. They are, in fact, higher than those in some countries of the European periphery (Portugal, Greece, Ireland) and thus impose a disadvantage to Argentina as a location for developing export-oriented SIS activities, since these European are closer to the main markets and they belong to the EU. However, with the massive devaluation of the peso in 2002, labour costs are now much lower than before and should constitute a positive factor for increasing the price competitiveness of local SIS firms.

In turn, even though it is widely acknowledged that Argentine graduates in informatics-related careers are well trained, according to Perazzo *et al.* (1999) there are few universities with a staff of full-time professors or where research is done *pari passu* with teaching activities. In addition, there are very few post-graduate courses, and their quality is assessed as mediocre. Since budget restrictions have for a long time prevented the country from offering a wide grant programme which would enable students to study abroad, it is no surprise that only about 30 professionals with doctoral degrees currently work in the Argentine SIS firms. Thus, the SIS sector lacks high-skilled professionals for high-level consultancy or research activities. In turn, university teaching is affected not only by the lack of high-quality personnel, but also by the fact that university wages are very low compared to the private sector. In addition, best students are often hired by private firms before completing their graduate courses, and many of these never graduate. Furthermore, universities do not seem to instil an

entrepreneurial attitude among their students, a factor that may be hindering the creation of new firms.

In any case, it is clear that the scarcity of high-level personnel is a major limitation to developing innovative activity, and is also a factor that may negatively affect the academic training of students. Last but not least, if the local demand for professionals in this area continues to increase and the 'braindrain' of the last years is not stopped, a shortage in the absolute supply of professional for local SIS firms is foreseeable in the medium term.

It also needs to be mentioned that even though the telecommunications infrastructure has substantially improved over the last decade, telecommunication costs were considered high by local firms. With the peso devaluation, these costs are now lower but the quality of service may be also less due to the higher costs of importing inputs, components and equipment for telecom companies. This factor may cause further delays in the technological modernization of the communications infrastructure.

On the other hand, the use of information technologies has grown substantially in both the public and the private sectors. Argentina is above the average for Latin American in terms of the diffusion of information and communication technologies, but other countries such as Uruguay, Brazil, Chile and Mexico show comparable or even better indicators.

Another clearly negative factor for the development of the SIS sector is access to finance. SIS firms, and SMEs in particular, have trouble in accessing the formal financial system. In addition, there is a lack of financing alternatives since the stock market is weak and systems such as venture capital are almost unknown.¹⁰ Even though some public policies aimed at facilitating access to credit by SMEs have been in effect for many years, they do not extend to the specific circumstances of these high-tech sectors that mainly produce intangibles and are knowledge intensive. The situation has worsened recently because, following foreign debt default and currency devaluation, the current problems in Argentina's financial sector have cut off the access to formal financial mechanisms for the time being. Thus, in this scenario, it comes as no surprise to find that some local firms wanting to expand their operations have looked for funds from abroad.¹¹ At least two firms taking this step have finally sold the majority stake of their companies to foreign owners. In any case, this may not necessarily be bad insofar as the management remains in local hands and domestic development activities are preserved.

Research and technological institutions are generally weak in Argentina, and this is all the more visible in the case of the SIS sector. There are almost no R&D activities in software either in public institutions or in universities. Furthermore, when these activities are undertaken, they have no commercial impact. Even though the government has put in place some initiatives aiming at fostering R&D activities in private firms since the mid-1990s, they have had only a marginal effect on the mostly negative scenario. In this regard, it needs to be noted that the size of the domestic market is

¹⁰ The problem of access to finance is common to all high-tech SMEs in Argentina.

¹¹ In fact, this is not unusual for this sector, since the same has happened even with some successful European firms.

judged by the SIS firms to be too small for recovering the high costs faced by firms trying to undertake truly innovative activity.

Which public policies do the SIS firms consider as the most helpful in order to foster the development of the sector? Given the fact that firms consider the tax burden to be the factor that causes the greatest hindrance to their operations, it is no surprise to find that fiscal incentive measures have been much appreciated by the firms under review.

In comparison, policies aimed at facilitating access to foreign markets have not been perceived as relevant. This is a reflection of the fact that SIS firms do not seem to be worried about the excessive inward-orientation of the sector. Policies geared at fostering entrepreneurship, such as incubators, etc., have also been viewed as somewhat relevant by the surveyed firms.

Finally, piracy levels are above the average or Latin American. This is due more to the low level of domestic law enforcement rather than the absence of regulations governing software piracy.¹² Understandably, firms distributing foreign software products are worried about this situation.

5 Conclusions and policy suggestions

From what has been said, it seems clear that the Argentine SIS sector is missing most of the conditions considered by Heeks (1999) as key elements for successful entry into this activity.

It has been suggested that some incidents, where an export-oriented strategy has been followed, may have become confined to a low-innovation trajectory.¹³ The experience of Argentina shows that strategies which are strongly focused on serving the domestic markets by taking advantage of local circumstances (geographic and cultural proximity with customers, the distinctive features of domestic accounting, fiscal, labour, etc. regulations) may also lead to the same type of 'lock-in' or confinement. Factors, which facilitate the survival of SIS firms in their local environment, may also prevent them from developing the evolutionary learning process needed for a sustainable expansion strategy for this sector.

The Argentine SIS sector is dominated by a small group of mostly foreign-owned large firms, which mainly sell foreign software products and/or provide information services. These services are associated with the implementation and customization of complex software packages for large customers, including private firms and government organizations. This group of dominant firms had a relatively better performance between 1998 and 2000 vis-à-vis other SIS firms. There are, on the other hand, several small, young local firms that develop software products and provide different information services. Their main clients are SMEs. As a whole, this group of firms did not perform as well as the large SIS firms.

¹² According to the Business Software Alliance, piracy rates in Argentina are around 62 per cent compared to 36 per cent for world level and 59 per cent for the Latin American average. Piracy, however, is declining, going from 80 per cent in 1994-95 to 62 per cent in 1998-99.

¹³ See D'Costa (2000) for details on the case of India.

Domestic firms have basically focused on a particular segment of the domestic market (software for accountancy, management, etc.) where they enjoy advantages derived from the idiosyncratic feature of the domestic regulations and their knowledge about the business culture and the needs of their local clients. However, for different reasons, these advantages seem to be fading and the SIS firms—or at least the majority of them—have not been able to redefine their market strategy and their specialization pattern, and they survive mostly by supplying the demands that they feel they may be able to satisfy.

The peso devaluation may have solved some of the problems Argentine SIS firms faced in attempts to compete in the area of skilled-labour costs, but it does not solve the systemic problems of the sector:

- Apart from some isolated exceptions, Argentine SIS firms have never competed through innovation;
- There is a lack of marketing and management capabilities;
- Networking mechanisms are weak, both among SIS firms as well as with their customers, R&D institutions, etc.; and
- Access to investment and working capital has always been a problem and presently working capital exists neither from local nor international sources.

The situation is even worse with regard to public policies. The lack of access to finance is a problem not only for SIS firms, but for most Argentine SMEs. Venture capital is almost unknown and tax incentives are absent. R&D capabilities are very weak; there are problems with the enforcement of intellectual property rights; the telecommunications infrastructure is modern but expensive, and state procurement does not favour local provision of SIS. With regard to human capital, the level of graduates in informatics is good, but there is a shortage of high-skilled personnel. Finally, nothing like a ‘national vision’ of the SIS sector exists in the Argentine case.

In this light, it is not surprising to find that even though the SIS sector has grown during the last ten years, it has not been able to overcome the problems diagnosed already in the 1980s and early 1990s: lack of access to finance, excessive inward-orientation, lack of marketing and R&D capabilities, etc.

The fact that this sector has grown in spite of the absence of stimulating public policies may be considered as proof of the ability of the SIS firms to survive without public support. However, it is clear that the dynamic perspectives of this trajectory are, to say the least, very uncertain.

As mentioned before, there is a small number of large, mostly foreign-owned firms that have performed very well in recent years and that are geared to selling foreign software products or to providing information services for the public sector and large domestic customers. Compared to the SMEs of the SIS sector, these firms have a relatively better access to human resources and finance, are advanced more in terms of quality management systems and dominate the most modern programming tools. However, they seldom undertake innovative activity and rarely export their products and services.

On the other hand, there are several small and medium-sized SIS firms that lack the size, human resource capacity and capital to engage in truly innovative processes, and are thus forced to survive mostly through inward-oriented strategies where they utilize the ‘localization advantages’, i.e. their knowledge and their capability of adaptation to the local regulations, customers requirements, business culture, etc.

In this environment, the Argentine SIS sector may continue growing *pari passu* to meet the local demand, but it is highly improbable that it will develop into a dynamic and internationally competitive sector. Its development will be constrained, among others, by the relatively small size of the domestic market, the lack of access to finance and of marketing and R&D capabilities, the absence of networking mechanisms, the paucity of public support (i.e., tax incentives, state procurement, etc.), the weakness of quality management systems and the shortages in the availability of high-skilled personnel.

To revert this negative outlook, there is need for measures aimed at improving the SIS firms capabilities and endowments, as well as public policies to support this sector, so as to restructure the SIS sector in order to dramatically increase its export capacity. While the peso devaluation certainly brings some relief, it is of major importance to work on non-price competitiveness issues as soon as possible. This should be accomplished through a gradual process, in which improvements in the firms’ competitive position will allow them to increasingly penetrate foreign markets. This, in turn, this might result in a sort of ‘virtuous circle’, since local firms, once having gained access to expanded markets, could attempt to cater to the requirements of foreign customers. These can be not only different but in some cases also more demanding than those of local customers. The state needs to help in this process through some support measures as well as through enhancement of the local technological structure and the system of human resources formation. The creation of a supportive environment which would induce young entrepreneurs to engage in this sector should also be a major task for the state. This could be done, for example, by dismantling red tape and barriers, facilitating the access to finance etc. Lastly, *pari passu* there is the strengthening of the domestic SIS firms: the possibility of attracting large international SIS firms should be explored in order to establish their regional basis in South America, since Argentina—in spite of all the problems mentioned above—has some major advantages which would allow the country to achieve a dominating presence in the region.

References

- Arora, A., V. S. Arunachalam, J. Asundi, and R. Fernandes (1999). ‘The Indian Software Services Industry’. Pittsburgh: Heinz School, Carnegie Mellon University. Mimeo.
- Baeza Yates, R., A. D. A. Fuller, J. A. Pino, and S. E. Goodman (1995). ‘Computing in Chile: the jaguar of the Pacific Rim?’. *Communications of the ACM*, 38: September.
- Bastos Tigre, P., and A. J. Junqueira Botelho (1999). ‘Brazil Meets the Global Challenge: IT Policy in a Post-Liberalization Environment’. November. Draft.
- Coe, N. M. (1999). ‘Emulating the Celtic Tiger? A Comparison of the Software Industries of Singapore and Ireland’. *Singapore Journal of Tropical Geography*, 20 (1).

- Computerworld Chile (1999). '¿En qué está el software chileno?', No. 196.
- Correa, C. (1990). 'The Legal Protection of Software. Implications for Latecomer Strategies in Newly Industrializing Economies and Middle-Income Economies'. Technical Paper No. 26. Paris: OECD Development Centre.
- Correa, C. (1996). 'Strategies for Software Exports from Developing Countries'. *World Development*, 24 (1).
- D'Costa, A. P. (2000). 'Export Growth and Path-Dependence The Locking-in of Innovations in the Software Industry'. Paper presented at the 4th International Conference on Technology Policy and Innovation, Curitiba, August.
- Heeks, R. (1996). *India's Software Industry: State Policy, Liberalization, and Industrial Development*. New Delhi: Sage Publications.
- Heeks, R. (1999). 'Software Strategies in Developing Countries', Working Paper Series N° 6. Manchester: IDPM, University of Manchester.
- MIEM (Ministerio de Industria, Energía y Minería) (1999). Informe Sector Software. Montevideo.
- Nasscom (2000). 'Indian IT Software and Services Industry'. New Delhi: Nasscom.
- Perazzo, R., M. Delbue, J. Ordoñez, and A. Ridner (1999). 'Oportunidades para la producción y exportación argentina de software'. Documento de Trabajo No. 9. Buenos Aires: Agencia Nacional de Promoción Científica y Tecnológica.
- SECYT (Secretaría de Ciencia y Técnica-/Subsecretaría de Informática y Desarrollo) (1987). 'Producción y comercio de software en la Argentina'. Documento SID No. 35. Buenos Aires: SECYT.
- Stamm, A. (2000). 'La industria argentina de software: perfil, opciones de desarrollo y recomendaciones de política para su fomento'. Buenos Aires. Draft.
- Tallon, P., and K. Kraemer (1999). 'Ireland's Coming of Age with Lessons for Developing Countries'. *Journal of Global IT Management*, 3 (2).
- Teubal, M., G. Avnimelech, and G. Alon (2000). 'The Israeli Software Industry: Analysis of the Information Security Sector'. TSER PROJECT 'SME in Europe and Asia: Competition, Collaboration and Lessons for Policy Support'. Draft.
- Weber, K., C. J. do Nascimento, D. da Silva Marinho, and G. Durski (2000). 'Measurements of Quality and Systemic Productivity in the Brazilian software Industry'. Paper presented at the International Productivity Symposium, Curitiba, May.
- Zhang, G. (2000). *Knowledge-based industries in Asia*. OECD, Science, Technology, Industry, Paris: OECD.