

**Information and Communication
Technology (ICT) for development of
small and medium-sized exporters
in Latin America:
Mexico**

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IDE-JETRO

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Abstract

Although small and medium-sized enterprises (SMEs) in Mexico are gradually adopting information technology (IT), many are still far from fully leveraging the potential operational advantages of that technology. This is especially true of SMEs whose interaction with large clients or whose role in supply chains depends on their ability to share various types of information, such as information related to inventories, factoring, production control and logistics, and to connect to their clients' headquarters. The lack of a more fully developed IT culture partly explains Mexico's lagging international competitiveness.

A new IT culture has begun to emerge within many large companies, and a small number are implementing enterprise resource planning (ERP) systems; however, only a few are improving their competitiveness by using second-generation customer relationship management (CRM) systems.

Although ERP-based solutions appear to be gaining acceptance among Mexican SMEs, in many cases such solutions are inadequate, because of the many obstacles preventing ERP from being implemented according to the needs of individual companies. Foremost among these difficulties is the fact that most Mexican companies lack information on management and operational procedures.

The case studies presented in this survey underline Mexican SMEs' reluctance to use IT and their poor understanding of it. Even SMEs in the most advanced economic sectors continue to be hesitant to use IT-based solutions—or to improve upon systems in place—to gain a competitive advantage. Hence, the Government needs to implement an industrial policy that will promote the development of such tools and a program to test various software applications. From this perspective, economic policy instruments implemented by the federal Government to encourage the development of the IT industry in Mexico and instil an IT culture among SMEs might prove to be one of the most important ways of enhancing SME competitiveness in many business sectors.

I. The current IT market and IT use by SMEs

A. Market estimates

The 2,095 companies in Mexico's IT industry employ 110,000 professionals. Their annual output exceeds US\$ 600 million. Yet, IT-related expenditures in Mexico account for only 1.4% of gross domestic product (GDP).

Mexico's fledgling software-development industry is characterized by slow growth and a high degree of dispersion. Many companies have family-management structures, are new to the industry, are unable to obtain financing and lack market credibility. The failure rate is high: fewer than 50% of these companies remain in business for two years. The industry is composed of a small number of businesses most of which do not meet internationally recognized quality standards such as Carnegie Mellon Software Engineering Institute (CMMI) or the International Organization for Standardization (ISO) 15504 model, among others.

There is little information on the number of SMEs that, either on their own or in conjunction with medium-sized or large enterprises with IT departments develop computer products and services for their own use.

In addition to the lack of financing, including loans and leasing plans, SMEs are saddled by the lack of a stock exchange for the SME sector, which makes it difficult for their employees to participate as investors in business ventures. This obstacle to employee participation in company ownership and in earnings on share valuations harms companies in the short term by preventing them from retaining highly qualified human resources.

SMEs in the IT sector generally do not have a large amount of fixed assets to use as collateral to secure bank loans. Their main assets are the talent of their personnel and their technological intellectual property. Their greatest need is for working capital to cover current expenditures such as payrolls, certifications, materials, rent, advertising and marketing and business travel. These expenditures are governed by the economic cycles of their business projects.

This issue is difficult for the loan officers of traditional banks to understand, because they usually deal with businesses having a different profile. As a result, in Mexico there is a low rate of creation of new IT businesses and a high failure rate of companies in the process of moving up the economic ladder, due to their inability to obtain financing.

In this business sector, talented employees are frequently lured away by competitors, making it more difficult for new SMEs to survive. The global IT industry, including that of the United States, draws talent from all over the world. In 2003, the United States Department of Commerce reported a deficit of some 1.4 million programmers in the country. International Data Corporation (IDC) estimates that the number of openings in Europe rose from 510,000 in 2002 to 1.6 million in 2006. Moreover, the United States and Europe had a combined need for 3 million programmers in 2003. To prevent United States companies from losing competitiveness due to managerial talent being lured to other countries, the United States and Mexico signed an agreement, allowing more than 1,500 Mexican IT experts to receive work visas for the United States each year since 2002. (Similar agreements have also been signed with the Indian and Irish Governments).

TABLE 1
MEXICO'S PARTICIPATION IN THE GLOBAL IT MARKET, 1994-2002

		1994	1997	1998	2002
Mexico	(%)	0.8	0.5	0.6	0.5
World	(US\$ millions)	414 398	716 903	781 297	2 180 000

Source: National Institute of Statistics, Geography and Information (Instituto Nacional de Estadística, Geografía e Informática (INEGI)), on the basis of IDC, Worldwide Black Book, 199, Gartner Group, 2003.

Mexico accounts for a very small portion —less than 0.6%— of the overall global IT market. According to a 2003 study by Intel Mexico, SMEs' propensity to acquire computer equipment and implement IT-based solutions had decreased 7.4% in the previous two years, partially explaining Mexican enterprises' loss of competitiveness. As noted by Rodrigo Sandoval Arroyo, head of Intel Mexico: "There is a direct correlation between Mexican SMEs' lower investment in technology and their loss of competitiveness". Mexico's IT-related enterprises have a much lower rate of technology penetration than do those in countries such as India, Brazil and Russia. The same study indicated, however, that Mexico's market for home computers grew by 10.9% in the same period, as compared with a 4.1% drop in business purchases.

TABLE 2
IT MARKET IN MEXICO, BY ECONOMIC ACTIVITY, 1998-2002
(In millions of U.S. dollars)

Economic activity	1998	1999	2000	2001 ^a	2002 ^a
Overall	4 134.9	4 856.4	5 716.2	5 929.9	6 185.7
Public services	665.9	764.3	850.9	877.5	915.1
Finance	1 347.1	1 537.5	1 637.6	1 638.0	1 723.8
Distribution	598.3	680.0	812.0	860.6	904.5
Services	233.5	275.0	325.9	336.3	351.8
Discrete manufacturing	260.6	298.9	346.1	350.2	358.0
Processes manufacturing	553.8	631.8	729.6	751.6	769.4
Home construction	475.7	668.9	1 014.1	1 115.7	1 163.1

Source: National Institute of Statistics, Geography and Information (INEGI)/Select-IDC (October 2001).

^a Estimate.

Financial entities, including banks, and other institutions use IT intensively. The first reason for this is the recent internationalization of Mexico's banking sector. The second reason is the need for enhanced quality, transparency and efficiency in government services. The third reason is demand from distribution companies, which use IT to track shipments and inventories. In addition, the manufacturing industry is increasingly adopting IT to promote competitiveness and ensure smooth information flows with suppliers and distributors. Other important IT users are the energy and communications sectors.

TABLE 3
MEXICAN IT MARKET BY SEGMENT, 1998-2002
(In millions of U.S. dollars)

Segment	1998	1999	2000	2001	2002
Overall IT	4 106.1	4 512.7	5 091.9	5 648.9	6 080.4
Computers	2 124.5	2 179.2	2 333.5	2 507.1	2 677.5
High-end servers	32.0	25.4	21.2	18.6	15.9
Midrange servers	168.0	174.7	187.8	206.6	227.5
Low-end servers	221.8	230.5	248.6	267.0	288.0
Peripheral servers	85.0	98.0	109.0	123.5	146.5
PCs	1 313.6	1 350.4	1 450.9	1 559.0	1 654.4
Work stations	33.0	32.0	32.1	32.2	31.7
PCs terminals/station servers	271.1	268.1	283.8	300.2	313.5
Bundled software	471.4	514.2	566.0	614.8	648.8
Systems/tools	73.1	77.0	81.2	83.8	84.4
Hardware applications	164.6	177.9	195.6	212.0	222.7
Solutions applications	233.8	259.3	289.3	319.0	341.8
Data communications equipment	249.9	289.7	334.8	379.2	418.4
Services	1 260.3	1 529.6	1 857.6	2 147.8	2 335.7
Professional consultancy services	962.2	1 209.1	1 505.1	1 768.5	1 941.0
Maintenance	298.1	320.5	352.5	379.3	394.7

Source: National Institute of Statistics, Geography and Information (INEGI), Economic Indicators, 2003/Select-IDC (October 1998).

Note: The computer-equipment segments with the strongest growth in sales are midrange-peripherals and low-end servers. The new service with the highest potential market growth for SMEs is not expensive on-site software licenses and systems infrastructure but application service provider (ASP) solutions. The number of highly trained IT professionals has grown over the past 10 years, thanks to their rising employment by banks, large companies and IT service providers.

In general, the product make-up of Mexico's IT markets has varied little in recent years, despite declining investment in equipment by industry and business due to downsizing and economic stagnation in the country, which, in turn, has led to greater IT outsourcing. The education sector is placing greater importance on IT as well as stepping up its purchases of IT equipment and software as more personal computers (PCs) are bought for home use.

All figures are taken from estimates by the sources.

According to the IDC study, software sales in Mexico in 2003 totalled approximately US\$ 800 million, with the software market expected to grow at an average annual rate of 6% from 2003 to 2007. More than 90% of general software packages were imported from the United States.

Most software sales consisted in applications packages rather than integrated information system solutions. This niche market was expected grow 5.1% per annum from 2003 to 2007. Ninety percent of the applications in this market were developed in Mexico. Customized software packages are very popular among Mexican enterprises because of their price competitiveness vis-à-vis the high-end ERPs or CRMs made by companies such as SAP or JD Edwards.

Telecommunications infrastructure expanded at a fast pace and paved the way for the expansion of IT operations, through, for example, new networks and the spread of broadband Internet. Growth was stronger in telecommunications services than in infrastructure, which encouraged the Government to modernize its own equipment and promote new telecommunications networks based on advanced technology.

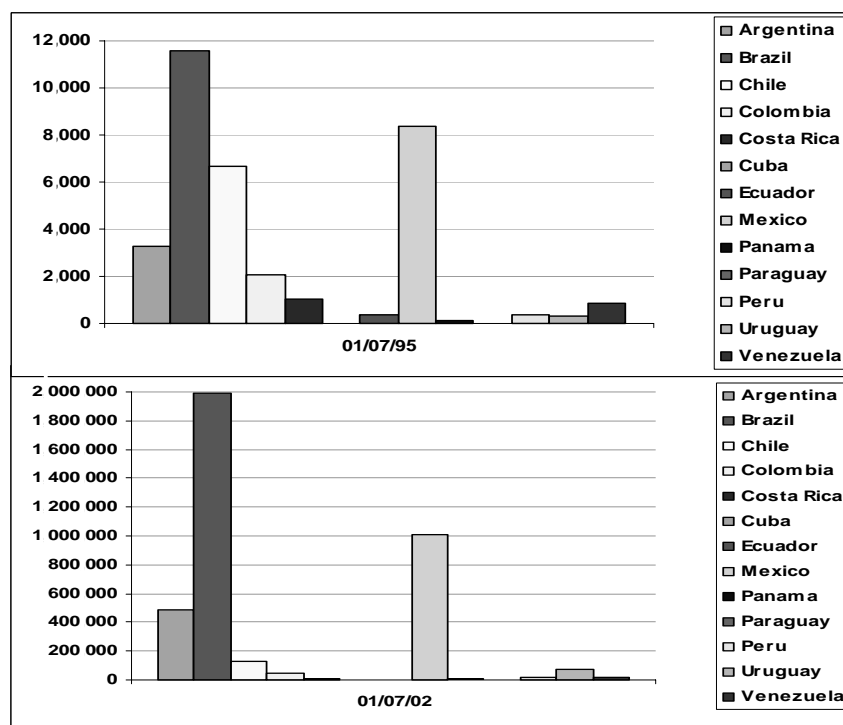
TABLE 4
MEXICO’S IT AND TELECOMMUNICATIONS MARKET, 1998-2003
(In millions of U.S. dollars)

	Total	Information technology			Telecommunications			
		Total	Equipment	Software	Services	Total	Equipment	Services
1998	16 009.0	4 170.0	2 377.0	493.7	1 298.9	11 839.0	1 777.3	10 061.7
1999	19 598.9	4 663.5	2 513.3	521.7	1 628.5	14 935.4	2 040.6	12 894.8
2000	22 219.0	5 716.0	3 328.0	608.0	1 780.0	16 503.0	2 449.0	14 054.0
2001	24 625.0	5 929.0	3 444.0	632.0	1 853.0	18 696.0	2 484.0	16 212.0
2002	26 929.0	6 186.0	3 600.0	631.0	1 955.0	20 743.0	2 538.0	18 205.0
2003	29 433.0	6 510.0	3 773.0	637.0	2 100.0	22 923.0	2 515.0	20 408.0

Source: National Institute of Statistics, Geography and Information (INEGI)/Select-IDC (October 2001).

From 1995 to 2002, the number of Internet hosts in Mexico increased more than one hundred fold, due to the rapid growth in IT adoption by the business, education, health and banking sectors, and despite the slow growth in IT use by SMEs and their sluggishness in leveraging the advantages offered by the Internet.

FIGURE 1
INTERNET HOSTS IN LATIN AMERICAN COUNTRIES, 1995-2002



Source: Internet Software Consortium (ISC) < www.isc.org >.

Most computer and peripheral-equipment manufacturing in Mexico is carried out by large suppliers that work for international companies and to a certain extent by in-bond producers, or *maquiladoras*. In the 1990s, many larger firms encouraged SMEs to manufacture and supply them with housings, peripheral equipment and other parts assembled by other large companies. Technology developed abroad has quickly generated new products and paved the way for competition in the Mexican market from suppliers in Asia and other regions, forcing many Mexican small manufacturers to close shop.

TABLE 5
VARIATION IN GROSS DOMESTIC COMPUTER-RELATED OUTPUT,
BY BRANCH OF ACTIVITY, 1995-2002
(In percentages)

Year	Manufacturing of computer equipment and peripherals	Telecommunications	Professional services in computer science and related activities
1995	12.4	6.6	-29.8
1996	61.9	13.3	14.9
1997	59.7	7.3	20.1
1998	23	11.1	12.6
1999	4.7	17.3	10
2000 ^a	25.1	14.2	9.3
2001 ^a	-7.4	15	-2.7
2002 ^a	-12.1	8.7	0.8

Source: National Institute of Statistics, Geography and Information (INEGI).

Note: Figures are annual percentages for the third quarter of the year.

^a Preliminary

The most important reason for growth throughout the IT sector is the expansion of the telecommunications sector, followed by higher sales of equipment, peripherals and professional services.

TABLE 6
TOTAL GDP AND COMPUTER-RELATED OUTPUT, 1994-2002
(Constant 1993 MXN x 1,000)

Year	Total GDP, in market prices	IT-Related Output				IT/GDP (%)	Annual variation in computer-related output (%)
		Total	Equipment and peripheral computer processes	Telecommunications	Professional services in computer science and related activities		
1994	1 311 661	24 614	1 351	22 485	778	1.9	NA
1995	1 230 771	26 030	1 518	23 966	546	2.1	5.8
1996	1 294 197	30 238	2 458	27 153	628	2.3	16.2
1997	1 381 839	33 816	3 924	29 137	754	2.4	11.8
1998	1 451 351	38 043	4 827	32 367	849	2.6	12.5
1999	1 503 930	43 966	5 054	37 977	934	2.9	15.6
2000 ^a	1 602 543	50 703	6 325	43 357	1 021	3.2	15.3
2001 ^a	1 599 787	56 718	5 855	49 869	994	3.5	11.9
2002 ^b	1 611 667	60 368	5 147	54 219	1 002	3.7	6.4

Source: National Institute of Statistics, Geography and Information (INEGI).

^a Preliminary

^b Estimate based on figures for first quarter.

Mexico's information and communications technology (ICT) and software sectors are highly fragmented. According to the Mexican consultancy firm Select, in 2003 sales totalled US\$ 26.387 billion, with telecomm services accounting for the largest share (US\$ 16.672 billion), followed by equipment (US\$ 6.523 billion), IT services (US\$ 1.939 billion), software (US\$ 693 million) and printing consumables (US\$ 560 million). The telecomm services market grew 2%; equipment, 0%; IT services, 2%; software, 3%; and printing consumables, 10%. Expected growth for 2004 was 6% for telecomm services, 3% for equipment, 5% for IT services, 3% for software and 2% for printing consumables. Excluding voice equipment and telecomm services, total sales were US\$ 7.321 billion, with 5.5% growth in 2002 and -0.5% in 2003, while estimated growth for 2004 was 3.4%.

Mexico's ICT and software sectors have had mixed results in the last 13 years. In 1990, sales in these sectors totalled US\$ 10 billion but contracted dramatically in 1995, to US\$ 1.6 billion. From 1995 to 2001, the sector recovered partially, with sales fluctuating at between US\$ 6 billion and US\$ 7 billion. From 2004 to 2006, sales were expected to stabilize at about US\$ 5.8 billion (UK, 2004).

Regarding PC infrastructure, although Mexico is not far below the international average for number of personal computers, its leading trading partners have up to eight times as many computers per inhabitant.

TABLE 7
PERSONAL COMPUTERS IN SELECTED COUNTRIES, 2002
(Number per 1,000 inhabitants)

Country	2002
Entire world	99.1
Canada	487.0
United States	658.9
Mexico	82.0

Source: National Institute of Statistics, Geography and Information (INEGI)/International Telecommunication Union (ITU) <www.itu.int/home/>

Business-to-business (B2B) transactions are not widespread in Mexico. Most large firms have web pages with catalogues of products and information on their distribution networks. Online sales need to be encouraged with better logistic and transmission infrastructure. Many companies make purchases online, however.

Still, e-commerce has begun to take hold in Mexico over the last decade. As in most countries, B2B transactions are by far more common than transactions between businesses and consumers (B2C) (Palacios, 2003). In part, this is due to the important role played by transnational corporations (TNCs) in the Mexican economy. TNCs have facilitated the introduction of new Internet-based technologies and management practices.

TNCs quickly became among the most intensive users of the Internet for conducting business in Mexico; in fact, they have been the main engine of growth of B2B in the country (Palacios, 2003). SMEs are also investing more in information systems, as they rapidly adopt Internet-based business solutions.

Another factor encouraging B2B growth is the increased use of e-commerce by companies to improve their IT platforms, their competitive position and the efficiency of their internal processes. This implies that the Internet has allowed them to discover unique advantages in terms of products, content and processes.

TABLE 8
CRITO SURVEY ON E-COMMERCE IN MEXICO, 2002
(In percentages of companies surveyed)

Companies that use IT for:	
E-mail	98.3
Website maintenance	79.0
Intranet	50.9
Extranet	31.1
Extranet access by suppliers/partners	22.6
Extranet access by customers	16.2
Electronic data interchange (EDI)	58.4
Companies that use the Internet for:	
Marketing/advertising	72.9
Online sales	11.8
After sale customer service and support	40.2
Online purchases	64.8
Exchanging operational data with suppliers	50.1
Exchanging operational data with business customers	46.7
Formally integrating business processes with those of suppliers or other business partners	54.8
Companies that engage in online sales with:	
Other businesses	24.0
Mean percentage of total business sales conducted online (only includes firms engaging in B2B sales)	20.2

Source: United Nations Conference on Trade and Development (UNCTAD), E-Commerce and Development Report 2003 (UNCTAD/SDTE/ECB/2003/1), New York, 2003, and information from the Centre for Research on Information Technology and Organization (CRITO), University of California, Irvine.

The number of Internet users in Mexico is growing, as new providers emerge, offering dial-up and cable and wireless-modem service as well as Wi-Fi hotspots in shopping centres and other locations. Users for the most part are high school and university students and independent professionals, while SMEs are a less significant segment of Internet users. The number of Internet users is increasing by an average of more than 40% per year.

TABLE 9
INTERNET USERS IN MEXICO, 2000-2002
(In thousands)

Year	Overall	Home	Other
2000	5 058	3 136	1 922
2001	7 047	4 095	2 952
2002	10 765	5 933	4 832

Source: INEGI (2001 and 2002)/Federal Telecommunications Commission (Comisión Federal de Telecomunicaciones (COFETEL)) <www.cofetel.gob.mx>

Internet use by individuals to search for products and make purchases is increasing quickly, but still lags far behind the levels seen in other industrial countries.

TABLE 10
POPULATION MAKING PURCHASES ONLINE IN SELECTED COUNTRIES, 2002
(In percentages)

Country	E-commerce among	
	Entire population	Internet users
Germany	11	16
Australia	7	14
Canada	10	16
Denmark	14	22
United States	19	32
United Kingdom	9	23
India	1	4
Ireland	9	19
Italy	3	7
Korea	16	31
Mexico	1	7
Taiwan Province of China	5	12

Source: INEGI, with data from CRITO Global E-Commerce Report, 2002.

Almost all SMEs have an adequate number of PCs, which are used mainly by office staff for management and accounting tasks. Some companies limit Internet browsing by employees, to avoid distractions and ensure efficiency.

TABLE 11
COMPANIES AND GOVERNMENT OFFICES; OFFICE EMPLOYEES;
INSTALLED PCs, 2002

Type of establishment	Total	% with PCs	Number of companies with PCs	Office employees	% of office employees with access to PCs	Total number of PCs
Micro	2 311 230	28	647 844	2 586 990	23	643 858
Small and medium-sized	68 940	92	63 261	1 304 858	65	882 331
Intermediate	5 265	100	5 265	919 526	75	714 447
Large	470	100	470	758 582	88	624 259
Education-related	144 197	52	74 754	1 174 065	43	577 941
State and Federal Government offices	3 019	100	3 019	3 733 823	15	551 959
Total	2 533 122	31	794 613	10 477 843	37	3 994 794

Source: Ministry of Economy, “Identificando Nichos de Actividad Económica con un Fuerte Potencial para Adoptar Tecnologías de Información,” 2003.

Mexico has a small share of the world’s total IT investment and a high rate of software piracy. For efficiency in Mexico to increase and for the country to begin to catch up with industrialized countries, the Government must promote IT-infrastructure development. Until recently, general software and multimedia applications were the products most commonly found in the informal market; now, however, some specialized software products are being sold on the street for a fraction of their real price.

Purchasers of pirated software are typically students, freelance service providers and the general public. SMEs are normally able to afford software licenses or to pay IT professionals to develop and install specialized business applications.

Commerce is the sector with lowest computer penetration rate, as fewer than 30% of commercial establishments have computers. The penetration rate in the construction and agribusiness sectors is high, with more 80% of the firms in these sectors using computers. In the manufacturing sector, more than 60% of the companies have computers.

TABLE 12
ESTABLISHMENTS BY TYPE OF ECONOMIC ACTIVITY AND COMPUTER OWNERSHIP, 1999

Sector	Total	Owned computers	Did not own computers
Total	3 239 575	1 089 260	2 150 315
Construction	12 450	11 912	538
Agribusiness	2 458	2 261	197
Manufacturing	402 435	276 434	126 001
Commerce	1 685 330	480 500	1 204 830
Services	1 136 902	318 153	818 749

Source: Local INEGI surveys on “2000: the Year of Computer Adoption”, among non-financial private firms, June 1999 (third survey).

An analysis of the value added in different branches of the economy shows significant deficiencies in basic industries, including those oriented to consumer sales, company sales and exports. The branches where high profits are earned are infrastructure and consumption-related services. As consumer services begin to diversify, IT-services providers have increasingly strong prospects for growth. This should put SME exporters in a position to offer new IT-related services and products in Latin America and the United States. IT could also encourage many SMEs to become suppliers for larger companies and thereby to contribute value added to production chains.

TABLE 13
BRANCH OF ECONOMIC ACTIVITY; BREAKDOWN BY GROSS VALUE ADDED, 2001
(In percentages)

Orientation of selling branches	Orientation of purchasing branches						Total
	Basic industries oriented to consumption	Industries oriented to			Services oriented to		
		Companies	Exporting	Consumption	Infrastructure (utilities)	Consumption	
Basic industries oriented to consumption	8.44	0.41	0.24	0.35	0.03	0.18	9.66
Industries oriented to:							
- Companies	0.25	3.65	2.86	0.18	0.06	0.31	7.32
- Exporting	0.36	1.33	14.36	2.05	2.80	1.03	21.94
- Consumption	1.96	0.61	2.25	6.56	1.38	1.92	14.67
Services oriented to:							
- Infrastructure (utilities)	1.38	1.18	2.29	2.14	2.78	3.60	13.37
- Consumption	3.44	1.40	5.81	2.08	4.39	15.92	33.04
Whole	15.83	8.58	27.81	13.37	11.44	22.97	100

Source: Ministry of the Economy, “Identificando Nichos de Actividad Económica con un Fuerte Potencial para Adoptar Tecnologías de Información,” 2003.

The manufacturing industry is the branch with the third largest number of office employees who use PCs. The branch that leads this category is that of financial services firms, followed by electricity, gas and water utilities. The reason for high PC penetration rate in financial services firms is the automation level required for real-time banking transactions. Utility companies have had to raise their product and services performance parameters to meet the needs of industrial suppliers and consumers.

Manufacturers are slowly adopting new IT applications, often because their clients require them to provide information online or to offer B2B transactions for suppliers and distributors and business-to-government (B2G) transactions for government clients.

TABLE 14
OFFICE EMPLOYEES AND INSTALLED PCS, BY SECTOR, 2002

Sector	Companies	Companies with PCs		Office employees		Installed PCs
		%	Number	Number	% with PC access	
Commerce, restaurants & hotels	1 415 068	28	394 432	2 008 080	44	919 957
Construction	18 428	87	16 085	314 325	43	143 168
Electricity, gas and water	2	100	2	1 692	88	1 483
Manufacturing	273 470	33	90 408	1 251 180	76	951 698
Mining	28 662	21	5 876	97 680	46	47 267
Social and personal services	743 975	35	257 607	6 435 964	24	1 703 852
Finance, securities, and real estate	96	100	96	108 762	97	55 802
Transport, storage and communications	53 420	56	30 107	260 159	67	171 567
Total	2 533 122	31	794 613	10 477 843	37	3 994 794

Source: Ministry of the Economy, “Identificando Nichos de Actividad Económica con un Fuerte Potencial para Adoptar Tecnologías de Información,” 2003.

B. IT penetration and e-commerce among SMEs

As in other countries with insufficient investment in IT capital, in Mexico the largest share of annual IT investment is in hardware (60.8%), while the smallest share is commercial software (10.3%).

In fact, in Mexico commercial software as a share of total IT investment is expected to decline, unlike in other countries—including both countries that have a paucity of IT capital investment and those that do not. Although there are many possible explanations for this trend, what is important for this study is that between 2002 and 2006, investment in commercial software as a share of total IT investment is expected to fall from its already low level of 10.3% to a mere 7.9%.

Even among countries that are underinvested in IT capital and whose IT infrastructure is less developed than Mexico’s, investment in commercial software as a share of total IT investment will be higher in 2006 than it was in 2002. Moreover, among all countries with a dearth of IT capital, the average ratio of investment in software to total IT investment is expected to rise to 15.3% in 2006, two percentage points above the level in 2002.

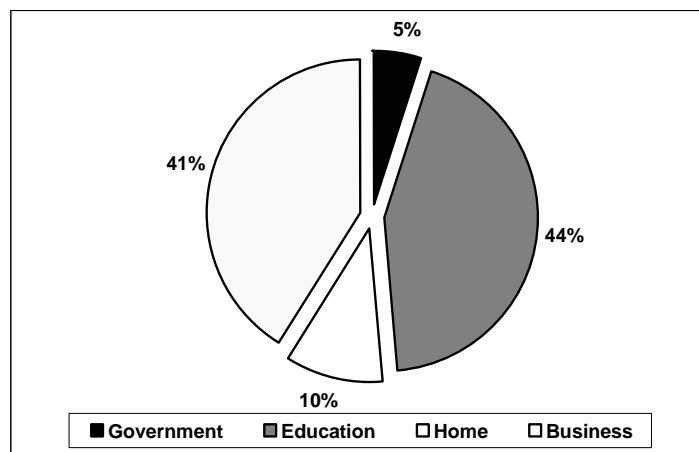
Mexico’s IT investment totalled US\$ 19.3 billion in 2002. If the make-up of that investment were to remain the same in 2006 as it was in 2002, 80,419 more jobs would be created in the country’s IT industry than can be expected with lower investment in software.

Moreover, because SMEs in Mexico lack a formal organizational structure or even personnel qualified in tasks as specialized as those required for IT, they must hire specialists or external consultants. In addition, SMEs are not fully aware of the ways in which available technologies can be applied.

An attractive option for SMEs with low IT budgets is to establish ties with universities, which generally have IT-training programmes for graduate students. Such cooperation allows SMEs to introduce IT in a cost-effective manner.

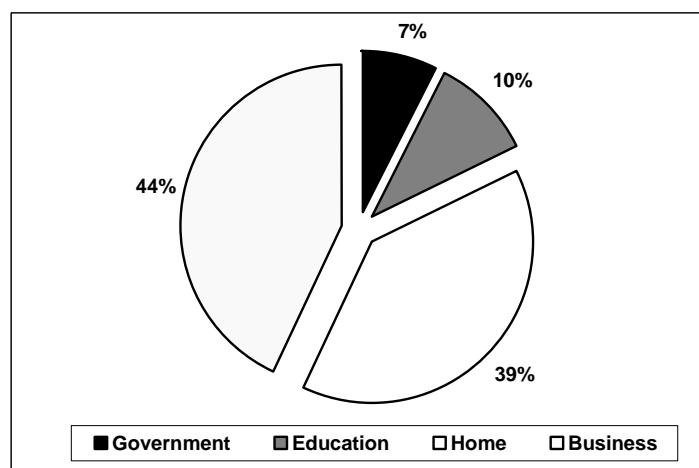
Regarding the breakdown of Internet users, users in the education sector declined from 44% of all users in 1994 to 10% in 2002, due to the strong increase —from 10% to 39%— in the percentage of home users. Business continues to account for the largest segment of Internet users, with its share rising from 41% to 44%, while government's share climbed from 5% to 7%.

FIGURE 2
INTERNET USERS IN MEXICO, BY SECTOR 1994



Source: Select-IDC.

FIGURE 3
INTERNET USERS IN MEXICO, BY SECTOR 2002



Source: Select-IDC.

According to a Cisco Systems survey in Latin America, 50% of the companies using the Internet have raised their productivity by using the web as a strategic tool. This is especially the case in Mexico and Brazil. Some 50% of Mexican companies reported that the Internet helped them raise their revenues, and 70% used the Internet for online purchases from international suppliers. In coming years, businesses are also expected to make significant use of the Internet to implement supply chain management (SCM) systems to facilitate the establishment of new business ties.

INEGI IT indicators are based on information from various public and private sources and non-government organization (NGO) reports. These indicators provide an overview of activity in the IT sector and of socioeconomic phenomena related to the digital economy, e-government and the information society, as well as comparisons of Mexico's technological infrastructure with that of other countries.

Such research is an important factor in decisions to adopt, integrate and develop ITs and can provide important data related to Mexico's IT industry. The IDC estimates that by the end of 2003, the e-commerce market accounted for 1.5% of GDP, including online purchases from SMEs and large companies and through international commercialization channels.

Mexico offers SMEs an important opportunity to sell consulting and other services and IT solutions as well as merchandise. Although large corporations frequently engage in B2B transactions, it is almost unheard of for SMEs to do so. In some cases, large firms have pressured suppliers to upgrade their systems and connections by implementing CRM.

II. SME development in the IT revolution

A. Overview of the importance of SMEs for the overall economy

1. Recent evolution of Mexico's economy

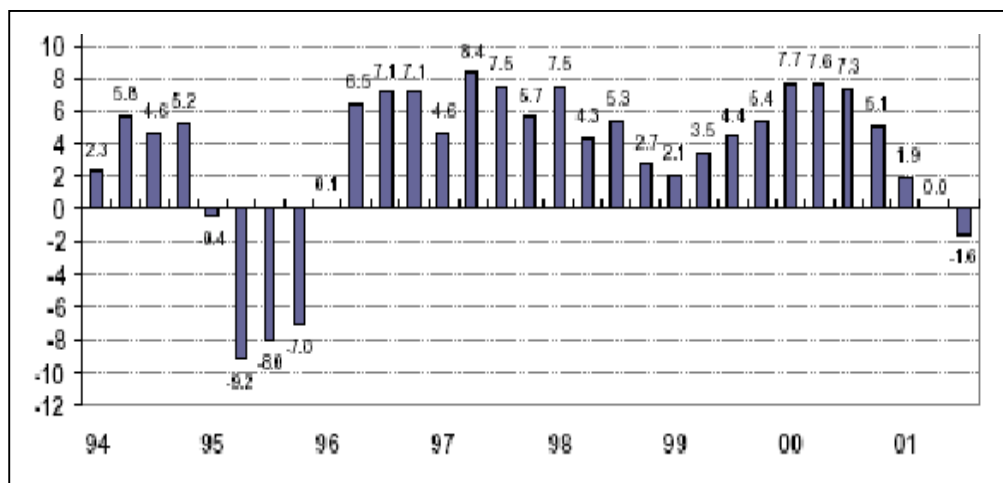
Mexico's economic development strategies and policies from the mid-1950s to the mid-1980s failed to bring economic stability. The high social costs of this failure included an exacerbation of social disequilibria, poverty and exclusion. Underemployment and informal employment became the normal way of participating in the economy for an ever-growing number of Mexicans.

By the mid-1980s, the Government abandoned import substitution as an economic-development model in favour of one based on opening the country to foreign trade. In 1986, Mexico joined the General Agreement on Tariffs and Trade (GATT). During the 1990s, economic policy was geared to further opening Mexican markets through deregulation and the signing of free trade agreements (FTAs). Mexico has thus far signed 12 FTAs with over 40 nations. The most important of these, the North American Free Trade Agreement (NAFTA), underscored the Government's aggressive opening to foreign trade. Along with a gradual recovery of the economy and a favourable international environment, increased foreign trade introduced a new scenario that has led to dynamic export growth in recent years. From 1994 to 2000, exports rose from US\$ 60.9 billion to US\$ 166.5 billion, for an average annual increase of 18.2% in real terms.

Starting in 1996, higher exports triggered a vibrant economic recovery, as evidenced by quarterly GDP growth.

However, in past years the sustained buoyancy of exports did not translate into widespread, uniform growth, nor did the prospect of export-led growth bring about regionally balanced development. Even more dramatic were the worsening economic, professional and personal prospects of small-business owners, of the most disadvantaged groups and of the indigenous population. The one sector that came out unscathed in the trying economic conditions is that of TNCs.

FIGURE 4
QUARTERLY GDP GROWTH, 1942-2001
(In percentages)



Source: INEGI, Banco de Información Económica.

2. Constraints on SME growth

As in other countries, the SME sector in Mexico accounts for an important share of economic activity. There are estimated 2 million SMEs in the formal sector throughout the country, or about 60% of all businesses. They contribute about 45% of the value added by the private sector and account for about 55% of private-sector employment (Gaxiola Meléndrez, 2003a). As is the case elsewhere, Mexican SMEs are very heterogeneous and are distributed in the commerce, services and manufacturing sectors. In the Federal District, for example, registered SMEs in the industrial sector are concentrated in the food, clothing, furniture and wood-products, publishing and printing, and metal works sectors.

SMEs operate in a variety of settings, including home offices, commercial premises, industrial facilities, and to a considerable extent, industrial parks. Among both owners and employees, the level of schooling is rarely above the eighth grade.

According to assessments released in 2001 by the Ministry of Economy, although Mexican SMEs are becoming aware of the need to innovate and to adapt to new technologies, they are beset by important weaknesses such as a lack of access to training and financing and weak ties with academic institutions. Surveys by INEGI, Nacional Financiera, S.N.C. (NAFIN) and the World Bank confirm this, and indicate that only 21% of the small businesses that have managed to remain afloat intend to make new investments, take on new employees or develop new products (Sánchez and Cunningham, 1998). SME owners say the principal adversities they face are a diminishing customer base, excessive competition, low profits, a lack of capital and the limited availability to and the high cost of credit.

In addition, a survey conducted in 2002 by the Inter-Agency Commission on Industrial Policy (Comisión Intersecretarial de Política Industrial (CIPI)) found that in most cases SMEs' failure to grow stems from the fact that they are managed by family members rather than professionals, and 90% see no need to obtain ISO-type quality certification although this is often a leading requirement for becoming a supplier of large companies.

TABLE 15
SURVEY OF URBAN SMALL BUSINESS IN MEXICO, 1998:
MAIN OBSTACLES
(In percentages)

Obstacles	% of responses
Small customer base	29.6
Excessive competition	28.3
Low profits	15.6
Lack of capital and credit	10.2
Customers' slowness to pay	6.5
Difficulties with government officials	2.9
Quality of merchandise, raw materials	4.0
Difficulties with employees/partners	1.3
Other	1.6

Source: INEGI.

Small enterprises often make scant use of cutting-edge technologies, although some 30% have Internet access and 40% were expected to have their own website and to engage in B2B transactions by 2003. Small enterprises have highly localized markets, as 65% do most of their business within a radius of 100 km and 50% have no more than four clients. Hence, their market is very concentrated and they are exposed to a high degree of risk.

By contrast, medium-sized enterprises are better prepared to take advantage of government development programmes. In addition, they are more flexible and more integrated into production chains and their dealings with large clients have given them a greater awareness of IT.

a) Exports

The fact that most of Mexico's exports (88.56%) go to the United States market puts Mexico in a vulnerable position. Still, INEGI notes that the most export products (88.6%) are concentrated in the manufacturing industry, especially metalwork, auto parts, electric and electronic items, and machinery and equipment for various industries (most notably, machinery for information processes and machine parts).

Other leading exports include textiles, foods and beverages, chemicals and petrochemicals. *Maquiladoras* are major exporters, although *maquiladora* products contain little added value due to the high content of imported raw materials.

b) SMEs

SMEs have benefited little from export incentives because SME exporters have failed to establish linkages with domestic suppliers. The *maquiladora* industry thus requires a high volume of imported inputs and strong linkages and partnerships with international suppliers.

SMEs have a minimal participation in total direct exports of 6.65%, compared with 51.86% for large enterprises and 41.49% for large and medium enterprises located in *maquiladoras*.

Slow domestic growth has had a serious adverse effect on SMEs, resulting in the dismantling of production chains due to the gradual replacement of domestic inputs with imports that compete on the basis of lower costs and higher volumes and/or quality. The overvaluation of the Mexican peso also encouraged this process.

In 1995, the situation for SMEs was exacerbated by the downturn in the economy, which included severe inflation and a sharp increase in interest rates. A large number of companies were forced out of business when they were unable to meet their financial obligations, disrupting recently established production chains. Although the devaluation of the peso created an opportunity for export-oriented companies that had weathered the crisis, the benefits were insufficient to improve overall economic performance.

The weakening of production chains due to the crisis is reflected in the low participation of domestic suppliers in various sectors. Although in appliances, domestic suppliers account for more than 50% of inputs and in automobiles they account for more than 40%, in the high-tech industry, such as electronic auto components and computers, their share is lower. In some sectors, domestic suppliers account for less than 5% of inputs.

c) Factors that weaken SME growth

In addition to macroeconomic considerations, other factors directly undermine the competitiveness of Mexican companies. The manufacturing sector points to the following causes:

i) High costs of meeting regulatory requirements

The excessive requirements entrepreneurs must deal with when opening and running a business often limit their ability to expand their output.

ii) Lack of training in and development of entrepreneurial skills

An entrepreneurial culture has not fully taken hold in Mexico. Companies, especially micro and small ones, often begin as subsistence enterprises without a strong awareness of basic management techniques.

iii) Limited training in and development of human resources

Entrepreneurial and human-resource training constitutes one of the keys to raising productivity. Nevertheless, this need is often neglected by companies, due to budget and time constraints, among other factors.

iv) Lack of information systems and of an awareness of the market and marketing issues

An INEGI survey of micro and small enterprises indicates that the main problems that adversely affect business operations are related to a lack of awareness of potential market opportunities.

v) Lack of efforts to promote technological innovation

Mexican SMEs are hampered by the lack of a suitable policy to promote technological innovation and the failure to make technology a high priority.

vi) Lack of access to timely, affordable, and appropriately targeted financing

By and large, Mexican companies lack access to lending from—the generally risk-averse banking sector—since lending is mostly limited to large manufacturers and technology-related companies. Nevertheless, SMEs are sometimes able to obtain working capital through commercial agreements with suppliers. In fact, the Banco de Mexico reports that more than the 52% of the SMEs in the country obtain commercial loans from their suppliers.

3. Mexico's business structure

The following tables contain data from the Ministry of Economy on the breakdown as of 2002 of companies in Mexico by size, sector and number of employees:

TABLE 16
CLASSIFICATION OF ENTERPRISES BY SECTOR AND NUMBER OF EMPLOYEES

Size	Manufacturing	Commerce	Services
Micro	0 - 15	0 - 5	0 - 20
Small	16 - 100	6 - 20	21 - 50
Medium-sized	101 - 250	21 - 100	51 - 100
Large	>250	>101	>101

Source: Ministry of Economy, February 2002

Using these classification criteria, the 1999 INEGI economic census counted 2.84 million business units, of which 99.7% were SMEs. Overall, this group accounted for 42% of GDP and 64% of employment.

TABLE 17
BREAKDOWN OF ENTERPRISES BY SIZE

Size	Number	% of total
Micro	2 722 365	95.7
Small	88 112	3.1
Medium-sized	25 320	0.9
Large	8 474	0.3
Total	2 844 308	100

Source: INEGI, economic census, 1999.

Some 52% of the companies counted in the 1999 economic census¹ were engaged in commerce, 36% in services and 12% in manufacturing. Of total output of large firms, 43.7% was related to services, 34.3% to commerce and 21.9 to manufacturing. For SMEs, the respective figures were 52.1%, 35.3% and 12.5%.

The geographic centralization of production should be noted: forty percent of Mexico's productive units are located in the Federal District and in the States of Mexico, Jalisco, Veracruz and Puebla, reflecting the rapid growth and high share of GDP of the country's northern and central areas, in contrast to the south, characterized by very low growth.

In terms of size, the distribution of companies is as follows: The States with the highest percentage of medium-sized and large companies include Nuevo León, Sonora, Baja California, Chihuahua and Coahuila, and the Federal District. A higher percentage of less developed companies is found in central and southern States of the country, including Chiapas, Guerrero, Oaxaca, Puebla, Tabasco and Veracruz, where micro and small enterprises predominate.

¹ It should be noted that in May 2004 the INEGI began gathering information on enterprises for its new economic census, which will be available by mid-2005.

4. Business development programme

For the Mexican economy to grow, the country must address its huge inequalities and respond to pressing social demands. Accordingly, the present Government has put forth the National Development Plan, the aim of which is to achieve growth with equality. The plan's five key goals are to:

- spearhead responsible economic growth in the country;
- enhance the level of competitiveness throughout the country;
- ensure that development include the participation of all social sectors;
- achieve regionally balanced development;
- establish conditions allowing for sustainable development.

SMEs are the driving force of the Mexican economy, the pillar of development and the most important engine of wealth creation. They should receive special attention in order for them to take full advantage of opportunities in Mexico and in the global market and help the country modernize, by acting as job creators and as instruments for social development and a more equal income distribution.

The federal Government has introduced the 2001-2006 Business Development Programme, as part of the core strategy of the National Development Plan, to allow business to meet three major challenges.

The first challenge consists in promoting an environment conducive to enterprise development and a healthy macroeconomic climate through structural reforms and sound government management. The aim is to allow companies of all sizes and in all sectors to grow and to become more competitive, in addition to encouraging the creation of new enterprises.

The second challenge is to make SMEs competitive, by helping them develop the internal capacities they need to be successful players both domestically and internationally.

The third challenge is to identify economic opportunities in specific regions and productive sectors, all while enabling States and municipalities throughout the country to leverage their competitive and comparative advantages. This, in turn, should consolidate regions and sectors with local businesses that are striving to meet world levels of competitiveness and encourage the transformation of existing production chains and the formation of new ones.

5. The Mexican Government's strategies

Mexico's Government has devised six strategies to meet these challenges:

a) Promoting a competitive environment for enterprise development

The federal Government has promoted development to support competitiveness through its participation in different forums and through policies to encourage local government to take similar actions.

b) Giving companies greater access to financing

Financing is an essential instrument of the Government's strategy to promote development by enhancing SMEs' competitiveness. Accordingly, the Ministry of Economy and State and municipal governments and development banks are coordinating their approach vis-à-vis SMEs and encouraging lending institutions and funding agencies to operate as loans guarantee institutions and expand the access to credit.

c) Promoting business creation, worker training and production techniques to raise companies' competitiveness

The aim of this strategy is to strengthen the competitiveness of Mexican enterprises and encourage the creation of new SMEs able to meet world quality, service and productivity standards and to efficiently participate in global production chains.

d) Promoting better management techniques and greater technological innovation and development

The aim of this strategy is to raise SMEs' awareness of technology by encouraging them to adopt sound management practices, to innovate and to employ modern technology so as to improve their production processes, enhance workplace safety, lower costs and raise the quality of their products and services. In all cases, the need to protect the environment and adopt practices consistent with sustainable development objectives is being stressed.

e) Developing regions and productive sectors throughout the country

This strategy consists in creating business-development clusters and transforming agribusiness and agro-industrial chains, manufacturers, commercial television and radio units and services companies into authentic regional and sectoral networks, through cultural partnerships, the creation of permanent suppliers for industry and commerce, the reconstruction of production chains, as well as the attraction of multinational companies and large amounts of capital to regions and strategic sectors with new infrastructure projects.

6. Rebuilding and developing production chains to consolidate the domestic market

The aim of this strategy is to promote and support the rebuilding and development of production chains with technical and financial instruments that make it possible to utilize information on business opportunities, and especially with instruments that focusing on marketing, combined with follow-up models, business assistance and consultancy systems specialized in marketing.

- **Initiatives currently being carried out:**

In line with the six strategies outlined, in the Federal Government's Business Development Programme, actions are being planned at all three levels of government (judicial, legislative and executive) to implement the following initiatives related to SMEs, to municipal procurement procedures and to the monitoring of companies' performance:

- a system to streamline procedures for opening businesses, to be implemented by the Federal Regulatory Improvement Commission (Comisión Federal de Mejora Regulatoria (COFEMER));
- the Electronic System for Government Procurement (Sistema Electrónico de Contrataciones Gubernamentales, known as "Compranet") of the Civil Service Ministry (Secretaría de la Función Pública (SECODAM)); formerly known as the Ministry of Comptrollership and Administrative Development), and
- electronic portals to allow government agencies to provide services online.

B. Case studies on e-commerce and SCM in selected industries

1. Case A: Infocentre of the Quintana Roo Hotel Association

a) Project objectives

The association's prime objective in establishing the Infocentre was to provide SMEs with a site to offer their services, through the coupling of IT with an innovative marketing channel. Hence, the Infocentre was viewed as a way for suppliers to use IT to establish business models that would strengthen their commercial linkages with hotels through what was called a "Buyers Club".

b) Antecedents

In 2000, the World Bank, NAFIN and the Quintana Roo Hotel Association devised a project to create a business centre bringing together services for supplier development, training, technical assistance and online commercial activities. The aim of the project was to encourage the adoption of best practices by SMEs and thereby strengthen suppliers of goods and services to the hotel sector in the State of Quintana Roo.

The project's principal objective was to develop local suppliers in the States of Quintana Roo, Yucatán, Campeche, Tabasco and Chiapas and thus promote regional development and job creation as well as higher incomes for the population at large.

- The first step in the materialization of the project was the 21 September 2000 signing by NAFIN and the Quintana Roo Hotel Association of an Agreement on Collaboration and Joint Action to Provide Training and Technical Assistance. The principal goals were to:
 - promote a new culture in the development of e-business through an interactive Internet page for information and transactions, thereby allowing micro, small and medium-sized enterprises to promote their products;
 - coordinate and strengthen existing private and public initiatives to provide SMEs with training and technical assistance;
 - disseminate experiences in improving the quality of training and technical-assistance services that would serve as an example and encourage SMEs to become more competitive;
 - develop new application models for Internet-based business;
 - encourage the development of direct networks among companies and their clients and suppliers, and
 - contribute to the development of interactive training as well as online and traditional technical assistance so as to encourage the creation of new enterprises.
- The second step was the signing of a loan contract between the World Bank and NAFIN on 21 March 2002, to support the Southeast Regional Development Learning and Innovation Project. The two institutions agreed to carry out the following activities:

- promote sustainable SME financing, thereby increasing the number of companies eligible for financial services, and
- use IT so as to optimize commercial services and give SMEs the most cost-effective support possible.

It was felt that the best way to achieve these goals was through the creation a one-stop services and IT centre, to be called the Infocentre.

As a result of the two agreements, the Infocentre Cancún Trust Fund was created on 10 September 2002. NAFIN was named trustor, while the Quintana Roo Hotel Association was named trustee. Though the trust, the World Bank was to channel up to US\$ 100,000 to NAFIN for the development of the Infocentre project, with the hotel association matching that contribution.

c) General targets

The cornerstone of the Cancun Infocentre is a purchases portal where association-affiliated hotels can post their needs for goods and services and take bids from participating suppliers, in a framework intended to promote competition and e-business.

As it continues to develop, the Infocentre is expected to accomplish the following:

- support linkages between SME suppliers and the Quintana Roo hotel sector through a modern system that will provide information on, among other things, changes in the business environment, and, in particular, market needs, to give SMEs an opportunity to sell their products, effectively compete with foreign suppliers and raise their quality;
- utilize new types of financial, training and technical assistance programmes to support suppliers by allowing them to access the electronic network of Quintana Roo hotels, and
- facilitate local and regional initiatives by government and the private sector in Quintana Roo, so as to foster the development of production chains in the tourism sector through the upgrading of electronic infrastructure for SME promotion.

d) Mission of the Cancun Infocentre

The Infocentre's mission is to promote SME suppliers in Quintana Roo's tourism sector by establishing channels for products and services to be marketed and by providing advice on financial services, training and technical assistance.

(i) Benefits

- The Infocentre was expected to benefit hotels by encouraging:
 - the adoption of international best practices by suppliers, so as to ensure the quality of products and services;
 - streamlined decision-making regarding supplier identification and purchasing processes;
 - less duplication of efforts;
 - the establishment of a channel for automated communications with suppliers;
 - increased invitations for suppliers to participate;
 - the curtailment of irregular practices;
 - reduced idle capacity;
 - improved purchases operations, and
 - an ongoing search for new suppliers;

- In turn, it was expected to benefit suppliers by:
 - creating new business opportunities;
 - encouraging increased professionalism;
 - making sales procedures more efficient;
 - reducing duplication of efforts;
 - establishing a channel for automated communications with the hotels;
 - curtailing irregular practices;
 - eliminating idle capacity;
 - improving sales-monitoring operations, and
 - encouraging the use of promotions.

(ii) *Infocentre strategy*

The Infocentre is a business development centre (BDC) that promotes information technologies and best practices to support SMEs and encourage them to improve their understanding of business and to commit to providing high-quality goods and services.

The Infocentre's strategy responds to the need to provide companies with one-stop specialized, complementary, practical services. Accordingly, the Infocentre has been structured to prioritize meeting the needs of hotel suppliers in Quintana Roo. It provides the following services for businesses:

TABLE 18
INFOCENTRE SERVICES FOR BUSINESSES

Strategic service	Description	Benefits
Rating of the commercial channels' performance	Development of technological solutions to apprise potential suppliers of hotel-industry demand	Timely knowledge of the market and business opportunities
Training and technical assistance	Provision of training for general business development and on topics related to the tourism sector	Transfer of best practices by familiarizing SMEs with companies in Mexico's most highly competitive States and giving them practical knowledge of strategies and procedures
Information services for the hotel sector	Gathering of information relevant to the sector and offering tourism enterprises various forms of access to IT	Provision of information, and support for businesses that use this information for decision-making and planning
Development of commercial channels	Recognition of the role, perspectives and needs of purchasers and suppliers. Promote an understanding of their problems and proposed joint solutions	Econometric models to promote win-win solutions between purchasers and suppliers.
Development of consultancy businesses	Bringing together consultancy and support efforts, valuable for suppliers in any segment (manufacturing, distribution, imports, service providers)	Pragmatic consultancy actions lead businesses to discover opportunities and needs for change in their organizations and show them how to formulate suitable business development strategies and to implement best practices and leverage their advantages
Formulation of business assessments	Providing knowledge on the sector and its needs, expectations and best practices as well as benchmark studies with which to gauge results and the degree to which targets have been met	Helping entrepreneurs modify their practices to applying diagnoses (by consultants) so as to facilitate their understanding of business

Source: Prepared by the author.

Various studies in both Mexico and Central America have found that SME owners lack the tools to improve the management of their businesses. Such owners are reluctant to incur what they feel is an unjustified expense on training or consultancy services, and smaller businesses find the cost prohibitive.

Moreover, the way IT has been marketed in the region has led SMEs to question whether it provides a cost-benefit. SMEs have not brought their practices into line with strategic targets and technological developments. The real value of technological solutions has not been made clear to SMEs, which view technology more as an expenditure than as an investment.

The first step for the Infocentre was to establish commercial channels through the creation of an electronic market known as the “Buyers Club”. The Infocentre’s services provide a direct benefit to suppliers, who view joining the club as an investment, since the Infocentre brings higher sales and new business opportunities.

As the Infocentre has become known as a forum that aggressively promotes activities and provides solutions among companies in the hotel sector, other entrepreneurs have been prompted to evaluate the benefits of receiving professional management support from it.

Since the Infocentre was developed with the support of the Quintana Roo Hotel Association, it invites clients that want to know the needs and expectations of the hotel sector, which is the strongest link in the commercial chain. This has given the Infocentre an incentive to provide model solutions for SME development and has also encouraged partnerships among the suppliers in the region. Hence, the Infocentre has struck a balance between the needs of the hotels and those of their suppliers.

Experience shows that regional business development must be pragmatic. Hence, it requires a thorough understanding of local and regional markets as well as medium- and long-term planning. Without such elements, rather than promoting business development, such an effort could undermine existing advantages and reduce entrepreneurs’ credibility.

(iii) Projected market

The evolution of services provided by the Infocentre indicates that the members of the Buyers Club find membership in it advantageous. Initially, the Infocentre was to have 106 member hotels and roughly 2,000 suppliers. The following table shows the market segmentation by type of client:

TABLE 19
MARKET SEGMENTATION

	Potential market	Micro-enterprises	Small enterprises	Medium-sized enterprises
Suppliers	2 000	1 500	420	80
Percentage	100	75	21	4
% of suppliers with suitable Internet access ^a	58	45	95	100

Source: Survey on Infocentre project conducted by Nacional Financiera, 2002.

^a “Suitable” access is defined as Internet service that can easily be used by the company’s staff in charge of answering inquires from hotels or sending quotes and that is available at all times.

The geographical distribution of suppliers working for Cancun hotels is as follows:

TABLE 20
GEOGRAPHIC DISTRIBUTION OF SUPPLIERS
(In percentages)

Quintana Roo	36
Federal District-State of Mexico	31
Yucatan	22
Others States in Mexico	10
United States	1
Total	100

Source: Survey on Infocentre project conducted by Nacional Financiera, 2002.

- **Infocentre goals**

Using the foregoing information as well as data provided at meetings between hotel managers and the Quintana Roo Suppliers Association, the Infocentre set the following targets to meet the needs of hotels and suppliers:

TABLE 21
INFOCENTRE TARGETS: MEMBERSHIPS
(Number of participating enterprises)

Segments	Potential market	Jul-2003 Jun-2004	Jul-2004 Jun-2005	Jul-2005 Jun-2006
Hotels	106	106	106	106
Suppliers	2 000	600	400 new	200 new
Suppliers (membership renewal)	-	-	540	846

Source: Survey on infocentre project conducted by Nacional Financiera, 2002.

The expectation was that 100% of the hotels would use the system to some degree —at a minimum, to search for suppliers and request quotes.

(iv) Operational results of the Infocentre

The Infocentre began a trial phase in the second quarter of 2003. Formal operations began in May of that year, and the software needed for the Buyers Club (website), was brought online soon after that, and the results were:

TABLE 22
INFOCENTRE RESULTS: MEMBERSHIPS, JULY 2003
(Number of enterprises)

Segment	Target July 2003	Result	Result/target (%)
Hotels	4	2	50
Suppliers	100	102	102

Source: Survey on infocentre project conducted by Nacional Financiera, 2003.

TABLE 23
INFOCENTRE RESULTS: MEMBERSHIPS, JUNE 2004
(Number of enterprises)

Segment	Survey, 7 June 2004
Hotels	272
Suppliers	991

Source: Survey on infocentre project conducted by Nacional Financiera, 2004

These figures indicate that the number of suppliers using the Buyers Club has increased faster than originally expected. It is very likely that many Quintana Roo hotels are waiting for a critical mass to emerge before placing orders through the Buyers Club. Experience thus far suggests that new market needs have been detected, while services for the development of a commercial cycle are defined for suppliers and hotels. Other specific services should now be offered from both hotels and suppliers at the time, so that the IT use culture may grow.

e) **Buyers Club**

This electronic portal was designed to serve as a venue for “specialized clearinghouses”. With the “buyers clearinghouse” now well established, a “suppliers clearinghouse” and a “news clearinghouse” are to be set up. In this manner, the portal will provide the Buyers Club services described below:

(i) *Buyers (hotels) can:*

- Search for suppliers, using either an alphabetical directory or keywords related to:
 - line of business,
 - product,
 - trademark,
 - other relevant information;
- Ask for quotes on products or services from as many suppliers as they choose.
- Check quotations from suppliers, ordered automatically by price in a table to facilitate purchasing decisions.
- Directly access offers posted by suppliers on the corresponding bulletin board, thereby matching hotels’ demand with supply.

(ii) *Suppliers can:*

- access buyers’ names and the names of their managers in the hotel directory;
- reply to requests from buyers;
- announce special promotions, which are posted on a bulletin board;
- post their product and services catalogues (including, optionally, prices).

(iii) *Services provided by the Buyers Club*

(a) **Portal registration**

- Buyers:

Members of the hotel association are automatically registered in the system and are sent a username allowing them to update their information in the portal. In addition, all hotel staff responsible for procurement, including comptrollers, purchasing managers, housekeeping managers and employees of food and beverages and other departments, are also assigned usernames.

- **Suppliers:**

Suppliers register for the portal by paying an annual membership that allows them to access the system, including the directory of affiliated hotels, and to receive and reply to requests for quotes.

In addition, they are eligible for value-added services offered by the association and NAFIN. Their listings in the supplier directory include their commercial name, type of business, address, phone numbers, e-mail addresses, products and services and the brands under which they sell.

(b) Other relevant information

This is a space in the portal that allows suppliers to pay a fee to post additional information on their products and services, and thereby attract the attention of purchasers more quickly. The information in these postings is controlled by suppliers.

(c) Hyperlinks to web pages

Hyperlinks take member hotels directly to a supplier's web page.

(d) Micro-sites

These are single-page websites with special information on companies and their products and services. Micro-sites are especially useful for companies lacking a conventional website, and in fact can supplant the need to have such a website.

(e) Discount coupons

This is a novel classified-ads type service that allows suppliers to post special discounts on a bulletin board, where they are ordered by category. These special offers can be arranged according to hotel, product or service. The purchase of a coupon allows five, ten or twenty special offers to be posted. An additional fee is charged for this service, to limit its use to the posting of authentic discounts—for example, in the event of inventory surpluses, clearance sales, one-time markdowns, manufacturer rebates, and so on. Hence, this prevents excessive use of the space and ensures that searches for products and services will not become cumbersome.

(f) Advertising

Advertising is conducted through banner ads, buttons, hyperlinks, sidebars, direct mailings and advertising reports for clients.

- Training on using the portal

The Infocentre has a space where hotels and suppliers can learn how to use the Buyers Club.

Technical support and trouble-shooting are provided either by phone or by e-mail. In addition, customer service related to the Infocentre is provided over the phone or on-site.

- Infocentre training and technical assistance

One of the goals for the Infocentre is to provide training for hotels and their suppliers ensuring that they fulfil their commitments stemming from transactions handled through the portal.

TABLE 24
MAIN TOPICS COVERED IN THE TRAINING

Entrepreneurial culture	Marketing and selling
Investment projects Family-owned businesses	How to sell to the government: Marketing Selling
How credit works	The importance of quality
ABCs of credit access: Qualifying for a loan Self-evaluations Electronic factoring	Quality in services Ongoing progress
Information technologies^a	Production chains
Using information in the planning processes Basic office software suites (for word processing, spreadsheets, presentations and information management) Introduction to the Internet, with a focus on commercial uses	Training in the use of the NAFIN application for electronic factoring

Source: Author.

^a Modules being developed.

(iv) *Model solutions for the Buyers Club:*

The Buyers Club was designed on the assumption that it would grow; the strategy behind the Club is for it to reach a critical mass. The development of the Buyers Club can be divided into various stages of growth.

- Product and services catalogue

The catalogue of products and services is the starting point of the Buyers Club. The goal is to allow suppliers and hotel managers to obtain basic information on different products, services, companies and sector representatives.

Infocentre members can access the Internet-based catalogue and database to retrieve information on:

- use of advertising by hotels and suppliers;
- bulletin board requests for quotes;
- suppliers and pricing at the Buyers Club;
- supplier selection: by price, by timeliness, etc.;
- regulatory framework governing the Buyers Club;
- dissemination and marketing of the Buyers Club.

(v) *The technological-solution model*

The Buyers Club is based on an open-architecture technological model compliant with IT standards.

- Scope of the solution:
 - Based on a conceptual model
 - ITs used
 - First stage came online 2 July 2003; the second stage is expected to be ready in 2005

2. Case B: Cemex

In recent years, IT has become the most important tool for companies to gain a competitive advantage through efficient, effective and innovative production and management processes.

Many large companies have made sizeable investments in software and hardware and for the construction of digital networks, infrastructure, personnel training, system upgrading, application integration, and platforms for the migration of server infrastructure, among other things. In addition, some organizations have received support from consultancy and technological-development firms to create strategic alliances, mergers and procurement chains.

Both domestic and foreign companies, in all lines of businesses, have used IT to successfully compete in world markets. One noteworthy success story, Cemex, is Mexico's leading cement and concrete maker and the world's third-largest cement maker.

Cemex's chairman and chief executive officer (CEO), Lorenzo Zambrano, is a firm believer in the importance of IT. Accordingly, he has guided Cemex's large investments in hardware and software and the development of portals. The company has made strategic alliances and incorporated firms from the technological sector as subsidiaries.

a) IT, from Cemex's perspective

Investment in IT has allowed companies to increase their competitiveness as a strategic tool for developing new ways of selling, improving customer service and expanding plant capacity. IT has also had a strong impact through quality control and process optimization; the reduction of management and operational costs; and the improvement of online customer service, SCM, e-commerce and manufacturing operations.

IT has transformed a number of business practices by promoting a common vision among clients, associates and suppliers in productive chains. The management of information flows among departments and within organizations leaves little opportunity for information to be distorted. Such a system requires the backing of the entire organization and the board of directors, and especially the CEO.

Due to the importance of integrated information systems, IT investments of more than US\$ 120 million are expected at the end of 2005 in Mexico, in particular in integrated technological solutions and services such as ERP, CRM, SCM or business intelligence.

Cemex and its daughter company, CxNetworks, signed an agreement with the School of Engineering of Mexico's Instituto Politécnico Nacional (IPN) to jointly create a network development laboratory for the training of 300 to 400 telecommunications specialists and teams to research and test routing technology, virtual local area networks, wireless networks, virtual private sector networks and network security technologies. This undertaking highlights the importance of IT for Cemex.

b) The Cemex case

Over the years, Cemex has demonstrated its proficiency at using IT to optimize its operations. The first step consisted in implementing the "Cemex Way", a philosophy that encourages the company to adopt new technologies and meet world-class standards. By rationally developing IT, Cemex has standardized computer processes throughout the company, integrating new subsidiary companies into its system in less than four months and obtaining earnings results two days after the end of each quarter. Francisco Garza, General Manager of Cemex México, notes that IT has allowed the company to dramatically improve information management, achieving direct communication throughout the corporation by using Lotus Notes and JD Edwards System and allowing up-to-date inventory information to be obtained from each Cemex plant (Marrufo Vega, 2003).

According to Garza, by using satellite communications, Cemex has networked its computers, telephones and videoconferencing equipment, allowing management to access market information on operations throughout the world. However, these achievements —considerable as they are— pale in comparison to what Cemex expects to achieve in the future. To help the company make the transition to fully computerized operations, Cemex has created a subsidiary, CxNetworks, which has promoted the company's e-enabling process, as described below.

c) CxNetworks

CxNetworks has created alternative sources of sustainable growth for Cemex by supporting the starting up of new and innovative market-oriented businesses to leverage Cemex's strengths. CxNetworks' initiatives are focused on the knowledge industry and its logistic capabilities, and have a global scope and a solid technological platform. CxNetworks is expected to support the transformation of Cemex by investing in the most highly skilled managerial talent, by leveraging and disseminating its technology and by improving on good ideas in profitable companies.

CxNetworks has a global outlook, promoting unlimited connectivity to provide information technologies and encourage innovation. Its business model is based on the creation and promotion of networks of individuals, associates, suppliers, clients and technologies. For example, the Construrama portal (www.construrama.com) was designed to meet the needs of the entire construction industry, especially SMEs, by serving as a one-stop site for posting purchase requests and finding technical advice.

CxNetworks' team comprises more than 1,600 professionals working in Argentina, Brazil, Chile, Mexico, Portugal, Spain, the United States and Venezuela. The company has an ever-growing portfolio of clients, as described below.

d) Neoris

Neoris provides innovative business solutions based on a consultancy model that combines optimum technology and design. These solutions run the gamut from the strategic analysis of business problems to comprehensive approaches. Neoris offers its clients tools for creating competitive advantages through value chain management, human capital optimization and CRM.

Neoris, with a team of 1,400 professionals, belongs to the Arthur Andersen consultancy group, which was hired by Cemex to support its operations in Argentina, Brazil, Chile, Mexico, Portugal, Spain, the United States and Venezuela by addressing the needs of more than 150 clients, including leading TNCs and their subsidiaries. Neoris has two subsidiaries, Neoris Financial Services and Neoris Logistics.

Neoris Financial Services provides consultancy services and IT-based business solutions through a strategic alliance with PVA International, a New York-based financial consultancy firm. This daughter company also provides and technological solutions to financial organizations in Latin America by relying on the experience of 30 consultants.

Neoris Logistics (formerly Cosite) develops Internet-based logistics products. Its leading product is ActiveTrac, a scalable inventory-management system with a proven track record that helps companies lower costs by optimizing the delivery times of items with a high inventory value. ActiveTrac was developed jointly by Neoris and Ryder, a United States logistic services supplier.

e) Arkio

Arkio is an innovative one-stop shop for the distribution and sale of construction materials to satisfy every need of construction professionals. Its site offers a wide selection of materials made by industry leaders, guarantees on-time deliveries and offers value-added services to support its clients during every step of their projects. It has four principal channels for clients to contact it, including a website that allows its clients to manage all aspects of this relationship by computer. Another of these channels relies on a communications network that combines wireless and Internet technologies to connect clients with suppliers in real time, allowing users to send purchase orders for building materials to a store where there are readied for shipment. In addition, the network notifies suppliers of inventory levels and provides support and services to clients in real time. The network is named Arkionet.

f) Latinexus

Latinexus offers a set of services to optimize the purchase and distribution of goods and indirect services by SME associated companies. In comparison with traditional outlets, Latinexus has lower administrative costs and offers lower prices and a larger supply of goods and services as well as faster supply-cycle times.

Its services include purchases analyses, negotiations with suppliers, management of supply and support. SMEs can use this type of technologies online to optimize the purchase of goods and indirect services. Latinexus also offers Internet-based solutions such as electronic catalogues for clients and suppliers, auctions, reverse auctions, requests for bids, quotes, purchases and management of contracts. With the support of world-class practices and technologies, these services allow clients to develop a successful e-procurement strategy.

g) E-enabling Cemex

Cemex is being transformed into a digital company through the establishment of a structure based on open corporate information, which gives all parties concerned access to the company's information, resources and networks. Through this high-priority process, called "e-enabling", complementary initiatives are implemented to ensure that all parties and processes may take full advantage of the benefits offered by the Internet. E-enabling also offers the human skills, hardware and networks needed to take advantage of these possibilities. This process is promoted by multifunction teams that identify Cemex's best practices, incorporate them into standard platforms, and execute them throughout the organization.

The components of e-enabling are listed below.

(i) E-selling

Client satisfaction is a top priority at Cemex. To provide an efficient service, SME suppliers have to clearly understand their clients' needs as well as the means to meet those needs. One of Cemex's tools is based on Internet technology, specifically a commercial portal that has helped the company increase its orders and sales. The most important advantages offered by this portal for the final client include:

- easy access to information, from account balances to new products and services;
- tools for SME providers to improve their business management, such as online courses, systems to solve critical issues affecting clients and business management applications;
- online orders and order planning;
- order status information;
- technical assistance.

This initiative's various benefits include:

- greater efficiency in processes, reducing management, transaction and marketing costs;
- better SCM, optimizing transportation and inventories;
- new interactive communication channels, such as e-mail, Internet messaging and online courses.

As SMEs adopt this new way of doing business, electronic services will improve, leading to the introduction of new services both for their clients and for their sales force.

(ii) *E-procurement*

E-procurement allows SMEs to quickly and efficiently buy articles and materials online. Because of its capacity for customized user interfaces and convenient access, e-procurement can help users eliminate bottlenecks in the approval process, more efficaciously manage relationships with their suppliers and achieve effective coordination and faster response times.

Cemex's suppliers offer information catalogues in Cemex's standard format and are responsible for updating the information in them. To ensure the smooth operation of this system, the company has devoted significant resources to preparing its employees and SME suppliers, through training, orientation, consultancy and support to allow them to take advantage of this new electronic environment.

Savings are expected from improvements in the supply process and from greater access to information, as well as from lower prices from suppliers. E-procurement allows Cemex to standardize its processes throughout the world as well as its software, hardware and information. Regarding purchases, version 7 of the ARIBA electronic purchasing software has been implemented and integrated into the company's ERP system.

(iii) *E-workforce*

To facilitate the exchange of knowledge among its staff, Cemex has created a corporate-wide intranet with tools to improve efficiency and productivity. Together with these tools, training and incentives been provided to accelerate the development of the system and transform Cemex into a learning-oriented organization.

To create a new culture throughout Cemex's global organization, all employees have received training in the hardware and software they need and given incentives to raise their productivity through the automation of workflows and the accelerated, routine sharing of knowledge and information. To meet these goals, Cemex has promoted:

- **Independent decision-making:**
The staff is authorized to negotiate deals and has access to the relevant information and professional hardware across the portal.
- **Personnel services:**
The Human Resources Contact Centre offers the company's employees individualized orientation on how to further their career inside the corporation and raise their earnings.
- **Development of competencies:**
Training is given to CEMEX personnel through an electronic centre, kiosks and a user portal.
- **Flexibility to change:**
A strategy to change management is being carried out through job descriptions that are subject to change. This project is the key component of this programme.

Cemex’s “e-workforce” initiative refers to its ongoing efforts to attract and retain managerial talent in order to strengthen its position in a dynamic business environment.

In 2003, Cemex was shown to be highly dependent on foreign markets, which at the time were experiencing a downturn. This led Cemex to implement a short-term strategy to mitigate the negative effects of its lower cash flows. The most important element of this strategy was the reduction in IT expenditures. Low investment in IT might however have negative consequences in the long term, since technology is moving forward at a rapid pace.

h) Conclusions from case study

Cemex has incorporated IT into its strategic plans, transforming it into a tool to meet targets. Through resource optimization and cost reduction, as well as constant innovation in products and processes, Cemex’s subsidiary companies have become more efficient, effective and profitable. A well-known company with a global reach, Cemex has shown its ability to use IT as the driving force behind its considerable growth and expansion by continuing to optimize and streamline its operations.

IT management at Cemex is based on the implementation of the “Cemex Way”, a philosophy to utilize new technologies and meet demanding world-class standards that has allowed the company to incorporate procurement operations in record times. In recent years, Cemex developed a corporate-information structure through “e-enabling”, which focuses on improving interaction with clients, optimizing the supply process and putting the entire organization online. In addition, through CxNetworks, Cemex has created alternative sources of sustainable growth by founding new and innovative businesses and by relying on an ever-expanding business portfolio.

All of these efforts have been made possible through the support of strategic alliances and consultancy firms focused on IT. The most important of these consultancy firms is Arthur Andersen México. The new IT platform is expected to support the transformation of Cemex through more investment in and the extension of its technology, as well as through the fine-tuning of good ideas and the innovative management of departments and businesses to make them profitable.

3. Case C: FreightMinds

FreightMinds’ motto, “Changing the way you think about freight”, underscores the company’s enthusiasm over its innovative approach to creating, managing and handling freight-forwarding and cargo-handling processes.

The company was founded by a group of Mexican and Columbian investors and developers devoted to providing web-based solutions, specifically logistics for the freight-forwarding and cargo-handling industry. The aim of the company is to meet import and export companies’ need for a systematized approach to shipping, tracking and performance measuring and for a comprehensive industry- and customer-database management tool based on warehouse operations visibility. All of these operations are to be handled over the Internet.

Recent technological progress, including improved Internet access, has made it necessary for many companies to upgrade their internal systems and to improve the management of their operations and customer service and their overall performance. FreightMinds has developed a modular system to facilitate international trade by SMEs.

a) E-CRM module

This solution was designed as a tool to assist with sales and marketing management, the creation and maintenance of a customer database, sales and marketing surveys and sales planning and to measure productivity.

The module serves as the foundation for all the remaining modules. It provides access to the customer database and customer information, handles customer relations and assigns tasks to the marketing and sales personnel. It is also a mechanism for internal communication and for sharing and posting customer-related information.

- Benefits of the e-CRM module:
 - Improved customer service
 - Interdepartmental information sharing
 - Improved management of the entire sales process
 - Sales and marketing management
 - Telemarketing/sales generation
 - Proactive teleservicing functions
 - Task assignment and management
 - Generation of standard and customized reports
 - Fully centralized databases
 - Mobile/remote access
 - Uploading and downloading of functions

b) Electronic freight operations module (e-FOM)

This module was designed to improve automated air, ocean and land shipping services, and simultaneously manage operational requirements and monitor shipment tracking and service performance. Technological advances require automation to raise productivity and improve client services. In keeping with technological advances, the core of this module is a simple, cost-effective approach to upgrading customer operating systems.

- Benefits; This module permits:
 - automated generation of shipping documents;
 - access to the International Air Transport Association (IATA) airport database;
 - access to the seaport database;
 - access to the IATA/cargo accounts settlement system (CASS) and airline payables;
 - pro-forma invoice generation;
 - management of accounts receivables;
 - invoice issuance;
 - other customized reports and functions.

c) Electronic-warehouse operations module (e-WOM)

This module was designed to automate warehouse and inventory processes, distribution and order tracking as well as to allow processes, inventory levels and locations to be monitored over the Internet. This was achieved through the integration into the system of virtual warehouses, which, in turn, allows for a more accurate and efficient management of all warehouse and distribution matters related to customers' business requirements.

Among its many features, the module offers real-time access to information from anywhere in the world, 24 hours a day. This permits the immediate tracking and distribution of goods sent to or from any geographic location and, thereby, the immediate shipping of inventories at any time and to any location in the world.

- In addition, the module:
 - is a fully Internet-based solution;
 - has barcode/radio frequency identification (RFID) capabilities;
 - allows extended mark-up language (XML) data transfers;
 - permits tracking of incoming and outgoing shipments;
 - permits inventory management from any location via the Internet;
 - is compatible with a virtual warehouse environment;
 - generates standard and customizable reports;
 - offers additional service features.

d) Electronic business intelligence module (e-BIM)

The e-BIM was designed to allow Internet-based access to customers' key performance indicators and balanced scorecards relative to productivity and performance. It also contains a special feature that enables users to go a step further and obtain real-time information from any of business department at any time.

Handling shipments and issuing freight, sales and management documents and reports does not provide the business performance visibility needed by the user; hence, FreightMinds has developed a module specifically focused on giving customers the tools they need to effectively and efficiently manage their day-to-day business activities. Moreover, this allows for immediate corrective actions in areas where performance does not meet expectations, from a company's upper management down to its operations level.

- The system provides the following benefits:
 - Immediate access to company performance data
 - Breakdown of daily, monthly and annual business results
 - Identification of sales and service items that are in line with budget targets
 - Assistance with maintaining historical data needed for budget preparation
 - Customized reports

e) E-FreightMinds Consulting (e-FMC)

Many Mexican SMEs need professional advice on how to use the best available logistics and systems in order to export.

To meet this need, FreightMinds has developed a complementary support service to work with customers and help them identify and analyze opportunities and determine the possible solutions to their operational and management requirements. In addition, the company evaluates and recommends best industry practices drawing on case studies of similar companies and its own expertise. This allows it to formulate a combination of solutions and tools ranging from its own operational modules platform to platforms already used by clients as well as others available on the market.

The main goal of these consulting services is to make customers' business processes and activities more efficient and profitable while raising the level of expectations of their services.

- The module provides the following benefits:
 - Expertise in freight-forwarding, logistics and cargo-handling operations
 - Expertise in sales, finance and accounting within the freight industry
 - The capability to understand, develop and implement the most advantageous business solutions
 - Development of interfaces allowing a single database tool to be used
 - Full consulting services regarding all aspects of the freight industry

C. Problems encountered by SMEs in participating in export-oriented value chains

The most common concerns for IT sector development and promotion of IT usage by SMEs have to do with basic business issues: inadequate access to financing, complex and time-consuming government procurement requirements, high training costs (obtainment of tax breaks to offset costs), labour laws, a lack of support for marketing, a lack of tax incentives and high communications costs. One major issue mentioned by nearly every company was the enforcement of intellectual property laws.

1. Mexico's IT sector

Although there are development programmes to strengthen the IT sector, Mexico still lacks a long-term, shared vision of the priorities for and of importance of the IT industry. The following general statements describe the IT sector in Mexico:

- The competitiveness of international companies based on government support results in market distortions.
- The quality of Mexican products prevents them from competing in global markets.
- The public sector's procurement system hinders SME growth.
- More programmes are needed to raise companies' performance and improve their competitiveness.
- Existing financing models have not been tailored to meet the needs of the IT sector.
- Financing for new ventures is practically non-existent and financial conditions are not conducive to the promotion of projects by established companies.
- Mexican industry has a low share of total domestic sales.
- Human resource training is insufficient.

There is a need for an in-depth analysis of basic issues (infrastructure-development policy, content and application, human resources; entrepreneurship) related to the development of Mexico's IT sector. On the basis of such an analysis, a proposal could be presented on how to encourage the development of the sector. Until now, this potential has been tapped only in some regions of the country, whereas in others work still needs to be done. Some of the issues affecting the sector are briefly examined below.

2. Infrastructure

The deregulation of the telephone sector paved the way to increased competition, to the widespread use of mobile telephones and to the growing popularity of the Internet. By 2000, there were 13.7 fixed lines and 21.7 mobile phones per 100 persons (ITU, (<http://www.itu.int/ITU-D/ict/statistics>)). In addition, the country had 98,112-km of fibre-optic

network (COFETEL, www.cofetel.gob.mx). By 2001, some 918,000 computers were connected to Internet network servers, and by 2003, 1.3 million were connected. The number of Internet users reached 7.4 million in 2001 and 12.3 million in 2003 (ITU's website).

- Regulatory framework and policy support

As a result of the new regulatory framework introduced in the 1990s, the burgeoning electronics industry generated about US\$ 35 billion per year in sales in 2001 and 2002. Importantly, software development alone represented 12% of the total.

The Government has taken steps to stimulate growth of the IT industry, for example, the electronic signature law recently passed by Congress. The legal framework is being brought up to date and promotion policies are being strengthened, because without such efforts the telecommunications sector will continue to stymie the growth of the IT industry.

3. Contents and applications

Mexico's software industry continues to be weak, as it is hamstrung by enormous obstacles in exporting its products. A breakdown of the 206 companies registered in the Association of Information Technology Industry is given in the following table.

TABLE 25
SOFTWARE COMPANIES IN MEXICO
(In number of)

Company size	Employees	Average employees	Companies
Micro	<15	7	63
Small	16 to 100	60	117
Medium-sized	101 to 250	175	14
Large	251 to 1 000	600	11
Corporate	>1 000	1 500	1

Source: Association of Information Technology Industry, 2004.

Most software companies have fewer than 250 employees. Size may considerably limit companies' ability to compete in international markets. A study by ESANE Consultants S.C. on IT services companies found 556 micro-enterprises, 512 small enterprises, 116 medium-sized enterprises, 103 large enterprises and 9 corporate enterprises.

4. Entrepreneurship

The definition of the IT sector used in Mexico includes both hardware and software firms. There are few integrated companies providing business solutions. Most IT firms are very small, and only a handful is technology developer. Most companies in this sector lack methodologies to determine their real costs or the capacity required to develop applications.

A business culture is only beginning to take hold in the country. Still, many established companies hire highly skilled human resources. Establishing a company requires dealing with red tape and overcoming hurdles to receive support from government agencies and the financial sector. Since growth in Mexico's software market has been and is expected to remain low, software promotional policies are needed.

III. Government policies to promote SMEs, IT, and foreign trade

In the past 15 years, Mexico has made progress in deregulating and in improving the business environment, with important reforms in strategic areas like property rights, basic physical infrastructure, telecommunications and the establishment of competition-promotion agencies (World Bank, 2001b). However, follow-up actions are needed to reduce institutional red tape. Some areas where simplification is needed are municipal requirements for obtaining or renewing registrations, operating permits and licenses; for registering with the tax authorities and for complying with tax regulations; and for labour-authority and Social Security registration. These factors rank among the most important constraints on business innovation and growth.

A. IT policies in the country's development strategy

To encourage IT development in Mexico, a law was passed creating the Software Industry Development Programme (Programa para el Desarrollo de la Industria del Software (PROSOFT)). This programme provides grants to encourage IT product developers to enter new technological markets.

The objective of PROSOFT is to give Mexico an internationally competitive software industry with strong long-term growth. The programme was designed in line with a consensus of opinions from the software industry, the public and academia. PROSOFT is executed by the Ministry of Economy with the support of the Mexican Association of Information Technology Industry. Some of the most relevant actions taken by PROSOFT, which began working on 3 September 2004, are described below.

1. Export and investment promotion

- A mechanism for the industry to promote its products and services in external markets and to facilitate business among suppliers and clients in this sector has been established.

- A one-stop information portal (www.software.net.mx) has been developed. The promotion of the portal was financed by the industry and the portal itself was launched by the Office of the Presidency. The portal's community comprises more than 4,100 registered users, 6% of whom are located in other countries.
- Value-added services have been provided for the export industry and for potential investors abroad. Such services include information on the capacities and services offered by companies in Mexico; the publication of value content; discussion forums; mechanisms to bring buyers and sellers together; an electronic job bank, among others.

2. Export-promotion actions in niches where Mexican industry has comparative advantage

- A study by the Ministry of Economy and ESANE detected potential market niches for Mexican industry in Europe, the United States and Latin America. This should be complemented with a strategy to allow Mexican industry to penetrate those niches.

3. Sufficient, quality education and worker training in software development

- To narrow the gap with commercial partners, trainers have been hired to reduce training costs and the time needed to incorporate skilled workers into productive plant.
- The Ministry of Education, in conjunction with the National Association of IT Education Institutions, has adapted computer science curricula to conform to industry needs and the type of support given by PROSOFT. Also, one of the financial instruments of PROSOFT is being used to design extracurricular courses in specific technologies (in-service training).
- Large-scale training of human resources has been given.

4. Developing the domestic market

- The domestic IT market has been expanded through the adoption of technology in specific productive chains.
- The Fundación México Digital (FMD) was recently created, with 11 private partner agencies. The objective is for it to contribute to the development of the domestic IT market through the execution of digital integration projects in value chains.
- A project is underway to promote digital integration by grocery-store and fast-food chains, *maquiladoras* and the tourism industry in general with the support of the FMD.

5. Determination of the IT penetration in different economic sectors and identification of sectors where adoption could be accelerated

- A study commissioned by the Ministry of Economy identified cargo transport, auto repair and auto parts, hardware, pharmacies and other businesses as niche sectors with a high impact on IT adoption. The value of the IT market in these niche sectors is expected to be between US\$ 18 and US\$ 54 million from 2003 to 2006.
- A supply-side strategy and a demand-side strategy are being used to promote IT penetration in the niche sectors identified.

6. Promotion of the domestic IT market

- A methodology to detect IT use in various productive sectors of the Mexican economy is being used.
- IT success stories based on the development of computer applications for specific economic sectors have been disseminated.

7. Strengthening of local industry

- New software companies have been created and the capacities of existing firms have been strengthened. Software financing needs are being identified, and a business-incubation methodology attuned to conditions in Mexico is being devised.
- Incubators are being operated, and their skills are being enhanced so as to promote new businesses, with the support of State governments and universities.

8. Opening up government procurement to Mexico's software industry

- Government demand for domestic software and related services has been promoted and negotiations have been held on this topic with Mexican IT enterprises.
- One objective is for US\$ 50 million to be allocated for national competitive bidding over the next three years, mainly by the Mexican Social Security Institute (Instituto Mexicano del Seguro Social (IMSS)), the Institute of Social Security and Services for State Workers (Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado (ISSSTE)), and e-Mexico.
- The Civil Service Ministry has agreed to monitor the procurement guidelines for government agencies.
- The Civil Service Ministry express its agreement or and design guidelines that will have to be conducted by the agencies in conducting procurement.

9. Attaining international levels in process capacity

- Mexico's software industry is seeking to become more competitive in domestic and international markets.
- The Universidad Nacional Autónoma de México (UNAM) has developed a processes model for the software industry. Known as MoProSoft, it helps meet needs related to quality, costs, ease of adoption, and SME best practices. The model, which is available to the general public, complies with Mexican Standards ("NMX") on quality in software development. A dissemination methodology and certification of the NMX have been completed.

10. A model based on MoProSoft to allow organizations to assess the quality of their processes and their overall performance

- The UNAM has designed a MoProSoft evaluation method to evaluate an organization's processes for a specific period of time.
- MoProSoft pilot projects were being implemented by an SME volunteer team in the second half of 2004.

11. **Creation of a National Technology Award in the category of information technologies**

- A technology-management model was developed for the software industry with a view to creating an award in the category of IT for the 2004 National Technological Awards.
- Promotion and training courses have been conducted in 20 States to encourage IT-oriented SMEs to compete for the award in this category.

12. **Promotion of construction-infrastructure and telecommunications clusters**

- An assessment of the strengths and weaknesses of the States has been conducted, so as to promote investments and projects with federal and State-government support, particularly in the construction and telecommunications sectors.
- A quantitative study by the School of Economics of the UNAM classified States into two broad categories: those with a high potential (above the national average) for developing digital-economy clusters and those with a low potential (below the national average). The two groups were further subdivided according to their interest in promoting regional development of the IT industry and the related actions they have taken.
- A methodology has been devised to integrate the qualitative results of the first phase.
- An analysis was made of the joint projects carried out in State IT clusters.

13. **Establishing IT initiatives at the State level and in business associations so as to bring the country's IT industry up to world-class standards**

- Cooperation agreements were signed with States willing to commit to investing in projects co-financed by the federal Government and in line with the rules governing PROSOFT.
- High-impact finance projects have been carried out according to specific agreements.
- Private investment has been promoted vis-à-vis broad-based projects in line with federal Government strategies for the States.

a) *The goals for PROSOFT for 2013 are to:*

- achieve annual software sales of US\$ 5 billion;
- ensure that Mexico reach the world average for IT investment;
- make Mexico Latin America's leader in software development and Spanish-language digital content

To meet these goals, strategies were identified in eight business areas (investment, exports, human capital, legal framework, domestic market, local industry, quality and business associations).

b) *The following specific targets were set:*

- By 2003-2004, the elements needed for industrial quality should be in place, to support the development of human capital, financing and a regulatory framework and encourage the widespread adoption of IT by SMEs, including those active in international markets.
- By 2005-2006, Mexican SMEs should have a larger share of the domestic IT market and be viewed as reliable suppliers of the Government and large

industrial users. Likewise, it is expected that SMEs will have modernized technologically and increased their share of exports.

- Between 2007 and 2009 there should be a significant increase in the number of companies and a diversification of the products and services offered by them. Research and development (R&D) should increasingly focus on the creation of new IT solutions to promote knowledge-based applications in diverse disciplines.
- By 2013, Mexico's software industry should be recognized as a world-class player.

One partnership to facilitate SME access to IT solutions is an agreement between Intel, the Ministry of Economy, NAFIN and Banco Santander. The aim of the agreement is to provide technical assistance and government-backed credit guarantees to allow SMEs to adopt IT solutions.

In addition, to promote new IT start-ups, the National Council on Science and Technology (CONACYT) and the Ministry of Economy established a programme to create IT incubation models with entrepreneurs. The programme will provide grants to universities who work to disseminate this model, participate with angel investors during the start-up stage and provide guaranteed loans.

A growing number of entrepreneurs, universities, industrial and commercial associations and private companies are interested in using these new development instruments, instruments that were lost 10 years ago when Mexico embraced neoliberalism and adopted an industrial policy whose guiding principle was “do nothing; the global market will provide incentives to SMEs; it is better to purchase technology than to produce it”. Now, however, Mexico is constructing a new long-term policy that views R&D and IT growth as high priorities and strategic issues.

B. Policies to support SMEs

The fact that software expenditures account for a low share of GDP —0.1% from 1992 to 1999, for example— reflects the absence of a State policy to promote this sector. Moreover, statistics indicate that products in this industry —an infant industry in Mexico— have a high price elasticity.

In the same period, expenditures on IT-related products (hardware, software, services and communications peripherals, among other items) accounted for less than 2% of GDP, compared with more than 6% or 7% of GDP in the United States and Canada.

The National Association of the Computer Program Industry (Asociación Nacional de la Industria de Programas de Cómputo (ANIPCO)) was founded in 1985. This can be viewed as the year when a critical mass of SMEs first emerged. Seventeen years later, in the absence of a government-promotion policy, this industry is still far less consolidated than are traditional industrial sectors, as support for it has been insufficient.

Countries that have successfully promoted their IT industries have done so, firstly, by using the State's economic resources to strengthen domestic companies and, secondly, by using fiscal policy to encourage those companies to proliferate and become geographically decentralized. Though this has required short-time fiscal sacrifices, in the medium term these sacrifices have paid off as the amounts spent on subsidies have been recovered and these countries' IT industries have contributed to stronger trade balances.

In Mexico, public policy instruments to support SMEs need to be more focused, as the actual recipients of assistance are mainly medium-scale enterprises rather than small ones.

The number of firms applying for assistance through development programmes is still low, due in part to a lack of information on these programmes, particularly among firms outside of major urban areas. There is also a lack of programmes structured to meet SMEs' needs. In two-thirds of the development programmes studied by World Bank experts, client users were very small.

Some programmes have introduced or plan to introduce client recovery fees. Many project managers do not place a high priority on loan repayment and most SMEs expect the government to cover most of the bill for their investments. The execution of federal programmes is often centralized, despite the growing participation of State or municipal institutions, NGOs and the private sector. Most federal programmes, rather than using external private service providers, hire outside experts and promoters.

In many cases, programme management and assessment are inadequate. Programme managers' compensation does not usually depend on improvements in efficiency and the fulfilment of programme objectives. Also, internal evaluations of programme performance are usually keyed to a programme's outcomes (e.g., number of firms served) rather to its impact (e.g., increased sales and employment).

The federal Government aims for the country's competitiveness ranking to rise. Mexico ranked 53rd in the world in an Organisation for Economic Co-operation and Development (OECD) survey in 2000. In 2003, it stood in 45th place, and the Government expects the country to climb to between the 35th and 45th position in the next two years.

In the National Development Plan, the software industry is viewed as one of the 10 most important strategic sectors for the country's long-term economic growth. In October 2002, the Minister of Economy presented a 78-page action plan titled "National Software Industry Development Plan" to promote the local software industry. The plan gives a detailed analysis of worldwide success stories and a description of Mexico's potential in this market and sets forth concrete objectives for developing the software industry and for achieving the objectives set forth in the plan.

The plan calls for seven key actions:

- Promoting software exports and attracting related investments
- Encouraging training to give the country top-level human resources for software projects
- Creating a legal framework to foster growth in the industry
- Developing the domestic market
- Promoting growth among existing software makers
- Attaining international levels in software-development capacity
- Developing infrastructure in all States that support the software industry

Software companies of all sizes, nationalities and areas of expertise have the potential to contribute to Mexico's economic growth and to the development of a strong local software industry. During a visit to Mexico in August 2001, Microsoft CEO Steve Ballmer formally announced a three-year US\$ 56 million donation from Microsoft to the Ministry of Economy. Of this amount, US\$ 1.5 million was to be used to create Spanish-language content and the rest to develop licensing packages (Visual Studio, Project, Office Developer, etc.) (Microsoft Corporation, 2001). Microsoft is now launching a second initiative, a software-industry development portal, to help Mexico meet the objective stated in its Software Industry Development Plan of training "top-level human resources for software projects".

1. Export promotion

One of the main objectives of the Software Industry Development Plan is to raise Mexican software exports —and ultimately to make Mexico a world leader in software services (Mexico, Secretaría de Economía, 2004, p.26). One of the areas where government support is most needed is with basic marketing to promote exports, and this area may be targeted for such support as export promotion programmes develop.

The plan calls for increased efforts involving several institutions, including the Ministry of Economy, the National Exports and Imports Development Bank (Banco Nacional de Comercio Exterior (BANCOMEXT)), the Association of the Information Technology Industry (Asociación Mexicana de la Industria de Tecnologías de la Información (AMITI)) and the Jalisco State-based Electronic Productive Chain Centre (Cadena Productiva de la Electronica A.C. [CADELEC]).

Since 1985, when Mexico first began to export software, several successful software exporters have emerged. Sinapsis Technologies México has been in business for 12 years, has a workforce of 180 and exports approximately 5% of its products. Other successful exporters include GE Dem, Seguridata and Softtek. These companies have the potential to make a significant contribution to Mexico's trade balance.

As part of the efforts to enhance the competitiveness of Mexico's IT industry and boost its exports, many IT development companies are examining the Capability Maturity Model for Software (CMM) process; indeed, six firms have now obtained CMM2 certification, eight have CMM3 certification and one has received CMM5 certification.

2. Trade facilitation

There are many trade mechanisms by which IT sector growth can be stimulated. These mechanisms including: bilateral agreements; free trade areas, such as the Free Trade Area of the Americas (FTAA) and NAFTA; and common-market approaches, such as the Southern Common Market, or the Southern Common Market (MERCOSUR).

Because Mexico has generally recognized the negative impact of tariffs on consumers' ability to purchase computer hardware and software, Mexico now has a zero tariff on such imports, to encourage the use of IT by the entire population. Similarly, Mexico's two NAFTA partners and the 38 countries in the other 11 FTAs that Mexico has signed have eliminated tariffs on Mexican computer exports.

Mexico should take the lead in encouraging its free trade partners to reciprocate its low tariffs. High tariffs on components and software imported from non-NAFTA member states are a burden for Mexican producers to export finished products to the NAFTA region.² Mexico's IT industry stands to benefit from Mexican efforts to lower import tariffs and value added taxes (VAT) in the region —particularly as Mexico vies to become an leading software exporter.

Importantly, the World Trade Organization's (WTO) Government Procurement Agreement (GPA) contains national treatment provisions as well as a requirement that technical specifications “not be prepared, adopted or applied with a view to, or with the effect of, creating unnecessary obstacles to international trade”. The Agreement is a set of useful global rules on the implementation of non-discriminatory procurement processes worldwide.

² Import tariffs are typically lower on software than on hardware. However, value added tax tends to be applied to all computer-related products and to be high. Hence, the result is the same: access to technology is restricted.

The Mexican Government could do much to help Mexican companies export software products by taking a more active role in negotiations in favour of opening up government-procurement processes and facilitating SME participation.

3. FDI promotion

In 2003, FDI accounted for nearly 9% of gross capital formation in Mexico. The need for capital and access to it in Mexico will play an important role in determining software industry capacity. Thus, work needs to be done in this area, as is acknowledged in the federal Government's Software Industry Development Plan.

4. Business promotion (new businesses, incubation, entrepreneurship)

The Government has launched more than 200 business-promotion programmes over the last ten years. These programmes have relied excessively on public institutions to provide business development services, contrary to the precepts set forth in international best practices (World Bank, 2001a). In addition, the programmes have drawn heavily on scarce fiscal resources and they frequently have lacked a fee-for-service policy to recover costs, limiting their market scope and sustainability. The quality of these supply-driven services has often suffered from an insufficient orientation to meeting client needs. Overall, little specific attention has been paid to building product and delivery systems with a strong focus on service and financial sustainability.

To address these shortcomings, CONACYT and the Ministry of Economy have redesigned business incubator programmes, restructured tax incentives for technology developers and revised grants for the commercialization of ICT projects. AMITI has worked closely with the Government to promote the establishment of software factories, while the Mexican Association of Incubators and Enterprise Networks (Asociación Mexicana de Incubadoras de Empresas y Redes Empresariales (AMIRE)) has promoted new incubators and ICT projects throughout the country.

5. Mexican immigrant nostalgia market

Mexican immigrant entrepreneurs, an increasingly important social actor in the communities in the United States where they have taken up residence, also play a significant role in the development of their communities of origin.

The immigrant nostalgia market (in Spanish, "mercado de la nostalgia") (Millán, 2004) is increasingly important for Mexico. It consists of Mexican products in demand by millions of immigrants in the United States, and largely reflects the cultural traditions of those immigrants' regions of origin—for example, the furniture, food and clothing that they buy. By purchasing these products, Mexican immigrants are able to keep their ties to Mexico.

The United States has a Hispanic population of some 35 million, of which more than 25 million are of Mexican origin. This population increases by some 300,000 each year. Various estimates put the value of the nostalgia market in the United States at more than US\$ 12 billion per year and estimate that it is growing at more than 8% annually.

Products such as Tex-Mex food have already considerable shelf space in grocery stores, influencing consumption patterns of the general population as well. In coming years, this influence is expected to continue to grow gradually. However, paradoxically, the nostalgia market is not sufficiently exploited by Mexicans; often it is businesses belonging to citizens of the United States, China, Canada or other countries that provide this type of products and services.

Information technology can play an important role in connecting suppliers with nostalgia market consumers. One Internet site allows brokers and suppliers of Mexican products to use B2B applications to promote a diverse group of regional brands, foods and handcrafts. Most of the companies that bring nostalgia market producers and consumers together are located in California, Texas, Illinois, New York and New Jersey. Behind these success stories are complex logistics models and transportation systems owned by Mexican immigrants who act as distributors.

The nostalgia market provides Mexico with the opportunity to develop an authentic binational market. To take advantage of this opportunity, Mexico needs policies specifically designed to make it easier for companies to sell their goods and services in this niche market. In the medium and long term, such policies should translate into higher investment and employment in Mexico, since immigrant entrepreneurs can be investors in their country of origin. There should be incentives to attract long-time immigrants with resources to invest.

Some highly educated immigrants in the United States have established high-tech businesses, mainly in California and Texas. For example, Roberto Medrano, president of the Silicon Valley chapter of the Hispanic Net Association, is promoting a binational incubator in San Jose, California, and a second one in Austin, Texas, with support from the United States–Mexico Science Foundation (FUMEC) and Mexico’s Ministry of Economy.

In sum, since the binational market offers Mexico substantial advantages and market opportunities, information on the topic should be analyzed and disseminated to benefit Mexican companies and the country overall.

C. Special measures to narrow the digital divide

To narrow the digital divide among companies, policies must be devised in line with the specific needs of and challenges faced by Mexicans and the obstacles that hinder the growth of the Mexican market. The Government has taken an important step in this direction through President Vicente Fox’s E-Mexico initiative.

E-Mexico’s mission is “to serve as an agent of change in the country, bringing together the efforts of various public and private actors to eliminate the digital divide and socioeconomic differences among Mexicans through a system whose technological and social components offer basic services such as learning, health, commercial exchange and a place for complying with Government requirements, all while spearheading technological development in Mexico” (Mexico, Secretaría de Comunicaciones y Transportes, n.d.; Sallstrom 2003). Academia, government and industry, by working in partnership day after day, could bring about surprising results for Mexican SMEs.

1. Human resources

Mexico does not have a large number of computer-science specialists. By 2006, the number of persons employed in Mexico’s IT industry is expected to reach 396,100. Of these, 25,200 will be employed by IT hardware, commercial software, and IT services companies. Another 29,900 will work for IT solution providers and distribution companies. The remaining 341,000 will be employed throughout the economy as IT professionals—in occupations requiring skills in designing, developing, implementing or supporting IT products or services. Examples of IT occupations include IT manager, network architect, web designer, computer programmer and systems design engineer.

On the surface, Mexico's IT industry appears to have an adequate supply of human resources, but a closer look reveals that the changing composition in IT investment —away from commercial software— will result in fewer total IT jobs. Historically, investment in hardware and commercial software has generated more jobs than has investment in IT services. According to IDC data, for each US\$ 1 million invested in hardware, 3.25 jobs have been generated, and for the same amount of investment in commercial software, 3.14 jobs have been created. In contrast, this amount of investment in IT services has led to the creation of only 2.97 jobs.

IT capital investment is expected to total US\$ 9.6 billion in 2006. If the composition of this investment among hardware, commercial software and services were to remain the same as it was in 2002, IT industry employment would be 20.3% higher in 2006 than it was in 2002, equivalent to an additional 80,419 jobs.

Prior to the e-Mexico initiative, the government had launched its “programa Telesecundaria” (distance secondary education), which allows students to attend class by watching satellite TV broadcasts and videotapes of their courses. Mexican universities are using IT extensively to offer a wide range of degree courses and expand the number of distance learning courses. A more recent initiative, e-education, uses technology to provide primary and secondary adult education. Indeed, education and human-capacity building are two of the cornerstones of the National Software Programme. Ongoing efforts in this area should help train human resources needed by the software industry as well as contribute to demand for specialized workers by increasing the number of qualified software engineers and creating a more e-savvy and highly skilled workforce.

Nevertheless, distance education takes much longer to mature than does traditional education. Experience in other countries has shown, unfortunately, that because of cultural obstacles to using IT in education, government will need to support and promote distance education. The maturation time of this sector is as unpredictable as are policies to promote it.

Since 1995, various policy instruments have been introduced to raise the educational level of employees in technology sectors. One such instrument is a programme to train between 500 and 700 teachers with the purpose of establishing software-development enclaves in educational institutions and thus, generate a critical mass for the training of human resources in software development.

As part of the programme to promote the training of human resources, consideration has been given to proposals to provide financial aid to needy students, to encourage students to enrol in advanced courses of study abroad, to promote project development in the industry, to encourage teachers to receive in-service training and become certified and to encourage the private sector to contribute with software mining technologies for the establishment of projects with educational institutions.

The Instituto Tecnológico y de Estudios Superiores de Monterrey (ITESM) and other universities offer continuing education courses to allow SME employees to receive IT training, as well as conventional and online master's degree programs in which they can improve their ability to use IT tools. National universities such as the UNAM and the IPN are making important strides in this regard, for example, through the establishment of IT R&D centres. Technological universities throughout the country, which have been networked following the French educational model, have been preparing IT professionals for 13 years. Many foundations and private and public universities offer accelerated undergraduate and graduate degrees in IT. The percentage of students majoring in IT and communications rose from 0.5% to 10.7% between 1979 and 2002.

TABLE 26
IT AND ICT MAJORS, 1979-2002

Period	University enrolment nationwide	IT and ICT majors	% of total
1979-1980	694 727	3 412	0.5
1980-1981	725 837	5 454	0.8
1981-1982	777 262	8 157	1.0
1982-1983	829 942	10 426	1.3
1983-1984	866 339	12 901	1.5
1984-1985	921 975	17 538	1.9
1985-1986	944 669	21 715	2.3
1986-1987	958 223	29 855	3.1
1987-1988	953 179	36 235	3.8
1988-1989	990 969	42 238	4.3
1989-1990	1 016 941	52 624	5.2
1990-1991	1 014 217	63 974	6.3
1991-1992	1 022 469	68 855	6.7
1992-1993	1 057 612	69 193	6.5
1993-1994	1 066 653	74 915	7.0
1994-1995	1 183 151	85 925	7.3
1995-1996	1 217 431	100 257	8.2
1996-1997	1 286 633	109 253	8.5
1997-1998	1 310 229	121 174	9.2
1998-1999	1 392 048	133 925	9.6
1999-2000	1 481 999	153 283	10.3
2000-2001	1 585 408	157 642	9.9
2001-2002	1 660 973	177 110	10.7

Source: INEGI/National Association of Universities and Institutions of Higher Education (Asociación Nacional de Universidades e Instituciones de Educación Superior (ANUIES)).

2. Technical issues

Steady growth of IT use requires high-speed broadband Internet infrastructure in industrial parks as well as in remote rural areas, trunking, radio Internet links, DSL through Teléfonos de México's (Telmex) network and cable-modem connections. The Mexican Government needs to ensure that access to the basic telecommunications infrastructure is expanded. (The country in 2003 has 15.97 fixed phone lines and 29.47 mobile lines per 100 inhabitants).

SMEs can choose from a wide range of management products sold by TNCs, including ERP and CRM systems, but implementing these systems is costly. There is a large potential market for IT developers and professional consultants to provide technological solutions for SMEs by working together in areas such as enterprise and software assessment, system development, pilot testing and implementation. In many cases, developers and consultants provide comprehensive solutions to meet industry needs. Some of the fields in which there is a high potential for IT to raise competitiveness are tourism, exports, hospitals, finance institutions, international trade, manufacturing and public services. IT can also be put to use in more specialized areas such as quality assurance, production planning and control, logistics, project monitoring, maintenance, services performance and banking management. ASPs can help SMEs reduce the cost of obtaining licenses and investing in hardware. In Mexico, although there is growing demand for this type of business services, SMEs find it difficult to upgrade their IT systems because their computer equipment is often obsolete. Some small IT businesses support SMEs by upgrading their IT equipment for a modest fee.

Technical support is basic for IT developers, from templates and programming tools to commercial platforms for launching new technologies on the market. Many of these tools are quite affordable.

3. Financial aspects

Among countries with a similar level of development, Mexico has the lowest rate of venture capital investment, the lowest availability of world-class engineers and scientists and the lowest ratio of IT investment to GDP. This is a clear example of the failure of Mexican companies to use technology to raise their competitiveness.

The former head of the Ministry of Economy's Office for SME Development once stated, "35% of the problems faced by Mexican companies are due to a lack of financing, but 65% are caused by poor management". To help SMEs overcome this shortcoming in developing ICT support projects, the Government created Angel Capital programme. It has a particularly important role in promoting IT-based industries. NAFIN and CONACYT are implementing an entrepreneur programme to support new ventures, with a mix of angel financing and government loans with terms of up to five years.

As noted by the OECD, "Angel capital plays an important role in bridging the financing gap for innovative projects by new firms and providing business advice to start-ups. Governments need to modify legal and fiscal provisions that impede the supply of private capital for risky undertakings and address funding gaps where access to financing is a major business constraint" (OECD, 2002, p. 122).

Since 2003, NAFIN has contacted 2,000 potential angel investors in what are known as "National Entrepreneur Committees" and in angel capital groups in the United States interested in investing in new ventures. NAFIN is promoting this initiative through an Internet site that provides information on new ventures and technological solutions for potential investors. Mexico also has an agreement with the European Union to promote business through a mixture of credit and venture capital. Although the number of IT ventures is still small, these initiatives may prove to be another source for financing for ICT projects.

IT solutions such as ERP appear to be gaining acceptance among SMEs; nevertheless, in many cases they are inadequate, as they are cumbersome and not easily adapted to a Mexican SME's specific needs. Moreover, they often lack documentation geared to management and operating procedures common in most Mexican companies.

Another recent government initiative is a credit-guarantee programme designed by NAFIN in conjunction with the Ministry of Economy, CONACYT and commercial banks. The programme guarantees up to 85% of the amount of a loan. Banks sometimes prefer to assume part of the risk when a company has been in business for more than three years and has performed well. However, banks rarely approve loans to new companies.

Most IT projects require financing but it is difficult for them to qualify for lending because the value of such projects is "intangible", from the standpoint of a commercial bank analyst. In the case of venture capital projects in technology, the market value of a new technology is difficult to determine a priori; hence, SMEs are required to provide convincing data when negotiating with investors.

NAFIN is working with the Ministry of Economy, the banking sector and the National Securities Commission (Comisión Nacional de Valores) to create a self-regulated, over-the-counter stock exchange where investors can freely trade in shares not listed on the Mexican Stock Exchange (Bolsa Mexicana de Valores).

As noted by NAFIN general deputy director Federico Patiño, “The idea is to work over the Internet and allow business people to freely sell shares in their companies, to register them, and to make public offerings on projects or companies. A firm’s partners will offer shares on the Internet, and potential investors will be able to see a firm’s characteristics and buy a percentage of the public offering without the intervention of the financial authorities. This is a face-to-face arrangement, a physical operation” (Patiño, 2004, p. 4). Under this mechanism, a typical venture-capital firm could generate more than 100 jobs in five years and its revenues could increase 66% per year. Subsequently, the firm would be eligible for listing on the conventional stock exchange.

This mechanism has led to major improvements in the efficiency of financial-instrument management at a minimal cost. In addition, it has led to a profound technological transformation at Nacional Financiera, facilitating SMEs’ access to Internet services and to a telephone service centre that provides financing instruments and free orientation to SMEs throughout the country. The number of companies throughout Mexico that have received support in the form of financing, training and technical assistance increased from 15,000 to 350,000 in the last three years. Currently, 98% of all operations with banks and non-bank intermediaries related to SME financing are carried out electronically.

The Ministry of Economy, NAFIN, Intel México and Banco Santander have announced a partnership to operate an SME loan-guarantee fund and thereby raise Mexico’s competitiveness. By establishing and strengthening such funds, the Government has found a way to channel financing to SMEs. Furthermore, loan guarantees promote lending by ensuring that risk is shared. As a development bank, NAFIN promotes the allocation of resources with a value 10 times greater than that of the guarantee fund. Giving SMEs the opportunity to acquire new technologies by taking out soft loans promotes their competitiveness and allows them to grow and to serve new clients and markets. Such assistance for SMEs was once unthinkable in Mexico. These mechanisms are promoted through an Internet site located on a secure platform. The site serves as the first business community specifically designed to provide SMEs with business opportunities, information services and training.

4. Infocentres

Mexico’s Infocentres are designed to assist “business development centres (BDC)” by providing SMEs with financial services, spurring their growth and ensuring their creditworthiness.

The first Infocentre experience in Mexico was outlined in the case study described in Chapter III. This Infocentre was implemented with the support of the World Bank, NAFIN, the Ministry of Economy and private investors.

Another Infocentre was established by the Ministry of Economy through an agreement with Microsoft, Hewlett-Packard and Interdirect, a Mexican telecommunications firm. This Infocentre belongs to the United Industries conglomerate and Tralcom, a supplier of management learning systems. The Infocentre is a broad-based project to assist SMEs through a business development centre, and it is supported mainly by CONACYT and public universities. Business development centres, in turn, are designed to provide entry-level business skills and IT training through traditional and distance-learning systems; help SMEs make the most of traditional communications devices (phones, fax machines and photocopiers) and marketing tools (advertising, packaging and labelling); support them with PC workstations; and provide them with software and local content to increase their business knowledge, help them devise growth strategies, solve common problems related to production, credit and marketing, and conduct basic e-commerce transactions.

This Infocentre project has defrayed the costs of new investments for the development of software tools and local content, equipment, infrastructure, office furniture, leasehold

improvements, client services and promotional activities. World Bank financing mainly covered R&D, promotion of start-ups, staff training, technical services and services improvement. Most equipment costs were covered by private sector participants and by the centre's management. Operating costs are partially covered through the charging of user fees. The project emphasizes institution-building and governance models needed to ensure sound business management and financial sustainability. The target is for each centre to break even by the end of the second year and for net profits to be equivalent to 5% of total revenues by the end of the fourth year. In the first stage, 50 centres were inaugurated. However, 50% of the centres offer services that do not meet SMEs' needs and that merely solve common problems through a satellite hook-up. A new business plan is now being drawn up.

Similarly, some industrial associations are devising a new concept for Infocentres, calling on them to give assistance with technological searches, industrial protection, quality improvement, enterprise management, technical issues, training and financial access. The Ministry of Economy has a grant programme to allow industrial associations to operate these new Infocentres —called Entrepreneurial Development Centres (EDCs)— for six months. However, Mexico's Infocentres and EDCs, like similar centres in other countries, reach only an estimated 1%-2% of all SMEs.

As the World Bank noted in its study on the Southeast Regional Development Learning and Innovation Project, the growth of demand for the services offered by Infocentres in Mexico is constrained by several factors. SMEs are much more likely than larger firms to face barriers to investment in pre-competitive learning and innovation needed to build new markets and increased operating productivity and competitiveness. This is due particularly to (i) the perceived and frequently actual high cost of pre-competitive product/market development in relation to very uncertain returns, lack of access to financing, insufficient information or SME-appropriate services, and externalities in skills investments; and (ii) "softer" factors, such as the lack of an information-seeking culture, weak entrepreneurial experience and confidence, and the absence of a tradition of using business development services which otherwise remains an informal, in-house and in-family process on-the-job. Thus, an important element of an SME growth strategy in Mexico is to encourage firms to increase such capacity-building investments.

D. E-government initiatives to promote SMEs and trade

E-Mexico. In line with the Informatics Development Programme of the National Development Plan and Mexico's vision of how to use digitization to its own advantage, President Vicente Fox has stated that "e-Mexico" is a top priority for his administration.

1. Overall strategy for and structure of e-government

The Informatics Development Programme calls for a series of infrastructure and technology projects. The Programme is composed of four main areas: e-health, e-economy, e-government and e-education. More specifically, the aims of the Program are to:

- accelerate the penetration of telecommunications and information technology;
- further the development of a national software industry;
- increase the ways of using technology to access and optimize education;
- facilitate access to health information and e-health initiatives;
- promote SMEs and create new opportunities for them;
- bring all of Mexico's different cultures and linguistic groups into the mainstream;

- provide access for the disabled;
- ensure access to the justice system, guarantee the rights of Mexican citizens and uphold their social and ethical values;
- coordinate the different groups —public and private— that have an impact on the growth of technology, and
- promote appropriate funding for these activities.

Government officials have indicated that, of these objectives, priority has been given to (1) building the infrastructure needed to support the system; (2) increasing the number of digital community centres to 10,000 (there were 864 at time of this writing, although this number was expected to rise by the end of 2004 when new figures were to be released) operating through the e-Mexico program, including at post offices, schools, health and community centres in the municipalities where 80% of the population is concentrated; (3) promoting the development of a domestic software industry; and (4) expanding the provision of e-services (Microsoft Corporation, 2002). Despite the programme's considerable forethought, it has —justifiably— been criticized for its slow implementation.

2. Some applications

a) E-procurement

Some of the most important companies in Mexico with binational operations are those in the *maquiladora* industry, which first emerged along the northern border several decades ago before spreading throughout the country.

Wherever Mexican SMEs have been integrated into the production chains of multinational suppliers, chain management methodologies and systems have been applied, with IT playing an important role in planning, production and monitoring. Large national firms and TNCs have, in conjunction with their suppliers and clients, adopted similar systems to create their own procurement and e-procurement models.

In northern Mexico, high-tech automotive industry, Delphi Automotive Systems (Microsoft, websites), is introducing more advanced IT solutions in all its operations with customers and suppliers.

Assembly lines in Delphi's Packard Electric division, spanning 36 countries, run day and night, producing 40 billion parts annually. Coordination is more than important: it is critical. One of the firm's most modern plants is its *maquiladora* in Ciudad Juárez, Chihuahua. The plant has an R&D group of more than 1,000 engineers and technicians, who are designing the automobile parts of the future, and a programme to integrate fledgling Mexican SMEs into Delphi's network of suppliers and distributors.

A world leader in mobile electronics, transportation components and systems technologies, Delphi began adopting Windows Distributed interNet Applications Architecture (DNA) in 1998 to improve its control and management of manufacturing processes at its plants in North America, including in Mexico. Now Delphi is using the Microsoft.NET for manufacturing platform to integrate all of its plants, suppliers and customers into its worldwide network.

Microsoft.NET for Manufacturing is a platform of software and services that allows manufacturers to coordinate worldwide operations using the Internet and intranets, as well as more localized communication networks. This platform extends the possibilities of Windows DNA for Manufacturing —the technology that links operations within plants— to a much broader

network, thus allowing manufacturers to leverage open Internet standards, reduce costs and speed up their time to market. It also allows them to see, use and act on their most important information and operations, closing the loop between their plants, their suppliers and their customers.

Microsoft.NET for Manufacturing also allows Delphi to send manufacturing instructions and other information via the Internet, almost without regard to the type of servers and infrastructure used by customers, suppliers and manufacturers, and thereby to network its entire supply chain internally and externally. This technology has prompted many Mexican SME suppliers and distributors to adopt new systems to be connected with Delphi, thereby optimizing their operations control, lowering their costs and enhancing their competitiveness. Other large *maquiladoras* view this as an example of the type of support than can be given to production chains.

b) Customs and other trade-related procedures

In 2000, Congress strengthened the legal framework that governs online and e-commerce transactions by amending the Civil Code for the Federal District in Matters of Local Jurisdiction and for the United Mexican States in Matters of Federal Jurisdiction,³ the Federal Code on Civil Procedures, the Commercial Code and the Federal Consumer Protection Law.

In civil and commercial matters, these amendments: (i) allow acknowledgments of consent to be given electronically; (ii) permit persons who engage in commerce to keep records in electronic format; (iii) define the legal scope and evidentiary value of data messages and electronic media; (iv) regulate online contracts, e-commerce transactions and the use of automated systems; and (v) introduce and define the crucial concept of data messages.

Regarding administrative issues, the amendments to the Federal Consumer Protection Law incorporated internationally accepted principles on consumer protection in e-transactions, including provisions on electronic content and advertising, and mechanisms for consumers to assert their rights. In addition, the Federal Law on Administrative Proceedings was later amended to give validity to electronic procedures. Two thousand amendments were introduced to the criminal code, and the Federal Law on the Protection of Personal Information (*Ley Federal de Protección de Datos Personales*) was amended to set forth penalties for unauthorized access to and corruption of data, including data of the government and financial sector. The use of electronic media to transmit child pornography was also criminalized.

Transparent legal and regulatory provisions are a requirement for the encouragement of e-commerce in products and services. Such provisions, which also encourage demand for software and services, are needed to:

- establish ground rules for online commerce;
- ensure network and information security;
- instil consumer confidence in electronic transactions.

The Government considered many of these policy needs in its e-Mexico initiative, which focuses to a large degree on the software industry.

³ Currently, the Legislative Assembly of the Federal District approves the Civil Code for the Federal District and Mexico's Congress approves the Federal Civil Code on Matters of Federal Jurisdiction. Since the Civil Code for the Federal District was previously applicable to matters of local as well as those of federal jurisdiction, the Federal Civil Code has provisions identical to those set forth in the Civil Code for the Federal District.

c) **E-finance and e-payments**

In 2001, NAFIN implemented a financial information system to promote factoring operations between suppliers and their clients and thereby provide liquidity to SMEs by enhancing their capacity to manage their working capital. This has resulted in vigorous growth in many production chains, with a leading role being played by commercial banks as first-tier financial intermediaries.

In 2004, NAFIN was a finalist for the Stockholm Challenge Award in the e-business category, for its development of a factoring-based electronic-services project for SMEs. More than 900 agencies from 107 countries competed for the award, which is given to the IT projects most successful at narrowing the digital divide and promoting digital processes. An international committee of 31 experts selected the finalists in six different categories: e-government, e-health, e-education, e-environment, e-culture and e-business. The principal selection criteria were degree of innovation, awareness of user needs, accessibility and transferability. The NAFIN Productive Chains Programme has granted nearly 800,000 factoring loans to some 40,000 SMEs, thereby channelling over MXN 7 billion to them.

E. Institutional Issues

1. Standardization

The World Bank's Development Indicators Report focuses on the number of secure computer servers in a country, with secure servers being defined as those that use some form of encryption technology. Although this may not be the most accurate definition of server security, the World Bank's data are useful for comparing different countries. According to the World Bank's definition, Mexico has a very low number of secure servers —one per 2.6 million inhabitants.

At present, personal data protection is primarily regulated by general civil law provisions. Specifically, the Federal Law on Transparency and Access to Government Public Information regulates the use of information provided to government bodies, and the Law to Regulate Credit Information Companies governs the use of personal credit and financial information.

Congress recently enacted amendments to the provisions of the Mexican Commerce Code relative to electronic signatures. The amendments, fashioned primarily in accordance with the United Nations Commission on International Trade Law (UNCITRAL) Model Law on Electronic Commerce, set forth the legal validity of electronic messages, regulate the use of electronic signatures and provide for the establishment of certification authorities as well as the recognition of signatures issued abroad (Mexico, 2003).

2. Telephony and the Internet

Mexico's landline telecom penetration rate, particularly in rural areas, is lower than those of many other countries in the region.⁴ Telephone costs are among the highest in the region.

Internet penetration rates, although still low, have begun to rise. According to the World Economic Forum (WEF) 2001-2002 Technology Indicators Report, the number of Internet users in Mexico increased by more than 200% from 1998 to 2000, and the figures for 2002 to 2003 show a similar increase. Improved access to Internet infrastructure can be attributed to several

⁴ According to Pyramid Research (2003), as of June 2002, there were 141 fixed phone lines per 1,000 inhabitants.

factors, including the e-Mexico agenda itself. Some basic connectivity objectives called for in e-Mexico include increasing the number of phones to 25 lines per 100 inhabitants by 2006 and establishing specialized community digital centres to increase public access to the Internet.

Another factor is the liberalization of the telecommunications market. Although Mexico opened its market to competition in 1996, Telmex, the former State telecom monopoly that was privatized in 1990, continues to dominate most market segments; nevertheless, increased competition has helped bring down Internet access charges and led to new price structures, especially in the face of growing competition from wireless and cable-modem services.

Part of the success of Mexico's Internet strategy is due to cooperation among academia, government, the private sector and NGOs with a view to expanding access to and ensuring growth in the country's IT industry. For example, through a CONACYT-sponsored project named Internet in My Library (Internet en Mi Biblioteca), a number of States and private organizations have come together to provide Internet access in libraries (Sánchez, Alfredo, 1999). One of the project's sponsors is Microsoft, which since 1998 has donated more than US\$ 400,000 in equipment to 50 libraries and sponsored high-level forums and IT project financing.

Internet infrastructure can be expanded in many ways, including through government-sponsored kiosks, Infocentres, tax breaks for Internet cafes and tax incentives to encourage the use of Internet telephony in lieu of traditional telephony. The key is to utilize these multiple alternatives and promote access. Hence, Mexico needs to:

- consolidate its telecommunications and Internet infrastructure;
- establish IT business incubators and industrial parks;
- provide incentives for telecom companies to build networks;
- expand the existing infrastructure so as to increase broadband access, thereby making it easier for consumers to purchase goods and services over the Internet.

3. Intellectual property rights

Under Mexican law, whereas IT-industry products and/or processes may qualify for patent protection (to the extent that they may be considered inventions within the scope and definition of Mexico's Industrial Property Law), software is specifically excluded from such protection. Instead, software is covered by copyright protection and related provisions.

AMITI, representing more than 200 Mexican and Mexico-based companies, points to intellectual property issues as a major problem faced by Mexico's software industry. Moreover, intellectual-property protection is singled out in the Software Industry Development Programme as a primary need for enhancing the capacity of Mexico's software industry.

Moreover, according to the International Intellectual Property Alliance (IIPA), a United States-based intellectual-property-rights coalition, Mexico's copyright law might not be fully compliant with the Treaty of the World Intellectual Property Organization (WIPO). The IIPA alleges that the amendments to the Mexican Federal Copyright Law passed by Congress on 30 April 2003 include several significant flaws, including the lack of a provision for technology protection measures and inadequate provisions for authors to control their own works. Another concern, according to the IIPA, is that the law did not provide adequate deterrent penalties as provided for under the Trade-Related Intellectual Property Rights (TRIPS) Agreement. In general, the amendments strengthen assurances of remuneration for authors and provide for longer terms of protection and prerequisites for using derivative works.

Mexican law already provides many forms of protections for computer software, including copyright protection through the Federal Copyright Law as well as administrative and criminal provisions, primarily in the Industrial Property Law and the Federal Criminal Code.

Strengthening piracy protection would boost investment in commercial software and, ultimately, GDP. Given the importance of investing in IT capital generally and in commercial software in particular, it is important to analyze and estimate the impact of piracy on IT investment. According to the Business Software Alliance, nearly US\$ 11 billion in commercial software sales was lost to piracy worldwide in 2001.

IV. Regional networks

A. Digital cities

The provision of access to and the intensive use of cutting-edge technologies to offer urban services enhance opportunities for development, for a better quality of life and for higher levels of social and economic well being for urban populations. Accordingly, the provision of such services needs to be supported in Mexico.

- Typically, digital cities:
 - have high population densities;
 - make intensive use of IT;
 - offer modern urban services;
 - provide citizens with access to those services.
- Digital cities offer an opportunity to:
 - provide high-quality IT services in urban zones with a high population density;
 - bring governments closer to their constituencies;
 - promote civil-society participation;
 - give the populace access to information and to new government services;
 - encourage synergies among different government agencies.

B. Latin American Network of Digital Cities

The Latin American Network of Digital Cities was created in April 2001 at the Second Annual Conference of Latin American Digital Cities, held in Puebla, Mexico. The network project was consolidated in April 2002, in Valencia, Spain.

The aim of the e-Mexico nationwide system is to serve as a catalyst for the expansion of the network of digital cities in the Latin American region. The first stage of this network was implemented by the Mexican municipalities of San Pedro Garza García, Tlalnepantla, Guadalajara, Mérida, Puebla, Monterrey, Tijuana and Querétaro and the Miguel Hidalgo delegación (district) of Mexico City.

The digital city concept is quickly gaining ground, as noted at the Fourth Annual Conference of Latin American Digital Cities, held in Monterrey on 25 March 2003.

C. Association of Mexican municipalities (AMMAC)

The Asociación de Municipios de México (AMMAC) and e-Mexico are collaborating on a pilot project to build a Mexican network of digital cities.

Other participating agencies and associations include the Committee on Informatics of the State and Municipal Public Administration (Comité de Informática de la Administración Pública Estatal y Municipal) and the Hispanic-American Association of Research Centres and Telecommunications Enterprises (AHCJET) (see www.iberomunicipios.org/, www.ahciet.net/, www.monterrey.gob.mx/Cds_Digitales/).

V. Conclusions and recommendations

A. Main findings

1. There is a direct correlation between investment in IT infrastructure and economic performance; the economies or countries in which the ratio of IT investments to total capital investment is higher than 7.5% far outperform those in which the ratio is less than 2.1%.
2. Mexico is underinvested in IT capital; IT capital represents 1.5% of total capital.
3. The investment mix in countries with low levels of IT investment differs from that of countries with high levels of IT investment.
4. In countries with low levels of IT investment, more investment goes to hardware (62.2%) than to commercial software (13.3%).
5. In countries with high levels of IT investment, hardware accounts for a much smaller share of total IT investment (21.5%) than does commercial software (36.3%).
6. Software piracy must be addressed by Mexico and other countries.
7. By 2006, despite increased IT investment around the globe, most countries currently underinvested in IT will continue to devote less of their IT investment to hardware than to software.
8. Software is the engine of growth. Yet Mexico is not expected to capitalize on the growth-generating benefits of the software sector. In fact, between 2002 and 2006, the ratio of investment in commercial software to total IT investment in Mexico is expected to decline from its already low level of 10.3% to a mere 7.9%.
9. For countries currently underinvested in IT capital overall, the ratio of investment in software to all IT investment is expected to increase to 15.3% in 2006, compared with 13.3% in 2002.
10. Employment in Mexico will decline. The shift away from software investment will lead to lower employment than if the investment mix were to remain unchanged: with an

unchanged ratio, 80,419 jobs would be added, whereas with the expected decline in investment in software overall employment is likely to decline.

11. Policies that bring about even small improvements in Mexico's IT infrastructure can significantly boost gross investment in IT capital, particularly in commercial software, with a perceptible impact on GDP. For example, a stronger legal framework for the enforcement of intellectual property rights (IPRs) in Mexico would reduce software piracy.
12. A mere 10% decline in piracy could increase the amount of IT capital by 13.4%. An increase of this magnitude in IT capital in Mexico in 2001 would have translated into a 0.75% increase in GDP, whereas a 10% reduction in software piracy could have added US\$ 4.6 billion to GDP.
13. Faster growth of annual gross investment in commercial software is needed to promote a faster expansion of IT infrastructure, employment and GDP.

In sum, the significant change currently underway in software development means that this is the ideal time for Mexico to transform its use of technology. Such a transformation should be evenly distributed geographically and cut across all industrial sectors and draw on creativity in problem solving. In the newly globalized economy, demand and new needs offer opportunities to create markets and establish new businesses while making intensive use of IT a competitive advantage for SMEs.

Ricardo Zermeño, CEO of the Select consultancy firm, along with many other IT analysts, feels that expanding the IT sector must be made a national priority. Zermeño believes that some government officials and IT companies have the wrong vision, since the country's IT strategy should focus on the promotion of software factories, rather than on made-to-order software products. He also believes that it is not sufficient for Mexico to rely on its geographical proximity to the United States as a competitive advantage; policy makers must find a formula to bring domestic supply into line with demand. Internal software development by Mexican companies could prove instrumental for this purpose.

Mexico has the opportunity to devise its own IT development model, rather than copy those of other countries, in order to meet future demand by SMEs. To achieve this, it should rely on the more than 100,000 professionals who work in different organizations, rather than on the 15,000 employees of the software industry.

To promote economic growth, policy makers should encourage the expansion of IT infrastructure, particularly through policies oriented toward the software industry.

Consequently, Mexico needs to continue to bring down its trade barriers, increase access to credit, keep the government-procurement bidding process open, invest in human capital and job creation and develop R&D support programmes.

The following list further describes the current situation with IT in Mexico and gives more specific policy recommendations:

B. Policy recommendations

1. Targeted policies are needed to expand IT infrastructure, particularly in the commercial software sector, which can have a perceptible impact on macroeconomic indicators.
2. For example, a stronger enforcement of IPRs in Mexico could reduce software piracy.

3. Measures need to be taken to promote the software industry, and data are required to compare Mexico with other countries in these particular policy areas.
4. Investment incentives need to be introduced, but they should be geared to promoting the software industry.
5. Export incentives are also needed, and Mexican industry considers such incentives, through the support of Ministry of Economy and BANCOMEXT, an important mechanism for promoting the domestic software industry.
6. IT-related SMEs should be encouraged to apply for CMMI certification to guarantee their ability to compete in the international market.
7. Fiscal incentives such as the tax breaks promoted by CONACYT for technology-based companies should be used to stimulate export activity.
8. Strategic alliances should be carried out with IT-related TNCs.
9. Access to venture capital should be expanded.
10. FDI accounted for 9.9% of gross capital formation in Mexico in 2000, compared with 85.4% in Ireland, a net software exporter.
11. Mexico has a solid SME foundation and quality managerial talent with which to attract IT capital.
12. The encouragement of long-term trust funds could lead to the risk sharing as well as to attractive business opportunities.
13. Efforts should be made to encourage a modification of the current government procurement law, in order to encourage IT purchases from Mexican SMEs. An initiative along this line is being studied but progress has been slow due to the legal ramifications and bureaucratic sluggishness.
14. Rigorous laws protecting IPRs should be enacted and enforced.
15. Mexico is a signatory to most of the chief multilateral treaties on intellectual property protection.
16. A new patent regime needs to be promoted in Mexico and abroad.
17. The country's telecommunications and Internet infrastructure, including broadband access, needs to be expanded.
18. ASP solutions need to be promoted in line with demand from Internet users.
19. Telephone rates should be reduced through an increase in the number of providers and the encouragement of competition.
20. There needs to be greater investment in human capital and job creation.
21. In a 2003 WEF survey of quality in 82 countries, Mexico ranked 77th in math and science education and 53rd in education overall.
22. An effort should be made to ensure that entrepreneurs have access to government R&D support programs.
23. There should be more government programmes along the lines of those of CONACYT and the Ministry of Economy, to raise investment to 1% of GDP.

24. CONACYT should step up its efforts to see that its programmes reach more projects carried out by IT-industry entrepreneurs and universities since, as is well known, only 5% of these R&D projects are commercially viable.
25. To stimulate e-commerce, policy makers should foment a legal and regulatory framework conducive to the introduction of new products and services.
26. The legal structure should be strengthened.
27. Mexico recognizes the legal validity of online contracts and e-commerce transactions.
28. A new legal framework is needed to facilitate the work of PROSOFT.
29. According to the World Bank, Mexico has 2.6 secure computer servers per one million people; hence, network and information security needs to be enhanced.
30. The Federal Consumer Protection Law sets forth consumers' rights *vis-à-vis* online contracts and e-commerce transactions.
31. Stricter penalties for electronic crime are needed.

C. Technical assistance network

- An IT technical assistance service is needed, to give SMEs orientation, technological support and training and to foment an IT culture. This would allow SMEs to make sound decisions regarding IT acquisitions and solutions and promote new R&D projects allowing SMEs to succeed in the global market. The goal of such an effort would be to promote competitive production chains comprised of SMEs and large companies through IT development, thereby enhancing Mexico's international presence.

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