Globalization and E-commerce: Environment and Policy in Mexico

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INTRODUCTION

The spread of Internet connections and networks around the world is opening the circuits of the World Wide Web (WWW) to conduct business, buy or sell products, procure inputs, or simply learn about the existence of suppliers or competitors. The pace at which such electronic transactions penetrate domestic and local markets varies according to the particular conditions prevailing in each national setting. These include a myriad of factors and characteristics that determine each country's predisposition to the growth of both digital networks and the volume of business conducted via the Web.

This report examines Mexico as one of the countries in Latin America where e-commerce operations have extended most, second only to Brazil, and where a digital economy has begun to emerge as a result of a complex set of factors. Factors are identified that can be considered critical, and then likely implications for the growth of e-commerce in the near future.

Key environmental factors that exert an important influence include the performance of the economy, its sectoral and business structure, the size of the population, and the distribution of national income. However, it is hypothesized here, the ones that critically determine the pace, quality and orientation of the process are the work of private organizations devoted to promoting e-commerce practices, and the political will the Mexican government has demonstrated in the last few years to improve the country's telecommunications infrastructure. The former includes the systematic work and effective actions of specialized working groups in the discussion of vital issues like the passing of legislation to regulate and provide security to electronic transactions, the design of guidelines, and the spread of knowledge on the benefits and opportunities offered by e-commerce so that firms and other organizations can embrace e-commerce as a new way of doing business.

The will of the Mexican government is materialized in programs, projects, and initiatives, epitomized by the mega project to build what is called the e-Mexico National System. Also of particular importance are the programs aimed at providing technical and financial support to businesses, especially small- and medium-sized, for the adoption of information technologies (IT) to use the Internet for conducting business-to-government dealings, such as the fulfillment of fiscal obligations or the supply of goods and services. Since both these programs and the telecommunications networks under construction also benefit private individuals, consumer-to-government transactions are being equally facilitated.

The two sets of inducing factors reinforce each other. Promoting organizations operate by means of specialized working groups whose membership includes representatives from the federal government, often at the ministerial level. Jointly, these factors are creating a favorable environment and the required physical conditions for the development of both business-to-business and business-to-consumer e-commerce transactions.

The report is organized in two major sections. Environmental factors of a demographic, economic and social nature are discussed in the first section. Public and private policies and initiatives are examined in the second one. The paper concludes with general remarks on the results of the different analyses presented in the two sections, and a discussion of the prospects all those developments have for the near future.

NATIONAL ENVIRONMENT

Population and Demographic Profile

Mexico's population increased from 81.3 million in 1999 to 97.4 million in the year 2000, becoming the 11th most populated country in the world (INEGI, 2000b; 2001a). These figures implied an annual average growth rate of 1.85% over the 1990s, which is slightly more than half that prevailing in the 1960s—3.4%—when the population used to double every 20 years; now it will require 46 years to do so (Ordorica Mellado, 2002). Gender structure, in turn, shows a typical 48.8% female and 51.2 male population (INEGI, 2001a).

The National Population Council (CONAPO) estimates that by the end of 2002, the Mexican population will reach 103 million, on the basis of a mortality rate of 4.19 deaths and a birth rate of 20.5 children per 1000 inhabitants. On average, Mexican women give birth to 2.27 children in their lifetime. As a result of substantial improvement in health standards over the last three decades, child mortality dropped to 23.2 and life expectancy is now 73.7 years for women and 78 for men (Lloyd, 2002).

With a surface area of 1,947,156 square kilometers, Mexico is a rather large country, at least by European and Central American standards. According to the 2000 census, Mexico's overall population density tops 50 inhabitants per square kilometer. This figure, though, is as high as 5,563 in the Federal District, seat of Mexico City, and the nation's capital, which concentrates as much as 18.5% of the total population (INEGI, 2001a).

As described in Table 1, nearly two-thirds of the population live in cities and towns of 15,000 or more inhabitants, which are classified as "urban" by the National Population Council (CONAPO)[2]. This proportion is predicted to increase to 64.3% in 2010, while that of rural settlements is expected to shrink to 21.7% in the same year, and the one corresponding to mixed localities to remain unchanged (CONAPO, 2002). Since nearly half of the population lives in cities of 100,000 or more inhabitants, it can be said that Mexico is a predominantly urban population.

[2] CONAPO classifies as "rural" settlements of less than 2,500 inhabitants; as "mixed localities" those between 2,500 and 14,999; and as "urban" those with 15,000 or more inhabitants (CONAPO, 2002)

TABLE 1
Population Distribution by Settlement Size, 2000

Size category	No. of localities	% of population
Total	199,369	100.0
Rural		
1–2,499	196,328	25.4
Semiurban		
2,500–14,999	2,528	13.7
Urban		
15,000-99,999	399	13.6
100,000-499,999	84	21.0
500,000 or more	30	26.4

Source: INEGI (2000c).

At the top of Mexico's skewed urban system is a group of nine cities with a population of over one million each, which jointly accounts for 19.3% of the country's total population (Table 2).

TABLE 2
Cities with over one million inhabitants

City	Population
Federal District	8,605,239
Guadalajara	1,646,183
Ecatepec	1,621,827
Puebla	1,271,673
Nezahualcóyotl	1,225,083
Ciudad Juárez	1,187,275
Tijuana	1,148,681
Monterrey	1,110,909
León	1,020,818
Total	18,837,688

Source: INEGI (2001a).

It is in these large urban centers where most of e-commerce activity—both business-to-consumers (B2C) and business-to-business (B2B)—takes place in Mexico: transactions, promotion events, advertising campaigns, and business solutions consulting. Mexico City and seven neighboring metropolitan areas: Puebla, Toluca, Cuernavaca, Cuautla, Tlaxcala, Querétaro and Pachuca, make up a huge megalopolis with a population of over 20 million people, which is the country's largest urban agglomeration.

The population is increasingly mobile and rural-urban migration is still a major propeller of urban growth. Thus, it can be expected that the urban character of the population will be reinforced, as over 80% of Mexico's demographic growth is predicted to take place in urban areas in the next 25 years (Poder Ejecutivo Federal, 2001). Therefore, a substantial growth can be expected to take place in the proportion of people with access to the educational opportunities, cultural amenities, and telecommunications infrastructure that only urban areas can provide. In this way, as more Mexicans become "urban", the proportion of those likely to use a computer and the Internet to conduct business or buy on-line can be expected to increase concomitantly.

Age Structure

In spite of the observed decline in growth rates, Mexico's population is still predominantly young. Over one-third is under 15 years of age, while more than a half is between 15 and 64 years (Table 3).

Most of those in the group of 15-64 years correspond to what is regarded as the economically active population, which amounted to 58.09 million in 2000. Of these, 39 million were employed (INEGI, 2001a).

TABLE 3
Population by Age Groups, 2000

Age group	Population	%
0-14 years	32,586,973	33.4
15-64 years	58,092,327	59.6
65 and more	4,750,311	4.9
Not specified	2,053,801	2.1
Total	97,483,412	100.0

Source: (INEGI, 2001a).

It is expected that some 1.2 million jobs will be demanded annually between 2000 and 2005, 1.1 million between 2005 and 2010, and nearly one million between 2010 and 2015 (Poder Ejecutivo Federal, 2001).

Although only 4.9% of the population is 65 years or older, this group is growing at an unusually annual high rate of 3.7%, unique in Mexico's demographic history; this rate could top 4.5% between 2020 and 2030, which would imply that this part of the population could double in only 15 years (Poder Ejecutivo Federal, 2001).

On a comparative perspective, Mexico shows figures that do not differ substantially from other relevant countries in North and South America as to the proportion of population living in urban areas, though major differences exist in regard to absolute size and age structure (Table 4).

TABLE 4
Demographic Structure of Selected Countries in the Americas

Country/Region	Population 2000[a]	Urban population (% of total) 2000[b]	Population over age 65 (%) 1999[c]	Population under age 15 (%) 1999[c]
Argentina	37,032,000	89.90	9.58	27.91
Brazil	170,115,008	81.30	4.89	29.56
Canada	30,750,100	77.10	12.54	19.46
Chile	15,211,300	85.70	6.99	28.56
Mexico	98,881,000	74.40	4.50	33.93
United States	275,129,984	77.20	11.85	21.20
Venezuela	24,170,000	86.90	4.31	34.42
Latin America[d]	345,409,308	80.83	5.34	30.92
OECD[e]	1,115,304,202	77.55	12.63	20.43

[a] *Source:* International Telecommunication Union, Yearbook of Statistics 1991-2000. Geneva: International Telecommunication Union, 2001. Geneva: International Telecommunication Union, January 2002. The data for population are mid-year estimates.

[b] *Source:* World Bank Group, WDI Data Query located at http://www.devdata.worldbank.org/data-query/. WDI definition: urban population is the midyear population of areas defined as urban in each country and reported to the United Nations. It is measured as a percentage of the total population.

[c] *Source:* World Bank, World Development Indicators CD-Rom 2001.

[d] Latin America here and in ensuing tables consists of the following countries: Argentina, Brazil, Chile, Mexico and Venezuela.

[e] OECD here and in ensuing tables denotes the OECD member countries, excluding Luxembourg, Slovakia and Iceland.

Language

The number of Mexicans aged five years or older amounted to 84.8 million in 2000. Of those, 83.3 million spoke Spanish and 6.1 million spoke an indigenous dialect; out of the latter, 4.9 million spoke both Spanish and a dialect, and 1.1 million only spoke their native language (INEGI, 2001b).

It can be said, therefore, that the existence of a sizeable native population does not represent a barrier to the diffusion of IT and e-commerce in Mexico. More than 98% of the population of five years or more speak Spanish, the country's national language, which can potentially be targeted in e-commerce strategies and campaigns, provided they can have access to a computer and to the Internet.

Implications for E-commerce

The above trends suggest that Mexico will continue to consolidate its urban character and its economic activities. As growth in rural areas slows down, mixed localities—those between 2,400 and 14,999—will remain unchanged. This rapid urbanization appears as one of the factors driving the growth of e-commerce in Mexico. More people and businesses can potentially use a computer and have access to the Internet to engage in transactions on-line.

It is in urban areas, and especially in the country's largest cities—Mexico City, Guadalajara, Monterrey, Puebla—where most of the new telecommunications infrastructure and most of the possibilities for local businesses to get into on-line commercial transactions, are now, and will be, located. These prospects will be strengthened with projects under implementation by the

present federal administration, and aimed at connecting all of the country's major cities, plus smaller towns in selected rural areas.

A drag on the process, however, may be the population of 65 years and more, which is growing at an unprecedented rate of 3.7% per annum, and already accounts for 5% of the total. This, may double in 15 years should the growth rate reach 4.5% between 2020 and 2030, as expected by the Mexican government. The problem is that the aging of the population is a typical trend societies experience as they become more urbanized, and Mexico is not likely to be an exception.

Again, language does not represent a barrier in Mexico to the development of e-commerce and the use of IT in general, for over 98% of the population speak the country's official language, Spanish. A large and growing proportion also have a varying command of English, which is taught as a second language in elementary, secondary and preparatory schools, as well as in most college-level education programs. In addition, numerous English institutes and schools operate in every major city.

Economy

Macroeconomic Policy and Strategy

Over the last 30 years, Mexico has gone through a series of stages of economic strategy. It has shifted in focus from import substitution between the 1930s and 1970s, through trade liberalization in the 1980s and 1990s, and to export promotion in the last few years.

In the face of the recession of 2001, the strategy has begun to shift toward the domestic market and, particularly, to small, medium and micro enterprises (SMMEs), which make up most of the country's business establishments. This is evidenced by the high priority placed on SMMEs by the federal government, mainly through Nacional Financiera (Nafin)—Mexico's top development bank and the Ministry of Economics, one of whose under-ministries is entirely devoted to this echelon of Mexican businesses through several support and incentive programs.

So, although export promotion will continue to be pursued firmly, the domestic economy is becoming a parallel target. This is a growing demand on the part of some of the most influential figures of the private sector, including Carlos Slim, Mexico's richest businessman, and, more recently, the Transformation Industry National Chamber Confederation (CONCAMIN). However, the domestic market is small and insufficient for both an efficient distribution of goods and services and the development of industrial supply chains, especially in rural areas and depressed regions.

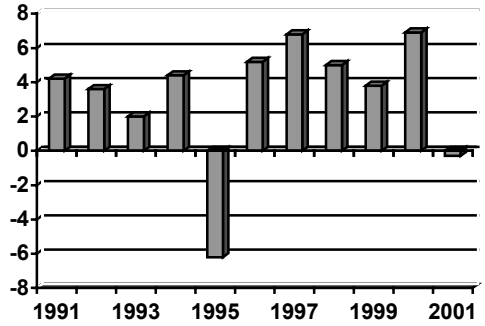
A low inflation rate, a tight monetary policy and a growing inflow of foreign direct investment have been among the first priorities of the economic policy followed by the last four federal administrations, including the present one. Inflation dropped consistently from 18.6% in 1998 to 4.4% in 2001. And foreign direct investment has increased consistently, too, from $10.7 to $14.0 billion in the same period (Banco de México, 1998; 1999; 2000).

Prospects for 2002 are modest, but more positive as compared to 2001. The economy is expected to resume growth at a rate of 1.5%, inflation will remain virtually unchanged at 4.5%, the fiscal deficit will stay quite low at 0.65% of GDP, and the trade balance will amount to 1.8% of GDP (Ortiz, 2002). The peso has been strong at a rate around nine pesos per U.S. dollar for the last few years, and can be expected to remain so in 2002. This has created a stable environment that has led companies to invest in imported technology to modernize their equipment and management systems (Jiménez, 2002). These predictions are reinforced by the positive prospects about the end of the recession of 2001 and the resumption of growth in the U.S. economy in 2002.

Economic Growth

After an outstanding performance for over three decades, known as the Mexican Miracle, in which an unusually high average growth rate of 6% was achieved, the Mexican economy began to slow down in the late 1970s and slipped into a series of recessive episodes in the 1980s and 1990s. From 1981 to 2001, the rate went down to a meager 0.5% per annum (Esquivel, 2002). The average improved in the last six years, but growth performance continued to be erratic: for example, there was a drastic slump in 1995 as a result of the peso devaluation of December 1994, and a second fall in 2001 (Figure 1).

FIGURE 1
Gross Domestic Product Growth Rates, 1991-2001 (Percentages)



Source: Prepared by the author with data from SHCP (2002b), p. 4.

The fall in 2001 was due to a 3.5% drop in the industrial sector. Agriculture, in turn, grew by 2.5% and services by 1.1% (Banco de México, 2002).

To give an idea of the magnitude of Mexico's GDP in absolute terms, Table 5 presents GDP figures in U.S. dollars for the period 1994-2000. Each year is calculated using the respective GDP value in current prices and the corresponding average exchange rate for that year.

TABLE 5
Gross Domestic Product in Mexico, 1994-2000 (US$)

Year	Value
1994	420,773
1995	286,184
1996	332,337
1997	400,870
1998	421,026
1999	479,446
2000	574,514

Source: Banco de México (2001), Table A6, p 121.

From an international perspective, Mexico presents a mixed picture. The inflation rate was the second highest among the selected countries in the Americas and vis-à-vis the OECD. In GDP growth, Mexico outperformed all the other Latin American countries in the group during the period, and exceeded the average rate for both Latin America and the OECD (Table 6).

TABLE 6
Key Macroeconomic Variables in Selected Countries in the Americas, 2000

Country/Region	Unemployment rate 2000[a]	Inflation, (annual %) 2000b	Average GDP growth, 1995-2000[b]
Argentina	15.00	1.13	1.79
Brazil	7.10	7.08	2.61
Canada	6.80	3.59	3.46
Chile	8.30	4.13	5.60
Mexico	1.60	10.73	3.57
United States	4.00	2.05	4.01
Venezuela	14.00	26.84	1.19
Latin America	9.20	9.98	2.95
OECD	6.56	4.79	3.43

[a]*Source:* International Labour Organization, LABORSTA (http://www.laborsta.ilo.org), Table 3A.

[b]*Source:* World Bank Group, WDI Data Query located at http://www.devdata.worldbank.org/data-query/.

Sectoral Distribution

From a sectoral perspective, the Mexican economy presents a mixed picture. Services are the predominant sector, with over two-thirds of GDP corresponding to tertiary activities. On the other hand, and contrary to what could be expected in a developing country, less than 5% corresponds to agriculture and other primary activities. Industry accounts for a little over a quarter of GDP (Table 7).

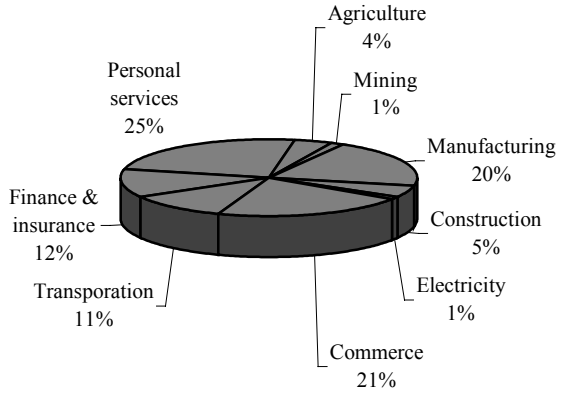
TABLE 7
Sectoral Distribution of Gross Domestic Product, 2000
(Billion US$)

Sector	Value	%
Agriculture	24.7	4.3
Industry	160.8	28.0
Services	388.9	67.7
Total	574.4	100.0

Source: INEGI (2001b).

At the level of economic division, manufacturing ranks high accounting for one-fifth of GDP. The other two main areas are commercial activities and services, this latter including both communal and social services. Finance and transportation follow close; the former includes real estate and housing leasing services (Figure 2). The point to note is that the Mexican economy is overwhelmingly a service economy.

FIGURE 2
Gross Domestic Product by Economic Division



Source: INEGI (2002a).

Trade Performance and Policy

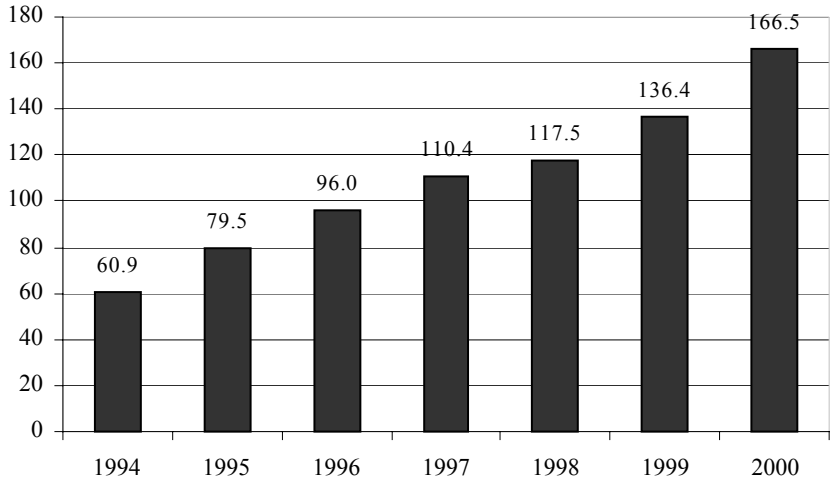
The strong will of the Mexican government to open up the economy to the flows of international markets was materialized in the 1990s with the abolition of most barriers to trade and investment, the subscription to nearly a dozen free trade agreements, and the privatization of most of the nationalized segments of the economy.

In what constituted the most important trade liberalization initiatives, Mexico joined the General Agreement of Trade and Tariffs (GATT) in 1986, signed the North American Free Trade Agreement (NAFTA) in 1993, and joined another with the European Union in 1999; in addition, eight more arrangements have been signed in the last decade. Altogether, these agreements opened new markets for Mexican exporters in over 30 countries in three continents and turned Mexico into one of the most open economies in the world.

An extensive program of privatization and economic deregulation was also implemented in the late 1980s and early 1990s, by virtue of which most public enterprises were privatized and foreign investment rules were relaxed so that the economy was left wide open to foreign capital, except for a few strategic areas explicitly reserved to the state, mainly oil (Palacios, 1992). This new regime was consolidated during the remaining part of the 1990s by the Salinas and Zedillo administrations, which adopted a hands-off policy to liberalize trade in most major industries, particularly computers and information technologies in general (Dedrick, Kraemer and Palacios, 2001).

The above, coupled with the dynamic performance of the Mexican economy and a favorable international environment, led to an outstanding performance of exports in the second half of the past decade. Total exports more than doubled from US$61 to US$166 billion, as a result of an annual average growth rate of 18.2% (Figure 3).

FIGURE 3
Total Exports, 1994-2000



Source: SEC (2001), p. 15.

As a result, Mexico became the United States' second trading partner, the top exporter in Latin America, and the 13th largest exporter worldwide (OECD, 2000)[3].

Foreign trade constitutes a key activity in Mexico's economy. Exports amount to a substantial share of gross domestic product nearing 30%, which has remained virtually stable since the mid-1990s, except for the slump of 1994 (Table 8).

TABLE 8
Share of Foreign Trade in Gross Domestic Product, 1993-2000
(Percentages)

Year	Imports	Exports	Total
1993	19.2	15.2	34.4
1994	21.6	16.8	38.4
1995	27.7	30.4	58.1
1996	30.0	32.1	62.1
1997	30.4	30.3	60.7
1998	32.8	30.7	63.5
1999	32.4	30.8	63.2
2000	33.2	31.4	64.6

Source: INEGI (2002b): *Oferta y Demanda Total* tables.

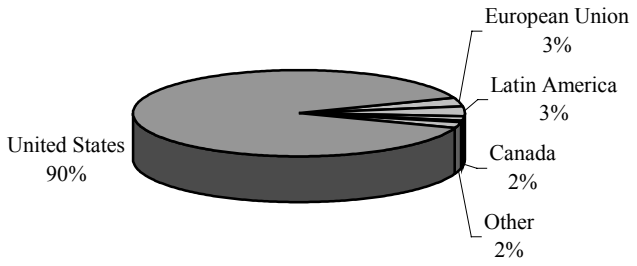
[3] If the European Union is taken as a single exporter, Mexico occupies the eighth place.

As a result of economic liberalization, Mexican businesses have been more able to improve productivity, probe into new markets, attract foreign capital, and learn about new technologies and new management methods.

One feature that continues to plague Mexico's foreign sector is the overwhelming predominance of the United States as the destination market for its exports. As much as nine out of 10 dollars worth of exported goods and services go to its northern neighbor[4] (Figure 4). Such a skewed structure has been reinforced since the signing of NAFTA, with Canada failing to increase its position as a prime market for Mexican exports. As a result, the vulnerability of the Mexican economy vis-à-vis international competition, not only is extremely high, but also has tended to increase even more in the last decade.

Another point is that exports are heavily concentrated in a few sectors, mainly in manufacturing. Within the latter, the category of machinery, equipment and metallic products accounts for as much as two-thirds of total exports, the automobile industry for 28%, and electric-electronic industries for 20%. As distinct from previous decades, crude oil and natural gas only account for 8% and agriculture—which includes cattle, forestry and fishing— for just 3% of total exports (INEGI, 2002b).

FIGURE 4
Top Export Markets, 2001



Source: INEGI (2002b).

In spite of both the good export performance observed in the last few years and the protracted strength of its currency, Mexico's trade balance became negative in 1998 and remained so up to 2000. Likewise, current account and service balances have been negative since the mid-1990s (Table 9).

[4] Even within the United States, Mexican exports are concentrated in only four states: Texas, California, Florida and Illinois (INEGI, 2002b).

TABLE 9
Foreign Trade Accounts and Balances as a Percentage of GDP, 1997-2000
(Percentages)

Balance	1997	1998	1999	2000
Current Account Balance	-1.9	-3.7	-3.0	-3.1
Trade Balance	0.2	-1.9	-1.2	-1.4
Foreign debt	38.1	38.5	32.1	27.6
Capital Account Balance	3.9	4.1	3.0	3.1
International reserves[1]	28.0	30.1	30.7	33.6

Source: Banco de México (2001), Table A1, p. 115.
[1] In billion US$

By sector, the composition of exports shows that non-oil goods account for over 90% of the total over the last three years. On the other hand, intermediate goods have the lion share of imports in the same period (Table 10).

Over the years, exporting companies operating in Mexico have developed significant links with the domestic market, as indicated by the sizeable domestic content of major export goods. A major exception here is the maquiladora (in-bond) industry, which in 2001 accounted for 44.7% of total exports and 13.8% of GDP (INEGI, 2002b), and whose domestic content after more than four decades of operations in Mexico is still as low as 3.5% (SEC, 2002a).

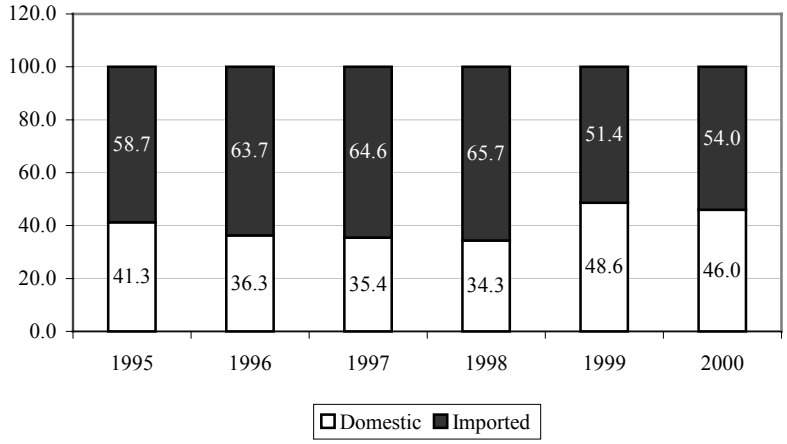
TABLE 10
Mexico: Trade Balance, 1999-2001 (Free on Board)
(Million US$)

Item	1999	2000	2001
Total Exports	136,391.1	166,454.8	158,546.8
Oil Exports	9,928.2	16,382.8	12,802.2
Non-Oil Exports	126,462.9	150,072.1	145,744.6
Agricultural Goods	3,925.9	4,217.2	4,014.7
Mining goods	452.5	520.7	388.5
Manufactured goods	122,084.5	145,334.2	141,341.5
In-bond industries	63,853.6	79,467.4	76,842.0
Other	58,231.0	65,866.8	64,499.5
Total imports	141,974.8	174,457.8	168,276.1
Consumer goods	12,175.0	16,690.6	19,766.6
Intermediate goods	109,269.6	133,637.3	126,013.7
In-bond industries	50,409.3	61,708.8	57,598.5
Other	58,860.3	71,928.5	68,415.2
Capital goods	20,530.1	24,129.9	22,495.7
Trade balance	-5,583.7	-8,003.0	-9,729.2

Source: SHCP (2002a).

The relatively high domestic content of manufacturing exports has not prevented, though, the presence of negative trade balances as reported in Table 10, given that exports have expanded at rates of over 15% per annum since 1995 (Figure 5).

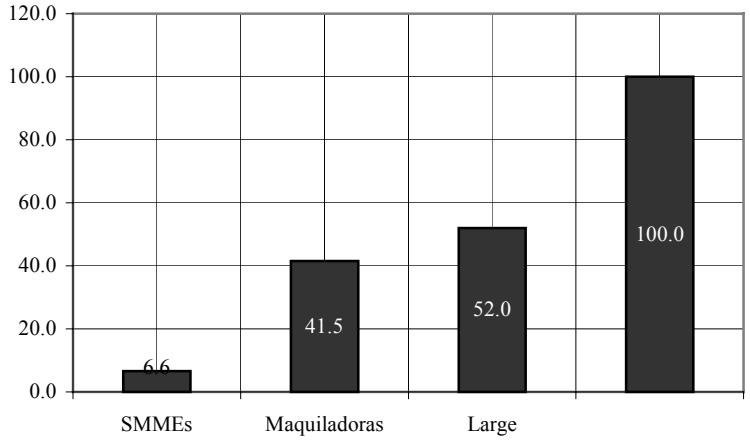
FIGURE 5
Domestic Content of Manufacturing Exports



Source: SEC (2002), p. 18.

As to firm size, small, medium and micro enterprises SMMEs account for only a small proportion of total exports. This figure was as low as 6.6% in 1999, while that of large exporting companies was 52% and 42% came from in-bond assembly plants, known as *maquiladoras* (Figure 6).

FIGURE 6
Share in Total Exports by Company Size, 1999



Source: Secretaría de Economía (2002), *Programa de Desarrollo Empresarial 2001-2006*, p. 17.
Note: SMMEs stands for Small, Medium and Micro Enterprises.

Large companies operate in a diversity of business areas, including automobiles, oil and gas, communications, cement, glass, air transportation, and food. Table 11 presents the first 30 of the 500 largest firms operating in Mexico in 2000, and their respective business activity. Most of them export a large part of their products, especially in automobiles, cement, oil and gas, beverages, and glass.

TABLE 11
The Largest 30 Companies in Mexico, 2000

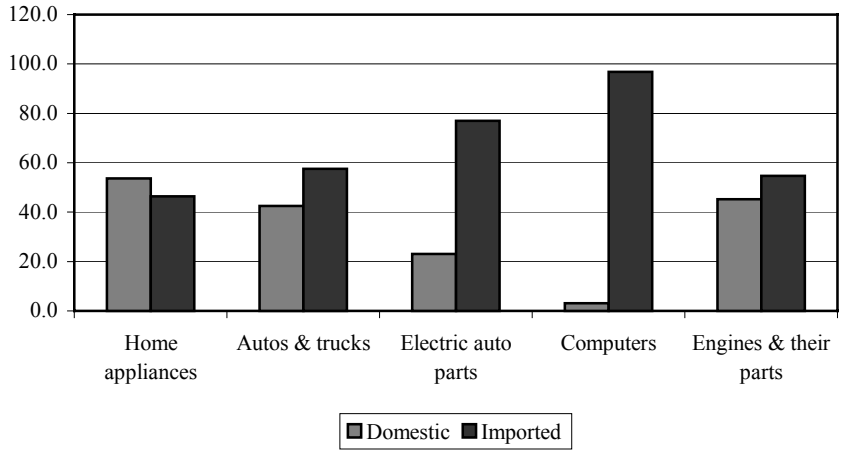
Rank	Name	Business
1	Petróleos Mexicanos	Oil and Gas
2	Carso Global Telecom	Communications
3	Teléfonos de México	Communications
4	Daimler-Chrysler de México Holding	Automobiles
5	General Motors de México	Automobiles
6	Volkswagen de México	Automobiles
7	Wal-Mart de México	Self-service Commerce
8	Cementos Mexicanos	Cement
9	Ford Motor Company	Automobiles
10	Grupo Carso	Various
11	Alfa	Various
12	Fomento Económico Mexicano	Beverages
13	Grupo Bimbo	Food
14	Controladora Comercial Mexicana	Self-service Commerce
15	Cintra	Air Transport
16	Vitro	Glass and derivatives
17	Savia	Agriculture
18	Grupo Modelo	Food
19	GE de México	Home Appliances and Various
20	DESC	Various
21	Gigante	Self-service Commerce
22	Organización Soriana	Self-service Commerce
23	Grupo Televisa	Entertainment and Sports
24	Grupo México	Various
25	Grupo Imsa	Various
26	Nestlé México	Food
27	Femsa Cerveza	Beverages
28	Hewlett-Packard de México	Computer Hardware
29	Gruma	Food
30	Empresas Ica	Construction

Source: Grupo Expansión (2000).

The Mexican government is pursuing a mixed strategy of export promotion and diversification of export markets and products through Nafin and the Ministry of Economics with a special emphasis on SMMEs (SEC, 2002a).

As a result of economic liberalization, the proportion of domestic inputs decreased, as imported goods tended to offer better quality and lower prices. This trend was reinforced by the overvaluation the Mexican peso experienced up to 1994. In this way, imports reached high proportions, particularly in some industries like computers, electric parts and engines. Conversely, domestic inputs account for proportions as low as 3%, as in the case of computers (Figure 7).

FIGURE 7
Domestic Input Content in Production of Selected Industries, 2002



Source: SEC (2002b): 19.

Potential of the Mexican Economy for E-commerce

With a per capita GDP of US$5,807, Mexico is among the 10 largest economies in the world, and offers large opportunities for the development of e-commerce. Considering that 59% of the Mexican population is between 15 and 65 years of age, this segment might in principle be regarded as the universe of people that are or can potentially become users of e-commerce services, or engage in e-commerce related activities.

More specifically, according to the 2000 Population Census, the employed population amounted to 33.7 million, or nearly 35% of the total. Of these, 14.7 million reported incomes equivalent to two minimum wages or more (INEGI, 2001a). The latter is, therefore, the segment of the population most likely to have access to a computer and the Internet, and thus to engage in electronic commercial transactions.

The size of that market segment has to be pondered, however, by the country's highly skewed income distribution and the correspondingly low purchasing capacity of over two-thirds of the Mexican population, which are unable to afford regular access to an Internet-enabled computer. In the end, the outcome will depend on the extent to which income distribution can be improved so that the potential for e-commerce can be actually tapped.

Wealth

The actual volume of a country's aggregate product is assessed only when weighted by the relative size of the population that generates it. Table 12 shows the figures for a number of relevant countries in the Americas for 2000, with the OECD as a reference. Mexico does well compared to other Latin American countries, except for Argentina, whose GDP per capita was about 70% higher than Mexico's until its recent economic crash.

TABLE 12
Gross Domestic Product in Selected Countries in the Americas, 2000

Country/Region	GDP in billions US$ 2000[a]	GDP per capita 2000[a]
Argentina	$285.04	$7,697.26
Brazil	$595.46	$3,500.33
Canada	$708.73	$23,048.11
Chile	$70.54	$4,637.67
Mexico	$574.24	$5,807.43
United States	$9,962.65	$36,210.70
Venezuela	$120.48	$4,984.85
Latin America	$1,645.78	$4,764.72
OECD	$25,461.49	$22,829.19

[a]*Source:* International Telecommunication Union, Yearbook of Statistics 1991-2000. Geneva: International Telecommunication Union, 2001.
[b]*Source:* United Nations Development Programme, Human Development Report 2000. New York & Oxford: Oxford University Press, pp. 169-172. Dates for the data vary by country from 1987 to 1998.

If we consider that total GDP amounted to US$574 billion and the population reached 97.4 million in 2000, Mexico's per capita GDP grew to US$5,807, nearly 17% higher than the figure for 1999—US$4,966—and much higher than those of other countries like China (US$853) and India (US$450)[5].

Income Distribution

Beneath the overall average represented by per capita GDP figures, the distribution of income in Mexico presents quite a skewed structure that has not improved in the last two decades, in spite of the notable performance in exports and the absolute growth of the economy itself.

Dividing income earners in tenths, the proportion of income captured by the lower four brackets decreased from 29% in 1984 to 25% in 1998. Conversely, the share received by the highest tenth increased from 32 to 38 (Table 13).

After a sizeable improvement during the period between 1977 and 1984, income inequality started to increase from the latter year on and did not improve up to 2000. A Gini coefficient of 53.4 was estimated for 1992, the figure being only 54.7 for 2000, thus indicating that inequality remained practically unchanged over the 1990s (Székely, 2002).

[5] These two figures were calculated by the author with data from The World Bank's Country at a Glance Tables (*http://www.worldbank.org*).

TABLE 13
Income Distribution by Income Brackets, Selected years

Year	Income Brackets			
	I-VI	VII- IX	X	Total
1984	28.9	38.7	32.4	100.0
1989	26.0	36.0	37.9	100.0
1992	25.5	36.3	38.2	100.0
1994	25.4	36.2	38.4	100.0
1996	26.9	36.5	36.6	100.0
1998	25.5	36.4	38.1	100.0
Average	26.4	36.7	36.9	100.0

Source: INEGI, *Encuesta Ingreso Gasto de los Hogares*, various years.

Thirty-eight percent of households in Mexico are poor, as defined by the Economic Commission for Latin America (ECLA)[6]; the proportion gets as high as 49% in rural areas. Nearly 20% lack piped water, 33% sewage system, and 6% electricity inside the house. In addition, poor people practically do not have access to credit and financial service in general (De la Torre, 2002). Therefore, this substantial segment of the Mexican population is not likely to engage in e-commerce practices in the near future, and thus constitutes a major barrier, at least to the spread of the B2C economic activity.

On a comparative perspective, Mexico's income distribution did not look much worse at the end of the 1990s relative to that prevailing in other countries. The share captured by the richest 20% of the Mexican population in 1999 was smaller than in Brazil and Chile, as well as the average for Latin America as a whole (Table 14). The opposite occurs in the case of the share received by the poorest 10%.

TABLE 14
Income Distribution in Selected Countries in the Americas, 1999
(Percentages)

Country/Region	Share of income or consumption, richest 20% 1987-1998[a]	Share of income or consumption, poorest 20% 1987-1998[a]
Argentina	N/A	N/A
Brazil	63.80	2.50
Canada	39.30	7.50
Chile	61.00	3.50
Mexico	58.20	3.60
United States	46.40	5.20
Venezuela	53.10	3.70
Latin America	59.03	3.33
OECD	40.19	7.71

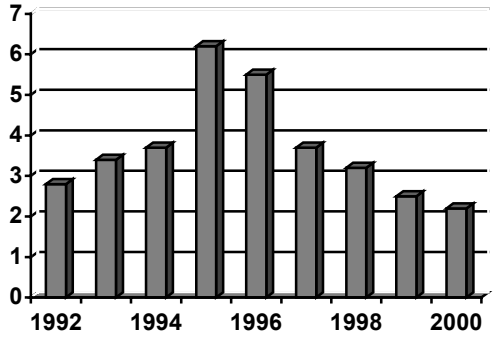
[a] *Source:* United Nations Development Programme, Human Development Report 2000. New York & Oxford: Oxford University Press, pp. 169-172. Dates for the data vary by country from 1987 to 1998.

[6] According to ECLA, a person is poor if he/she has a monthly income of less than US$120 in urban areas and less than US$78 in rural areas.

Unemployment and the Informal Economy

After the slump of 1995, when GDP dropped sharply as a consequence of the drastic peso devaluation of December 1994, a period of prosperity ensued in the second half of the 1990s. As one reflection of this, the unemployment rate consistently declined in those years from over 6% in 1995 to 2.2 in 2000 (Figure 8).

FIGURE 8
Open Unemployment Rates in Urban Areas, 1992-2000



Source: INEGI, *Encuesta Nacional de Empleo Urbano*, various years.

The trend, however, topped off in 2001 due to the economic slump in the U.S. and its impacts on Mexico. Using data from INEGI and the Ministry of Labor, some analysts estimated that as many as 388,000 jobs were lost that year, while 600,000 people joined in the ranks of the economically active population and the number of unemployed only increased in 290,000 workers[7]. The difference is explained by the fact that many of the new unemployed transferred themselves to the informal side of the Mexican economy. In this way, the number of workers in informal activities increased in by 500,000 relative to 2000, reaching 18.9 million; this latter figure accounted for as much as 46% of the total employed population, so that over two fifths of the employed population dwelled in the informal economy (Carrillo, 2002).

Another analyst (Quintana, 2002) estimates that the number of informal workers in 2001was only 15.2 million, of which seven million were in agriculture and 8.2 million in urban activities. He explains that while 740,000 jobs were lost between November 2000 and January 2002, and 640,000 people joined the economically active population, official statistics only recognized some 1.3 million unemployed. The trick again is performed by the informal economy as a "miraculous" mechanism that has prevented unemployment from exploding (Quintana, 2002).

Whatever estimate is considered, the unavoidable point is that official economic statistics take account of only one part of the picture. Another, quite significant one, exists below those figures, in the underground circuits of the Mexican economy, which is estimated to contribute

[7] The estimates were made recently by the Analysis Department of *Mural*, a major newspaper that circulates in the Jalisco and neighboring states of West Central Mexico, and is part of one of the largest news organization in this country, which includes other newspapers like *Reforma* in Mexico City (Carrillo, 2002).

12.7% of GDP (Rincón and Cabadas, 2002) and absorbs 48 or 39% of the economically active population, depending on which of the above estimates is used.

On a comparative perspective, Mexico's unemployment rate for 2000, as calculated by the International Labour Organization, was the lowest of the major countries in the Americas, including the averages for Latin America and the OECD as wholes (Table 15)

TABLE 15
Unemployment Rates in Selected Countries in the Americas, 1999
(Percentages)

Country/Region	Unemployment Rate 1999[a]
Argentina	15.0
Brazil	7.1
Canada	6.8
Chile	8.3
Mexico	1.6
United States	4.0
Venezuela	14.0
Latin America[b]	9.2
OECD[c]	6.6

[a]*Source:* International Labour Organization, LABORSTA (http://www.laborsta.ilo.org), Table 3A.
[b]Argentina, Brazil, Chile, Mexico and Venezuela.
[c]OECD member countries, excluding Luxembourg, Slovakia and Iceland.

Implications for E-Commerce

With a per capita GDP nearing US$6,000 in 2000, up from US$5000 in 1999, Mexico has become a major economy capable of substantially increasing the average product each of its inhabitants is able to generate in one year. It is proper to argue, therefore, that the Mexican economy has, in general, enough potential for the emergence and development of new activities such as e-commerce, both B2C and B2B.

Moreover, as noted before, official employment statistics only present a partial picture, for in addition to those employed in the formal economy, a whole army of economically active people dwell in the underground world of informal activities in both rural and urban areas. The point is that this "surplus" working population constitutes an additional slice of potential consumers and traders of goods and services over the Internet.

Since being "informal" does not necessarily imply that business establishments can not have access to a computer and to the Internet, there is no impediment for informal businesses to deal with "formal" companies and, vice versa, for the latter to have "informal" customers via the Web when acting as sellers. It is more complicated when formal companies play the role of buyers, given that they require official invoices from their suppliers, which informal suppliers cannot produce.

In general, although there are no statistics, it can be inferred that many companies in the formal economy procure inputs from informal suppliers, or vice versa, that many underground

businesses have formal companies as customers. As a consequence, the estimates for the growth potential of e-commerce in Mexico underestimate the actual size of the domestic market that can be tapped for extending commercial transactions over the World Wide Web.

Such encouraging prospects are hindered, though, by the highly skewed income distribution prevailing in Mexico where 40% of households are poor, while the highest tenth of income earners increased their share from 32 to 37 between 1984 and 1998.

Industry Structure

Given the wide diversity of criteria and purposes for the classification of business establishments up to the late 1990s, the Mexican government in 1999 issued a decree whereby it established the categories to be used officially in the formulation of promotion policies and the treatment of fiscal matters. Table 16 shows the four categories that were instituted to accommodate the innumerable sizes of business enterprises.

TABLE 16
Classification of Business Establishments by Size

Category	Sector		
	Industry	Commerce	Services
Micro	0-30	0-5	0-20
Small	31-100	6-20	21-50
Medium	101-500	21-100	51-100
Large	501 and more	101 and more	101 and more

Source: Diario Oficial de la Federación, March 30, 1999.

This classification was used in the 1999 economic censuses, which once more revealed the pyramidal, highly skewed structure of Mexican businesses. As much as 96% corresponded to micro establishments with less than 30 employees (Table 17). Although small businesses are predominant in most economies, including in some highly industrialized ones like Germany, Italy and Taiwan, the proportion in Mexico is really overwhelming.

TABLE 17
Business Establishments by Size, 2000

Category	Establishments	
	Number	%
Micro	2,722,365	95.7
Small	88,112	3.1
Medium	25,320	0.9
Large	8,474	0.3
Total	2,844,308	100.0

Source: INEGI (2000a).

What makes such a heavy presence of small businesses problematic is the fact that size in Mexico, as in developing countries in general, tends to bear a direct relationship with the degree of inefficiency, and lack of resources for firms for investing in technology and to improve productivity. There are, nonetheless, others who argue that SMMEs are not simply a burden for an economy. For example, Cristina Hernández, an analyst close to AMECE, has pointed out that "when people speak about small and medium enterprises, there is a certain 'protection'

tone, but to me a country with many SMMEs is one with an independent and creative population" (Hernández, 2002).

She added that the OECD has reported that 99% of companies in its member countries are small and medium enterprises and that SMMEs not only generate much of the jobs, but also are indicative of the effort and entrepreneurship of individuals. Hence the fact that major government agencies and the e-Mexico System, as well as makers, developers, and marketers of both IT equipment and software, are all focusing on SMMEs as the target of their projects and programs, and are working on programs to tap this fundamental part of the Mexican economy (*El Financiero*, January 24, 2002; *www.amece.com.mx/emexico*).

In effect, micro, small and medium enterprises generate 68% of total employment in the industrial sector (Table 18).

TABLE 18
Employment in Industrial Sector by Economic Division and Firm Size
(Percentages)

Economic division	Firm size				Division share
	Micro	Small	Medium	Large	
Metalic products, machinery & equip.	14.8	7.8	23.1	54.3	30.21
Textiles, apparel & leather	21.0	15.4	35.6	28.0	20.52
Food, beverages and tobacco	42.2	9.7	22.9	25.5	18.16
Chemicals, plastic & rubber	27.5	16.2	25.9	20.4	11.01
Paper, printing & editing	34.6	17.1	35.2	13.1	5.11
Wooden Manufactures	55.6	16.3	22.2	6.0	4.91
Non-metalic minerals	45.6	12.3	20.5	21.6	4.61
Basic metalic industries	38.8	16.0	28.7	16.5	3.94
Other industries	29.7	13.0	32.7	24.7	1.52
Total employment	28.1	12.1	27.9	32.0	100.00

Source: INEGI (2000a).

Industrial production is, accordingly, highly concentrated. Three divisions account for nearly three-fourths of the total value of industrial output: metallic products, machinery and equipment; food, beverages and tobacco; and chemicals, plastic and rubber. The first accounts by itself for nearly one-third of the total, and is the one with the significantly highest participation of large companies: two-thirds (Table 19).

Concomitant with the high sectoral concentration discussed above, business establishments are also heavily concentrated in a geographic sense. Only five states, namely the Federal District, Mexico State, Jalisco, Veracruz and Puebla, account for more than 40% of the national total (INEGI, 2000a). It is in these states, therefore, that the bulk of Internet connections and e-commerce activity will also tend to be concentrated.

TABLE 19
Mexico: Value of Production in the Industrial Sector
(Percentages)

Economic division	Firm size				Division share
	Micro	Small	Medium	Large	
Metalic products, machinery & equip.	8.8	7.4	21.7	62.2	31.60
Food, beverages and tobacco	12.1	7.1	33.7	47.1	20.69
Chemicals, plastic & rubber	17.5	12.7	38.1	31.7	19.19
Textiles, apparel & leather	17.5	13.5	35.2	33.8	8.42
Basic metalic industries	13.9	6.7	30.8	48.6	6.37
Non-metalic minerals	12.2	10.0	48.2	29.6	6.03
Paper, printing & editing	17.7	11.6	50.4	20.3	5.18
Wooden Manufactures	38.2	19.6	32.9	9.3	1.75
Other industries	14.7	11.3	36.9	37.1	0.77
Total	13.4	9.5	32.4	44.7	100.00

Source: INEGI (2000a).

Multinational Corporations and Production Networks

Since the infrastructure required to access Internet markets is quite basic and thus fairly inexpensive, SMMEs represent a large potential for B2B e-commerce, for most of them can afford to buy a personal computer and connect it to the Internet provided they are properly induced to. This is being reinforced by the fact that large companies are requiring their smaller suppliers to acquire the technological resources that enable them to go on-line and will permit them become part of the broader supply chains (Grupo Expansión, 2001).

The above is occurring particularly in the electronics and computer, and the auto and auto parts industries, which in 2000 accounted for 20% and 28.4% of total exports, respectively (Vidal, 2000). For a detailed analysis of the local and transnational production networks that have developed in Mexico's most important electronics and computer hub, see Palacios (2001a). Most of the companies that manufacture automobiles and trucks in Mexico are subsidiaries of multinational corporations, just like in the case of electronics and computers. The top players are listed on Table 20.

TABLE 20
Largest Auto and Truck Makers in Mexico

Company	Nationality
Daimler-Chrysler de México, S. A. de C. V.	Germany/USA
Ford Motor Company, S. A. de C. V.	USA
General Motors de México, S. de R. L. de C. V.	USA
Nissan Mexicana, S. A. de C. V.	Japan
Volkswagen de México, S. A. de C. V.	Germany
Honda de México, S. A. de C. V.	Japan
BMW de México, S. A. de C. V.	Germany
Volvo Bus de México, S. A. de C. V.	Sweden
Daimler-Benz de México, S. A. de C. V.	Germany
Kenworth Mexicana, S. A. de C. V.	USA
Grupo Dina. S. A. de C. V.	Mexico

Source: SIEM (2002). For BMW and Honda, Vidal (2000).

Another 61 companies are engaged in the manufacture and/or assembly of automobiles and trucks and a total of 1,218 firms make up the industry's entire supply chain (Table 21).

TABLE 21
Company Composition of the Auto and Truck Industry Supply Chain

Industrial activity	No. of companies
Manufacturers and assemblers of automobiles and trucks	69
Major Suppliers	1218
Manufacture and assembly of car bodies and trailers for automobiles and trucks	251
Manufacture of engines and their parts for automobiles and trucks	351
Manufacture of parts for transmission system of automobiles and trucks	42
Manufacture of parts for suspension system of automobiles and trucks	60
Manufacture of parts for brake system of automobiles and trucks	99
Manufacture of other parts and accessories for automobiles and trucks	415
Total	1287

Source: SIEM (2002)

Many of the 1218 suppliers to the automakers are established domestic companies that have prospered due to the location and established operations in Mexico of the subsidiaries of the large corporations referred to above. An intricate web of customer-supplier networks has been formed in the more than half a century since these subsidiaries started operations in this country. As observed in Figure 7, the inputs supplied by domestic companies in this industry account for over 40% of total inputs.

For example, Unik, a subsidiary of DESC (Desarrollo Económico SC)—a domestic holding that has concerns in the autoparts, petrochemicals, food, and real estate industries—manufactures and markets transmission and constant speed traction systems, pickup truck bodies, pistons and piston rings, front and rear-drive axels, gears, joints, seals, valves, wheel rims, spark plugs, electric parts, among other products. Unik caters to top carmakers in Mexico like: Daimler-Chrysler, Dina, Ford, General Motors, Kenworth, Mercedes Benz, Navistar, Nissan, Sangyong, Volkswagen, and Volvo (Grupo Expansión, 2000). Other top domestic auto parts companies are Superdiesel, Sistemas Eléctricos y Conmutadores, Industria Eléctrica Automotriz, and Maquinados y Estampados Automotrices.

Ford Motor Company is developing a global e-business supply chain known as Auto-Xchange using Oracle e-Business solutions. Auto-Xchange is a virtual channel for managing procurement and outsourcing with Ford's 30,000 plus suppliers worldwide (Oracle, 2001). This suggests that Ford's Mexican affiliates are pulling their domestic suppliers into the company's supply network in this country, and that this can be the case for other automakers operating in Mexico.

The incorporation of domestic suppliers into the supply networks of foreign corporations in both the electronics and auto industries has been propelled by the fact that their subsidiaries have to require some type of ISO certification to their suppliers, as their own ISO certification requires them in turn to do so.

The case of SMMEs is facilitated by the fact that small companies in general tend not only to be more flexible and prone to engage in e-commerce (Palacios, 2001a), but also to entirely transform their management structures and strategies to embark on e-business. Larger domestic companies tend to be less flexible, and therefore, less prone to do business on-line (FINSAT, 2000a). The big export-oriented firms, most of which are subsidiaries of transnational corporations, are most likely to have the required resources, mindset and business culture to acquire IT equipment and know-how, and thus to engage in e-commerce activities,

Historically, the presence of foreign capital in the Mexican economy has been notably large. By 1970, the subsidiaries of U.S.-based multinational corporations already controlled most, or at least quite significant segments, of key industries, such as: automobile, 57%; oil and coke, 49%; mining and metallurgy, 53.6%; copper and aluminum, 72%; industrial chemicals, 50%; chemicals and pharmaceuticals, 86.4%; and computers and office equipment, 88% (Cockcroft, 1983).

In the last eight years, foreign direct investment (FDI) has amounted to 2.4% of GDP and 12.3% of gross capital formation in average, the figures fluctuating from a low of 1.8 and 8% in 1998 to a peak of 3.4 and 17% in 2001 (Table 22).

The weight of U.S. firms in the Mexican economy may be grasped even better by considering that, according to the U.S. Department of Commerce, as much as 67.5% of exports were made by subsidiaries of U.S.-based multinational corporations operating in Mexico in 2001. Companies with majority Mexican stock only account for 15%. Top car assemblers like General Motors, Ford, Daimler-Chrysler, and Volkswagen account for 18% of total exports. Other major exporters include IBM, Hewlett-Packard, and Kodak in the electronics industry, Bayer in chemicals and John Deere in agricultural equipment (Orozco, 2002).

TABLE 22
Foreign Direct Investment Flows as a Percentage of GDP and Gross Capital Formation, 1994-2001
(Percentages)

Year	Gross capital formation	GDP
1994	10.98	2.11
1995	17.85	2.91
1996	10.88	2.07
1997	12.99	2.66
1998	8.3	1.76
1999	10.6	2.25
2000	9.88	2.12
2001	17.3	3.4
Average	12.35	2.41

Source: Calculated by the author with data from INEGI (2002b).

Implications of Industry Structure for E-Commerce

The overwhelming presence of SMMEs is a doubled-edged sword for the development of e-commerce in Mexico. On the one hand, it constitutes a major barrier in the short run, given that smallness implies lack of know-how, resources, and the required business culture to fully embrace IT, and engage in Internet-based commercial transactions. An additional drag in this regard is the rather large investment and relatively long time (eighth months to one year) required to install IT infrastructure and equipment and set up a Web site, let alone a whole portal.

On the other hand, the very existence of that mass of business units represents a large pool of opportunities for e-commerce to flourish, given the ever and fast declining prices in computing equipment, and the growing availability of access to the Internet. This trend is reinforced by the tendency for small firms to be pulled by larger customers into the supply networks and value chains. Moreover, the limitations of SMMEs to acquire IT and have access to the Internet are being overcome with the work of a growing number of ASPs offering low cost access to software and business solutions to SMMEs (Castelán, 2002).

Another propelling factor is the large presence of subsidiaries and affiliates of multinational firms, which are the main practitioners of e-commerce and also the most active and effective technology transfer agents that are inculcating in Mexico the adoption of electronic data interchange (EDI), enterprise resource planning (ERP), customer relationship management (CRM), and Internet-based technologies and management systems.

Human Resources

Literacy

Literacy levels have been on the rise in Mexico, particularly from the middle of the 20th century. The overall illiteracy rate dropped from over 12% down to less than one out of 10 Mexicans, reaching a literacy rate of 90.5% (Table 23). Most significantly, the sharpest decline occurred in the case of the female population, where the rate dropped practically four percentage points.

TABLE 23
Education Levels, 1990 and 2000 (Percentages)

Category	1990[a]	2000[b]
Illiterate population 15 years and older	12.4	9.5
Illiterate male population 15 years and older	9.6	7.4
Illiterate female population 15 years and older	15.0	11.3
Population from 6 to 14 years old not attending school	14.2	8.2
Population 15 years and older with no instruction and/or with Incomplete elementary instruction	37.0	28.2
Population 15 years and older with postelementary education	43.4	51.8
Population 18 years and older with higher education	9.4	12.1
Average schooling of population 15 years and older (years)	6.6	7.6

Source: INEGI (2000b) for 1990; INEGI (2001a) for 2000.
[a]As of March 12.
[b]As of February 14.

The above reflects a decline in the percentage of the population from 6 to 14 years of age not attending school, and those 15 years and older with no instruction and/or with incomplete elementary instruction. Conversely, the figures for the population with postelementary or higher education improved in all counts (Table 23).

School Enrollment

Enrollment in education institutions, in general, has reached high levels and has shown a modest, though consistent growth in the last few years. Except for technical schools, the figures for all the other levels have been on the rise. As shown by Table 24, 1.6 million were enrolled in professional education programs, while well over one-quarter million were attending technical schools in the last school term. It is intriguing, though, that enrollment in this latter has shown a decreasing trend in the last three terms.

TABLE 24
Enrollment by Education Level, 1997/1998 - 1999/2000[a]

Education Level	School Term		
	1997-1998	1998-1999	1999-2000
Elementary	14,647,797	14,697,915	14,765,603
Secondary	4,929,301	5,070,552	5,208,903
Technical	390,828	392,812	374,845
Preparatory	2,323,069	2,412,722	2,518,001
Teachers	206,292	210,544	215,506
Professional	1,414,043	1,516,093	1,629,158
Postgraduate	107,149	111,247	118,099
Total	24,018,479	24,411,885	24,830,115

Source: SEP (2000a).
[a] School term

Male students outnumbered women in professional and postgraduate education, though the reverse did not occur in the case of technical schools, where females accounted for 52% of the student population (Table 25).

TABLE 25
Schools, Instructors and Enrollment by Education Level and Gender, 1999/2000[a]

	Student population			No. of instructors	No. of schools
	Total	Male	Female		
Technical	374,845	180,720	194,125	33,249	1,711
Professional (Bachelors')	1,629,158	863,291	765,867	167,049	2,172
Postgraduate	118,099	67,550	50,549	17,004	1,036

Source: SEP (2000b).
[a] School term.

IT and Engineering Skills

The number of Mexicans with skills relevant to information technologies increased consistently over the last decade. The pool of human resources in science and technology (S&T) activities amounted to 6.6 million people in 2000—nearly 7% of the population—of which two-thirds were working in an S&T occupation (Table 26). As to gender, men outnumbered women: 55 and 45%, respectively.

TABLE 26
Human Resources in Science and Technology, 2000

Category	Total	Female	Male
HR in a S&T occupation	4,283,800	1,909,000	2,374,800
HR with completed third level education in a S&T occupation	2,358,00	981,800	1,376,200
Total HR in S&T	6,557,600	2,995,000	3,602,600

Source: CONACYT (2002b).

The large number of graduates from public engineering and technical schools that pour into the pool each year, which totaled 375,000 in the 1999-2000 school term, should be added to the above (SEP 2000a), as well as those trained in the private computing schools that have mushroomed in every major Mexican city, which include students, housewives, senior citizens, and clergymen.

According to the National Council of Science and Technology (CONACYT), a growing number of graduates are produced each year by postgraduate engineering programs. The number increased threefold between 1991 and 1999, though their share of total graduates only showed a slight incremental growth (Table 27).

TABLE 27
Graduates from Postgraduate Programs by Field, Selected Years

Field	1991		1999	
	No.	%	No.	%
Natural Sciences	637	5.5	1,256	4.1
Agricultural Sciences	326	2.8	864	2.8
Engineering Sciences	1,315	11.4	4,063	13.4
Social Sciences & Humanities	5,080	44.0	19,426	63.9
Health Sciences	4,185	36.3	4,800	15.8
Total	11,543	100.0	30,409	100.0

Source: CONACYT (2002a).

The problem is that the number of graduates from social sciences almost quadrupled and their share went up from 44% to nearly two-thirds of the total over the same period. This is a characteristic pattern of Latin American countries, where mathematics and the study of hard sciences are not among the first preferences of young people that go to college, nor of those that go on to graduate school.

Nonetheless, the number of people earning doctoral degrees in science and engineering per million people has been on the rise as well, and much faster than that of graduates in the social sciences and humanities. In the case of the former, the figure increased almost fivefold to nearly seven, while in that of the latter the number only multiplied by 3.7 (Table 28).

TABLE 28
Doctoral Degrees by Field per Million People, Selected Years

Year	Field		
	Natural Sciences & Engineering	Social Sciences & Humanities	Total
1990	1.4	1.1	2.5
1995	2.8	1.6	4.4
2000	6.8	4.1	10.9

Source: CONACYT (2002a).

Implications for E-Commerce

With a literacy rate of 90.5%, and a population 18 years and older with higher education accounting for over 12% of the total, Mexico's population has an instruction level reasonably sufficient for acquiring IT skills, in general, and computing and Internet use, in particular.

In absolute numbers, the pool of Mexicans with S&T skills seems large enough for supporting the development of Internet-based activities like e-commerce. The number increases every day, as more students graduate from computing and technical schools, as well as from university programs in those fields. Moreover, most students in professional and postgraduate university programs acquire the basic skills for using a computer and browsing the Internet, a circumstance that strengthens Mexico's capabilities for e-commerce growth and use. In the 1999-2000 school year, over 4.8 million students were enrolled at schools—technical, preparatory, teachers', professional, and postgraduate—where some form of training in computing and informatics is taught.

The above prospects are dragged down, however, by the tendency of Latin American students to prefer social science disciplines (64%) over science and engineering (36%). It is promising, however, that the number of students earning doctoral degrees in science and engineering has been increasing much faster than that of doctoral graduates in social sciences and humanities.

In sum, the pool of human resources with engineering and IT skills Mexico possesses up to now are consistent with the extent to which e-commerce activities, both B2B and B2C, have grown in this country over the last decade. The present size of the pool and the rate at which more young people are educated in degree programs and trained in IT and computing each year, point to a continuing growth in the number of Mexicans able to embrace and use new technologies and the Internet—either as consumers to buy or as managers to conduct business on-line. Mexico's proximity to the United States, and the heavy U.S. exposure this circumstance implies for its inhabitants and its businesses alike, particularly under NAFTA, strengthens such trends.

Infrastructure

Physical Infrastructure

Although it is still insufficient and has a varied quality, Mexico's physical infrastructure is reasonably acceptable and fairly efficient in most areas. It has grown in reach and developed in quality and scale of operation, particularly over the 1990s (Table 29).

TABLE 29
Physical Infrastructure, Selected Years

Item	1990	1996	1997	1998	1999	2000[a]
Roads (km)	239,235	310,591	313,604	319,792	329,532	331,635
Federal toll roads (km)	1,761	6,356	6,394	6,388	6,429	7,005
Federal non-toll roads (km)	45,743	41,014	41,411	41,653	41,765	41,943
Paved roads (km)	83,925	98,717	102,250	104,023	108,086	110,918
Railway network (km)	23,361	26,622	26,622	26,622	26,622	26,622
Transported passengers (millions of passengers/km)	5,336	1,799	1,508	460	254	91
Commercial cargo transported (millions of tons/km)	36,417	41,723	42,442	46,873	47,273	48,916
International airports (number)	42	53	54	55	55	56
Passengers (thousands)	20,449	26,493	28,896	30,922	32,662	33,864
Cargo transported (thousands of tons)	164	285	335	388	407	422
Number of ports (maritime and river)	85	85	107	107	108	108
Passengers (millions)	3.8	6.4	6.2	7.2	7.9	8.9
Shipping (thousands of tons loaded and unloaded)	169,139	208,581	219,653	237,380	231,440	241,115

Source: Banco de México (2001): Table A3, p. 117.
[a] Preliminary

The extension of federal toll roads quadrupled, topping 7,000 kilometers in 2000, while that of non-toll roads correspondingly decreased during that period. The railroad network, in turn, remained virtually unchanged and, as expected the number of passengers consistently declined in those years. Similarly, the number of both airports and maritime ports, and the respective number of passengers, all grew substantially thus extending the respective coverage.

Telecommunications Infrastructure

By international standards, Mexico presents a mixed picture as well regarding infrastructure in the various modalities of telecommunications (Table 30). Investment in this area, as percentage of gross domestic product, exceeds that registered in the Americas' most developed countries, Canada and the United States, as well as in the troubled economies of Argentina and Venezuela. This is due to the fact that Canadian and US telecommunications infrastructure is already far more developed and so investment is more marginal.

TABLE 30
Comparative Telecommunications Infrastructure in Selected Countries, 2000

Country/Region	Telecomm Investment as % of GDP, 2000[a]	Main phone lines per 1,000 population, 2000[a]	Cell phone subscribers per 1,000 population 2000[a]	% Digital phone lines, 2000[a]	CATV subscribers per 1,000 population 2000[a]
Argentina	.67	213.17	163.37	100.00	159.32
Brazil	1.49	181.80	136.31	92.50	13.70
Canada	.57	676.51	284.60	99.70	259.41
Chile	1.56	221.22	223.62	100.00	45.20
Mexico	.89	124.72	142.33	99.98	23.11
United States	.29	699.74	397.91	91.60	252.13
Venezuela	.24	107.80	217.46	80.00	40.21
Latin America[b]	1.05	165.38	150.46	95.02	35.25
OECD[c]	.73	524.53	457.27	94.82	145.37

[a]*Source:* International Telecommunication Union, Yearbook of Statistics 1991-2000. Geneva: International Telecommunication Union, 2001.
[b]Argentina, Brazil, Chile, Mexico and Venezuela.
[c]OECD member countries, excluding Luxembourg, Slovakia and Iceland.

As to phone lines and cell phone subscribers per 1,000 population, Mexico's figures are low with respect to other Latin American countries in the group, except for Venezuela. In the case of the number of CATV subscribers, Mexico is second lowest (Brazil is lowest, which is rather surprising in that the latter leads Latin American countries in other key aspects of IT development).

In absolute terms, the most significant developments in the 1990s were the solid growth of fixed phone lines from 5.4 to 12.4 million, the explosion of cellular phone lines, and the sharp decline in the number of both telegraph service offices and installed telex lines (Table 31).

TABLE 31
Telecommunications Infrastructure, Selected Years

Item	1990	1996	1997	1998	1999	2000[a]
Telephone lines in service (thousands)	5,355	8,826	9,254	9,927	10,927	12,376
Cellular telephones (thousands of subscribers)	64	1,022	1,741	3,350	7,732	12,000
Telegraph service (number of offices)	2,604	1,771	1,813	1,868	1,878	1,878
Postal service (locations served)	22,000	30,828	31,167	31,515	32,015	32,126
Radio stations	1,045	1,325	1,342	1,351	1,369	1,410
Television stations	540	545	580	584	593	663
TELEX service (installed lines)	24,718	19,625	18,915	18,765	12,280	11,536

Source: Banco de México (2001): Table A3, p. 117.
[a] Preliminary

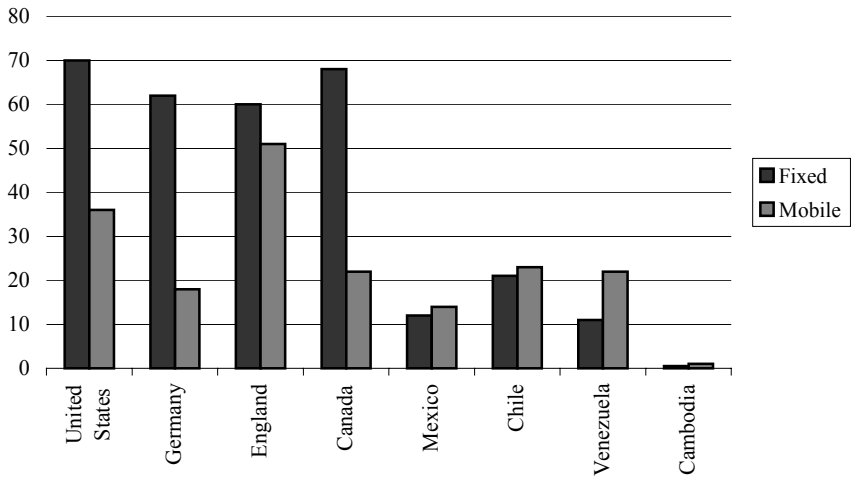
According to the Ministry of Transport and Communications, the number of fixed phone lines per 100 population reached 13.7 in 2001 and the goal is to increase it up to 25 by 2006 (SCT, 2001).

It is expected that so-called third generation technologies will be available soon in Mexico, which will further boost the use of cell phones. It is estimated that 50% of e-commerce that will take place in Mexico by 2006 will be m-commerce, and users of mobile devices are expected to increase from the current 15 million to 40 million by that year (AMECE, 2002; *El Financiero*, June 21, 2001)

There is an inverse relationship between the degree of development of a country and the degree of penetration of cellular telephony in its territory. Figure 9 illustrates this trend for a group that includes both developed and developing countries, Mexico among them.

This tendency occurs in Mexico, where mobile telephony is most extended in regions that contribute less to GDP, exceeding fixed phone in coverage (*Tecnología y Negocios*, No. 45, June 18, 2001). The number of mobile lines exceeded that of fixed lines by the end of 2000: 12.7 and 12 million, respectively. It is expected that by 2004 the former will reach 33 million and the latter only 15 million (Jiménez, 2001).

FIGURE 9
Telephone Line Density in Selected Countries
(Percentages)



Source: Tecnología y Negocios, No. 45, June 18, 2001

The extent of penetration of mobile telephony in both businesses and households has rapidly and consistently increased since the mid-1990s, so that over 21 people out of 100 were cell-phone users in 2001, up from only 0.8 six years earlier (Table 32).

TABLE 32
Mobile Telephony Penetration, 1995-2001
(Users per 100 people)

Year[1]	%
1995	0.8
1996	1.1
1997	1.8
1998	3.5
1999	8.0
2000	14.2
2001	21.5

Source: COFETEL (2002).

Information Technology Infrastructure

The picture is different in the case of infrastructure for information technologies. Although it has increased in the last years, the total PC installed base is still limited. In late 1999, only one million PCs were installed in homes and 3.9 million in offices. This meant a degree of penetration of just 4.2% of Mexican in homes (Select-IDC, 2000a).

By the end of 2000, the proportion of Mexican homes with at least one PC had increased to 10%, the corresponding figure for the United States being 50% (Select-IDC, 2000b). In January 2000, over 70%of installed PCs in companies had access to Internet (Torres Chávez, 2000).

The installed-PC base will increase as IT infrastructure is extended and improved by both the private telephone companies operating in Mexico and the federal government, mainly as part of the e-Mexico mega-project to be discussed later on in this report. In particular, the Ministry of Transport and Communications (SCT) is building the first Network Access Point (NAP) in Mexico, a huge data management center intended to manage the traffic of government digital services in education, health and commerce (Aguilera, 2002).

According to comparative country data from International Data Corporation (IDC), Mexico presents a contrasting case in terms of IT production and use (Table 33). It shows the lowest rate of investment in IT as a proportion of GDP in the group of selected countries in the Americas, but at the same time a figure higher than Canada's and Brazil's in exports of IT hardware. Regarding production of IT hardware, Mexico outperforms Canada, Venezuela and Brazil. As to the number of PCs per 1000 population, again Mexico presents figures higher than Brazil and Venezuela but lower than the rest of countries in the group. Thus, Mexico is a major producer and exporter of computer hardware, but its own investment in IT is somewhat low compared to other countries in the region.

TABLE 33
Information Technology Infrastructure in Selected Countries in the Americas

Country / Region	IT as % of GDP, 2000[a]	PCs per 1,000 population 2000[b]	IT Hardware production, US$M 2000[c]	IT Hardware exports, US$M 1999[c]
Argentina	1.29	51.31	N/A	N/A
Brazil	2.38	44.09	$9,083.78	$321.00
Canada	3.83	390.24	$3,361.73	$4,496.64
Chile	1.67	166.80	N/A	N/A
Mexico	1.00	50.57	$10,281.00	$6,950.00[d]
United States	4.56	585.18	$88,488.62	$38,488.00
Venezuela	1.30	45.51	$254.02	$2.00[d]
Latin America	1.60	52.22	$19,618.79	$7,273.00
OECD	3.60	312.01	$231,341.80	$182,730.10

[a] *Source:* International Data Corporation, The 2000 IDC Worldwide Black Book, IT is defined as "the revenue paid to vendors (including channel mark-ups) for systems, software, and/or services".
[b] *Source:* International Telecommunication Union, Yearbook of Statistics 1991-2000. Geneva: International Telecommunication Union, 2001.
[c] *Source:* Reed Electronics Research, The Yearbook of World Electronics Data, 2000. Surrey, UK: Reed Electronics Research, 2000.
[d] 1998 data

It is important to point out, however, that according to the Mexican government, investment in IT amounts to 1.4% of GDP in 2000, in contrast to a world average estimated at 4.1%, as stated by the Under Secretary of Domestic Trade, Ministry of Economics, in early May 2002 (Notimex, 2002).

Internet Use

According to the Federal Telecommunications Commission, the number of Internet users in Mexico exploded in the second half of the 1990s (Table 34). From 39,000 in 1994, the figure jumped to 2.7 million in 2000.

TABLE 34
Internet Users, 1994-2000
(Thousands)

Year	Government	Education	Homes	Businesses	Total
1994	2	17	4	16	39
1995	3	33	10	47	93
1996	5	69	29	84	187
1997	14	142	141	299	596
1998	31	154	297	740	1222
1999	167	166	478	1010	1821
2000	193	276	1066	1177	2712

Source: COFETEL (2002).

In absolute terms, the bulk of that growth occurred in the business sector, where the number multiplied by 73 while that in education only grew by 16.

Therefore, since 1,066,000 users were connected from homes, and a total of 21,513,235 housing units in Mexico were registered in the 2000 census, it can be estimated that the extent of Internet penetration into Mexican households is 5%, assuming that only one PC was in operation in those homes. Likewise, considering that 1,177,000 Internet users were business establishments in 2000, and knowing from Table 17 that the number of the latter was 2,844,308 in that same year, it can be inferred that the rate of Internet penetration in business was 41.4%, this assuming that each business user corresponds to one establishment. This figure is notably high taking into account that the number of Internet users per 1,000 population in Mexico is lower than in all the other relevant countries in Latin America, as will be discussed shortly.

Select-IDC estimated that the number of Internet users at the end of 2000 was 2.9 million, of which 60% were men and 40% women. Thirty percent were 25 years old and 17% 18 years old in average (Select-IDC, 2001b). In March 2001, IBM's Business Vice President for Latin America declared that "of the 40 million economically active people [in Mexico], 3.5 million have access to the Net" (Notimex, 2002). Finally, Empresa-e, a magazine specialized in e-commerce, estimates that the number of Web users had reached seven million in January 2002 (Empresa-e, 2002b).

While NetValue estimates that the most frequent users in Mexico are between 15 and 24 years of age, Select-IDC holds that 20% of Mexican users are "mature" (44-year or older males) (Empresa-E, 2002b: 48).

In another study, Select-IDC found that only 6% of the 3.1 million business establishments operating in Mexico in mid 2001 had implemented an Internet-based strategy. Nonetheless, about 1.3 million—42% of the total pool—were considering to apply one in the following months (Mejía Guerrero, 2001a, p. 1).

The above trend will be reinforced by initiatives like the one taken by Telecom & Soft, an IBM business partner, which established in Guadalajara the first Center for E-Commerce Solutions in May 2002. Focusing on SMMEs, this center offers small firms access to IT and to Telecom &

Soft's Internet-based e-business solutions. Two more of this kind of center are scheduled to be set up in the following months in Mexico City and Monterrey (Orihuela, 2002c).

Internet Infrastructure

Presently, some 300 Mexican cities are already connected to the Internet through fiber-optic cable networks built and managed by the main telephone companies operating in this country: Telmex, Avantel, Terra, and Alestra.

Broadband, high-speed Internet access has been offered only in the last few years[8] mainly via cable television networks and digital subscriber lines (DSL). Cablevision and Megacable, now the two leading cable television service providers, started to offer high-speed Internet access in late 1999 in Mexico City (Cablevision), and in Guadalajara and 13 other cities (Megacable). Megapo, another cable television service provider, started in late 2000 in Cuernavaca, Morelos in Central Mexico, while Cable California, a subsidiary of Las Americas Broadband, Inc., covered Tijuana, Baja California. All these services include unlimited Internet access, bundled with a premium cable television service (OECD, 2001).

By the end of 1999, cable television coverage was limited, as only 32% of households were passed and just 10% were connected to those networks. In general, Mexico was ranked 24th as to broadband network penetration by the end of 2000, only ahead of those countries where commercial services had not yet been deployed in that year (OECD, 2001).

In August 2001, Telmex, via América Movil, which owns 49% of Cablevision, launched an ADSL (Asymmetric digital subscriber line) service called Prodigy Infinitum. This service offers three broadband Internet access options, depending on the speed preferred the customer: at 256 and 512 kbps, and 2.0 mega bytes per second. The options are described in Table 35.

TABLE 35
Prodigy Infinitum Broadband Services and Charges

Service	Speed (Receive/send)	Modem	Monthly charge
Prodigy Infinitum 256	256 Kbps / 128 Kbps	US$306.00	US$50.00
Prodigy Infinitum 512	512 Kbps / 256 Kbps	US$306.00	US$92.00
Prodigy Infinitum 2000	2.0 Mbps / 512 Kbps	US$306.00	US$460.00

In general, Internet access costs via modem are reasonably low in Mexico. Phone companies only charge the number, not the length of local calls, while ISPs typically charge around US$40 a month, which is well within the range prevailing in OECD countries.

An Internet2 super broadband network has been under construction for the last four years in Mexico. It links Mexico's major universities and research institutions, and is managed by a

[8] The present report used OECD's definition of 'broadband' as those networks with the capability of supporting a bandwidth wider than 200 kilobits per second (kbps) in the last mile, in both the provider-to-consumer (downstream) and the consumer-to-provider (upstream) directions. This rate is approximately four times faster than the Internet access received through a standard phone line at 56 Kbps or 64 Kbps (OECD, 2001).

collective body called the University Corporation for Internet2 Development (CUDI), established in April 1999, to plan and manage the development of that higher echelon of Internet in Mexico.

Construction of CUDI's network and the backbone to power it, began in the late 1990s, following steps taken in that direction by the United States and Europe years before. It is 8,000-kilometer long and provides links at 155 megabytes per second (Mb/s) to the border cities of Tijuana and Ciudad Juarez, and to Houston, Texas in the United States. It also provides links at 34 Mb/s to 16 Mexican universities and research centers. It is sponsored by Telmex and Avantel, Mexico's top phone service providers, and up to now is exclusive for education and research purposes (CUDI, 2002).

Broadband network infrastructure is likely to be significantly extended and improved in the next few years as a result of the construction of the e-Mexico System, to be discussed later. For this project aims at providing broadband Internet connectivity to the country's 2,400 plus main localities.

In addition to education and research institutions, other Internet service providers (ISPs) include government agencies, large private sector organizations, and specialized domestic companies like Cablevision, Megacable, Pegaso, Infosel, and Telecable, as well as foreign providers like Prodigy and AOL. Prodigy recently signed an alliance with Telmex to offer a service package called Prodigy Plus 5, which includes one-year Internet access via modem and a Pentium IV-powered personal computing system (Compaq or IBM Netvista), all for about US$1,300 payable in 12 monthly payments. The package can be purchased in Telmex's 360-plus stores nationwide.

Regarding the number of Internet hosts per 1,000 inhabitants, Mexico ranks highest among Latin America's most advanced countries—Argentina, Brazil, Chile and Venezuela. In contrast, it shows the lowest figure with respect to the number of Internet users per 1,000 inhabitants (Table 36). This is consistent with the mixed nature of Mexico's performance by international standards in the Americas, observed in previous analyses.

The number of residential fixed phone lines was 9,034,054 in 2000 (COFETEL, 2002), and thus the extent of penetration of fixed phone lines into households rose to 42%, which is substantial to business Internet connections[9].

[9] This rate is obtained by dividing that number of fixed lines by 21,513,235, the total number of housing units in 2000.

TABLE 36

Internet infrastructure	Internet hosts per 1,000 population 2000[a]	Internet users per 1,000 population 2000[a]	Access cost, 30 hours, peak, US$ 2001[b]
Argentina	7.30	67.51	$92.02
Brazil	5.15	29.39	N/A
Canada	76.88	413.01	$24.87
Chile	4.91	166.80	N/A
Mexico	5.65	27.43	$30.78
United States	292.83	346.58	$22.05
Venezuela	.67	39.30	N/A
Latin America	5.20	39.66	$61.40
OECD	91.76	256.03	$39.43

[a]*Source:* International Telecommunication Union, Yearbook of Statistics 1991-2000. Geneva: International Telecommunication Union, 2001. ITU definitions: internet hosts refers to the number of computers that are directly connected to the worldwide internet network (note, however, that the statistic is based on country code in host address and may not correspond with actual physical location); internet users is an estimate of the number of internet users.

[b]*Source:* International Telecommunication Union, World Telecommunication Development Report 2002, Reinventing Telecoms. Geneva: International Telecommunication Union, 2002.

E-Commerce Infrastructure and Diffusion

According to Select-IDC, the penetration of businesses-to-consumers (B2C) e-commerce in the Mexican economy in 2000 was only 0.16%, this figure being expected to reach 2% in 2004. In the case of business-to-business e-commerce (B2B), the estimated proportion for the same year was 6.1, and it was expected to hit 20% in 2004. That is, in line with a pattern common in other countries, B2B e-commerce in Mexico is much higher—nearly forty times—than that for B2C, in this case due in part to the previous existence of EDI networks in many companies before the Internet was a reality in this country (Select-IDC, 2001a).

By mid-1999, 20% of Internet users were conducting some kind of transactions on the Web. By December 2000, 19% of users were buying and 7% were selling products and services on-line. In early 2001, about 15,000 Web sites were in operation in Mexico that offered some kind of product or service (García, 2001a)

Nearly eight out of 10 of e-commerce transactions corresponded to (B2B) and 22.5% to (B2C) e-commerce. Likewise, of the 2.9 million Web surfers estimated to exist at the end of 2000, 71% were in government, education, and the private sector (potential for B2B), while 29% were home users (potential for B2C) (Cruz Pantoja, 2000). The proportions are even more unequal according to Forrester Research, which estimated that B2B accounted for 93% of total e-commerce in 2000 (Table 37).

TABLE 37
E-Commerce Infrastructure and Extent in Selected Countries in the Americas

Country / Region	Secure servers per 1,000,000 population 1998[a]	Secure servers with strong encryption per 1,000,000 population 1998[a]	B2B trade in US$M 2000[b]	B2C trade in US$M 2000[b]
Argentina	.58	.11	$617.80	$47.18
Brazil	1.06	.38	$2,232.63	$170.50
Canada	30.66	21.82	$15,867.52	$1,496.00
Chile	1.28	.20	$142.50	$10.88
Mexico	.27	.08	$3,018.52	$230.51
United States	54.29	38.39	$449,900.00	$38,755.00
Venezuela	.34	.04	$2,13.27	$16.29
Latin America	.74	.24	$6,224.72	$475.36
OECD	17.77	11.47	$588,900.80	$52,184.17

[a]Source: Netcraft. http://www.netcraft.com. Strong encryption is defined as having a key length greater than 40 bits (systems limited to a 40-bit key are classified as 'weak' since it has been shown that messages encoded using a 40-bit key with RC4 can be broken in about a week by a good computer science student using facilities available in a good computer science lab).
[b]Source: Forrester Research Inc., Global eCommerce Model, 2000.

The main drivers of B2B electronic transactions are the big subsidiaries of multinational corporations operating in Mexico. For example, IBM has moved virtually all of its Mexican operations into e-business, and handles payments, procurement and international invoicing electronically through Internet by means of its Web page (Palacios, 2001a). This is also the case of the large electronics contract manufacturing plants operating in Mexico, and the affiliates of major foreign firms in the computer industry like Hewlett-Packard and Acer.

Large domestic firms are in turn joining the circles of e-commerce practitioners. An emblematic example is that of Peñoles, a leading mining conglomerate, which has built a portal to manage all its procurement operations within an Internet-based Global Market Place (*El Asesor de México*, August 15, 2001; *www.amece.com.mx/emexico*). Another is the case of Grupo Industrial Vitro, Mexico's top glassmaker, which invested US$20 million just in 2000 to build an Internet-based marketing arm and transform itself into a full-fledged e-commerce corporation (FINSAT, 2000a).

In the case of the technological base to support e-commerce activities, the number of secure servers per one million population in Mexico is lowest among other relevant countries in the Americas. The same is true in the case of secure servers with strong encryption, where Mexico's figure is much lower than Brazil's and Chile's, though higher than Venezuela's and close to that shown by Argentina.

A reverse situation occurs regarding the volume of B2B e-commerce, where Mexico outperforms all the other Latin American countries in the group, though the volume of its B2B transactions is three times smaller than Canada even though this latter has a population three times smaller than Mexico's (see Table 37).

Transportation and Logistics Infrastructure

Over 200 logistics companies are in operation in Mexico, as listed on national phone directories (www.seccionamarilla.com.mx). The world's giants in logistics and delivery services—DHL, UPS, and FedEx—have an ample presence and extensive operations, servicing most of the country's major cities. Other lesser foreign players like Airborne and Purolator are also present. Major domestic courier companies include Estafeta, Multi-Pak, Mexico Express, Speed Pak, and a considerable number of local companies.

FedEx offers an Internet-based package of e-services including applications like FedEx EC-Shop, FedEx PowerShip Server, FedEx World Software and FedEx Ship Manager. The latter is run from FedEx's central Web site, which permits users to speed up shipments any time, anywhere. FedEx World Software integrates pre-designed templates to speed up shipment preparation. The FedEx EC-Shop and FedEx PowerShip Server options are run on users' systems (Grupo Reforma, 2001).

Logistics companies proper include Redmond Systems, Emery Logistics, and global logistic giant Kuehne & Nagel, which joined recently, and in April 2002 opened its first Logistics Center in Guadalajara, Mexico's second largest city. This center provides an integrated and comprehensive service package including air, maritime and surface transportation; customs management assistance; a service in-bond (maquiladora) plant; and Vendor Management Inventory services (Mural, 2002). Grupo Pondisa, in turn, is a major domestic player, which has provided an array of services in logistics and warehousing for more than 25 years, with offices and facilities in 17 locations nationwide, the newest of which was set up in June 2002, also in the Guadalajara area.

In addition to courier services, over 7,800 freight transportation companies are in operation, which moved more than 413,000 tons in 2000 with a fleet topping 370,000 trucks and trailers (INEGI, 2002c). Most of these, especially passenger bus companies, provide package delivery services, notably Omnibus de México, Tres Estrellas, Autotransportes del Pacífico, and ETN.

Finally, the operations of logistics and transportation companies are supported by 85 airports, of which 57 are international and 28 domestic. Therefore, it can be said that Mexico has the required capabilities for both nationwide and international package delivery to support the functioning and development of both B2B and B2C e-commerce activities, presently and in the near future.

Enterprise Infrastructure

Although no detailed data seems to be presently available, the use of productivity tools, like Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), and Supply Chain Management (SCM), is spreading rapidly in Mexico, in both companies and government agencies. CRM solutions have built on electronic data exchange (EDI) networks constructed in the past decade.

Top software packages like Germany's SAP and U.S.' Oracle and People Soft are well known and used by both domestic companies and foreign subsidiaries, at least by those in the

electronics and computer industries. As much as 48% of all the companies surveyed by Palacios (2001) were using an EDI network for their dealings with suppliers.

SAP Mexico's director general recently declared that ERP solutions are the most demanded and on which the heaviest investments are made by companies operating in this country, followed by CRM and SCM. He added that SAP has more than 300 customers in Mexico and Central America, which is a small proportion of Mexico's company population; the largest ones in Mexico are Pemex, Hewlett-Packard, IBM, and Microsoft (Gassamans, 2002).

Other major consulting firms also have extensive operations in Mexico. This is the case of Gedas, which offers services in outsourcing, software development, ERP in manufacturing, CRM, logistics, and e-commerce.

The trend toward the adoption of such productivity tools is being reinforced and promoted by the federal government with the development of EDI networks like the one called Government Contracts Electronic System (COMPRANET), through which the federal government manages all of its procurement dealings. Another major example is the network developed by the Mexican Institute for Social Security (IMSS) to manage its transactions with suppliers. Both are seen as an initial step toward building full Internet-based systems by the Mexican government, which are well under construction.

In early 2001, IMSS's informatics chief stated that 6,000 businesses are already using EDI in Mexico, and that the number will increase to 12,000 in 2002 (Pérez-Moreno, 2001). Attesting to this, major subsidiaries of foreign firms like Hewlett-Packard, SCI Systems (recently merged with Sanmina), Solectron, and Jabil Circuit, have EDI networks in operation that handle their procurement operations (Palacios, 2001).

Commercial Base

Mexico's commercial base presents a highly skewed structure characterized by a large number of small establishments and only a few large companies. The Mexican Business Information System (SIEM), a database assembled and run by the Ministry of Economics, lists a total of 402,297 commercial companies currently in operation. Of these, as much as 91% (366,632) correspond to micro establishments of five or less employees, according to the classification presented in Table 16 (SEC, 2002b).

Units classified as "small"—those with 6 to 20 employees—amount to 26,789 accounting for 6.7%, while medium-sized ones total 6,981, or 1.7%. Finally, large establishments, those with 100 or more employees amount to 1,590 thus representing a negligible proportion of 0.4% of the total (SEC, 2002b).

The top retail chains in the supermarket category are controlled by the domestic business groups Comercial Mexicana, Gigante and Soriana, which are among the 30 largest companies in Mexico (see Table 11), and Aurrerá. All these chains have stores in all major cities. Close competitors are subsidiaries of foreign companies like Carrefour, Price Club, and Walmart. Aurrerá has recently entered into an alliance with Walmart and established a company called Walmart-Aurrerá. None has yet developed an EDI network or a package of Internet-based

solutions to promote on-line shopping in the spirit of B2C e-commerce. All rely on the entrenched shopping traditions of Mexican consumers, as will be discussed shortly.

Infrastructure Readiness for E-Commerce: Summary

According to the foregoing discussion, Mexico's infrastructure provides a fair level of readiness for the operation and future growth of both B2B and B2C e-commerce. Federal toll roads extend over more than 7,000 kilometers, and the number of airports and maritime ports grew substantially over the 1990s. Both fixed phone and cellular phone lines exceed 12 million; this is highly significant as it is expected that half of e-commerce activity by 2006 will be conducted through mobile communication devices, whose users are expected to increase to 40 million in that year, up from the current 15 million.

The proportion of Mexican homes with at least one PC, though, was only 10% by the end of 2000, as compared to a 50% for the United States. The proportion is likely to increase, nonetheless, as IT infrastructure is extended, particularly under the e-Mexico project. The construction of the first Network Access Point and the fact that Mexico invests 1.4% of GDP in IT attest to that.

The above was reflected in that the extent of Internet penetration in households was 5% in 2000, while that in businesses topped 41%. Also, two-fifths of the companies operating in Mexico are estimated to have implemented some kind of business strategy using the Internet.

The fact that over 300 Mexican cities are connected to the Internet, most of them allowing for 256 kilobytes per second access, already speaks of a quite sizeable pool of opportunities for the growth of e-commerce, in general. In this respect, it is encouraging that high-speed access and operation are already available in Mexico through broadband networks and backbones run by the top phone and cable television companies, including the one for Internet2. The fact that the latter is exclusive for users engaged in education and research is not as restrictive in general as it may sound, as CUDI members estimate that about one-half of Internet users in Mexico are linked to universities (CUDI, 2002). However, when it comes to e-commerce, the limitation is more apparent, given it is not accessible for commercial purposes.

Transportation infrastructure is fairly adequate, with over 7,800 freight transportation companies servicing Mexico's entire territory, many of which offer package delivery options. These are complemented by more than 200 logistics and courier firms, including DHL, UPS, FedEx, Redwood Systems, and Kuehne & Nagel. The operations of all these companies are supported by 57 international airports and 28 domestic ones. All this means, therefore, that Mexico has a reasonably solid capacity for distribution and package delivery to support B2B and B2C e-commerce activities.

The use of productivity tools like ERP and CRM is spreading rapidly, relying on EDI networks built in the past decade. This trend is being reinforced and promoted by the federal government with the development of EDI networks.

The large presence of small establishments in the commercial sector, in turn, in fact limits the possibilities for the spread of B2C e-commerce activities, given that most of those micro shops lack both the resources and the business instinct that may induce them to invest in IT and conduct business on-line. The main wholesale companies and the larger commercial chains operating in Mexico do have, nonetheless, the required resources and conditions for developing EDI or even Internet-based solutions that make them able to venture into B2C electronic commercial transactions.

In sum, it can be stated that Mexico's infrastructure has been instrumental in the inception and initial growth of e-commerce activities over the last decade or so, and offers the basic conditions and capabilities to support the operation of both B2B and B2C transactions now and in the near future.

FINANCIAL RESOURCES

Fresh capital for new ventures, e-commerce or otherwise, is provided by both commercial and development banks like Nafin and BANCOMEXT (Foreign Trade National Bank). Nafin operates a program providing venture capital for investment projects aimed at improving the financial management of new companies; another to provide fixed interest rate loans to SMEs; and, one more to offer loans for technological innovation projects (SEC, 2002b).

Another major source is the National Council of Science and Technology (CONACYT). The council runs a Support Program for Joint Research and Development Projects (PAIDEC), which provides venture funds for Mexican investors in this kind of project, linked with experts from public universities. CONACYT provides 50% of the investment as a lost fund reimbursement, up to US$250,000 per year for a period not exceeding two years (CONACYT, 2002a).

CONSUMER PREFERENCES AND PAYMENT INSTRUMENTS

In terms of payment mechanisms, the Director General of Terrapin, a firm specialized in intelligent cards, recognizes Mexico as the top consumer of this product in Latin America. The trend is toward convergence on international standards, so as to prevent waste of time and resources and protect infrastructure. Intelligent cards are most useful especially in the areas of commerce, health and education (*El Universal*, June 14, 2001, *www.amece.com.mx/emexico*).

Mexican consumers still tend to be highly skeptical of the Internet as a means to shop and carry out commercial transactions in general. Most people think that it is not safe to do so, given the numerous cases of electronic fraud and hacker attacks that have occurred since on-line shopping became an option for consumers in Mexico (Uribe, 2002). Reservations and fears, coupled with shopping habits and traditions rooted in national culture, have nurtured such skepticism in Mexican consumers about using credit cards to buy on-line, let alone do business over the Web. Non-authorized charges and the cloning of cards using devices, such as a beeper-like device called Skimmer, are the most common of those crimes (Cruz, 2002).

As a consequence, the use of credit cards, as a major means of payment, has a quite limited extent. Credit cards accounted for a negligible 0.1% of total bank loans in 1987, the figure just increasing to 5.9% nearly a decade later, with a peak of 10% in 1992 (Table 38).

TABLE 38
Share of Credit Card Accounts in Total Bank Loans
(Percentages)

Year	%
1987	0.1
1988	0.8
1989	4.2
1990	5.0
1991	8.8
1992	10.2
1993	7.5
1994	6.2
1995	5.5
1996	5.9

Source: Gómez Pacheco (1998), Table 2.

We see similar pictures of the number of credit card holders. As Table 39 describes, 6.6 million accounts were in operation in 2000, which amounted to only 6.8% of the Mexican population, and over 10% of those 15 years or older. The two main banking institutions, BBVA Bancomer and Banamex, account for four-fifths of the total.

TABLE 39
Number of Credit Card Accounts by Issuing Institution, 2000

Bank	No.	%
BBVA Bancomer	2,554,553	38.5
Banamex	2,761,730	41.6
Serfín	88,069	1.3
Bital	309,728	4.7
Santander Mexicano	57,315	0.9
Mercantil del Norte	175,707	2.5
Citibank	393,329	5.9
Scotiabank Inverlat	131,795	2.0
Afirme	3,514	0.1
IXE	3,283	0.1
American Express	157,426	2.4
Total	6,636,449	100.0

Source: CNBV (2000).

Given the high insecurity prevailing in Mexico, fraud victims have undertaken direct actions to defend themselves from hackers and credit card criminals. This includes the creation of specialized organizations like the Coalition against Fraud with Credit Cards and other Payment Means, a private organization created in 1998, which demanded the official recognition of those crimes in both federal and state legislations, so that sentences of up to nine years in prison with no bail option can be established (Orihuela, 2002a). As a result, appropriate provisions were introduced in 1999 in the Federal Penal Code for the case of crimes involving development banks; but, in order for these provisions to be applicable to individuals, state legislatures have to introduce the corresponding reforms, which has been achieved only in four states—Federal District, Mexico State, Quintana Roo, and Puebla. The coalition estimates that credit card fraud caused losses for US$54 million in 2001; nearly two-thirds of the losses occurred in those states, plus Jalisco and Nuevo León (Orihuela, 2002b).

Toward a Safe E-Banking

Commercial banks and other companies have in turn undertaken actions on their own to induce customers to use credit cards to trade on-line. Banamex, for example, offers a virtual credit card called Klick Card that can be requested only via Internet, while BBVA-Bancomer offers an electronic check that works in a fashion similar to the Klick Card (Galán and Vizcaíno, 2002). General actions include the setting up of digital kiosks in branch offices of most banks, information brochures sent to customers, and charges on transactions made in person at branch offices, which are free if carried out on the Internet through the banks' portals and Web sites.

The efforts to inculcate Mexican users into a new banking culture based on the use of digital technologies are strengthened by the heavy presence of foreign corporations in the originally home-grown top domestic banking institutions. Bancomer is now an affiliate of Banco Bilbao Vizcaya Argentaria from Spain, while Banamex was recently bought by U.S.-based Citigroup. The other big players are Banco Santander, another Spanish firm; Scotiabank, a Canadian concern; Citibank itself; and others like Tokyo-Mitsubishi, Bank of America, and Bank of Boston. As with other multinational firms, these banks are bringing new corporate philosophies and leading-edge management practices that revolve around the concept of electronic banking via the Internet. After the merger-cum-takeover between Citigroup and Banamex, the resulting joint company spun off an e-banking arm called Artikos, and has established as a top priority, the gradual replacement of its existing branch offices with virtual service centers. In mid-2002, electronic transactions already accounted for 60% of the bank's total (Flores, 2002).

An initiative in the same direction is the launching in May 2000 of a new product called *Yahoo Card*, jointly by Yahoo Mexico, Banco Santander Mexicano, and Visa, which offers more flexibility and special security in its use on the Internet guaranteed by a Verified-by-Visa certificate. The services provided by this card are linked to a specialized Web site called *Yahoo Mi Empresa* (Yahoo, My Company), which provides all that Mexican companies, especially SMMEs, need to set up new businesses on-line, or to digitize existing business establishments (García, 2002).

The fact is, however, that the penetration of the Internet in banking activities is quite limited in general, especially in Mexico where only 14.5% of the population—14.2 million people—had a banking account in 2000 (CNBV, 2002), and less than 13% had both a phone line and a bank account (Torres, 2002). In the United States, where nearly one-half of the population has access to the Internet and virtually everybody has a bank account, less than 5% of the people use it for their banking transactions. The figure is similar in the main European economies (Vernon, 2001).

Traditional payment options like bank drafts and long-distance deposits on bank accounts provided by well established institutions, are still most preferred in Mexico by individual customers and businesses alike. Other, new instruments available to Mexican consumers include a number of money transfer services provided by foreign firms. The most well known is PayPal, which permits credit card holders to make payments on-line to establishments or individuals not equipped to accept credit cards. Others include Billpoint and c2it, affiliates of eBay and Citibank respectively, which offer similar services. One more is P-Cash, run by

Patagon, which is a safe alternative to on-line transactions with a credit card, and consists of an account where the user can deposit cash that is immediately ready for transfer (Chávez, 2002). This service has been well received by users of Mexican auction portals like DeRemate, Mercadolibre, and Todito.com.

The safety of e-commerce transactions depends on factors like the authenticity of the parties involved; the certainty that only the client and the bank will have access to the information related to the transaction (confidentiality); the certainty that the information sent must be equal to the one received (integrity); and the certainty that none of the parties involved will deny his/her participation (recognition). As will be discussed later on, at least the first two are provided for in the legislative package on e-commerce in force since May 2000.

BUSINESS ENVIRONMENT AND READINESS

In spite of the prevailing fears and distrust about the use of credit cards and other digital payment instruments, a generally favorable business environment exists in Mexico for e-commerce to grow and prosper.

The economy is gradually recovering after the slump of 2001, and growth is expected to pick up in the second half of 2002 and post an annual rate of about 1.8%. An overtly pro-business federal government is in power, which is pushing for further reforms to open up to private capitals sectors still controlled by the state, especially oil and electric power. This government is intending to build a vast telecommunications infrastructure under the e-Mexico project, and is even postulating the Internet as the basis of a new development model, seemingly in line with the so-called Digital Opportunity Initiative, jointly launched in 2001, by the United Nations in association with The Markle Foundation (Bowman, 2001). Economic liberalization is well in force and progressing, and free trade ideology is deepening as reflected in the signing of more free trade agreements—nearly a dozen, the last one under negotiation with Brazil and MERCOSUR—all anchored on the North American Free Trade Agreement (NAFTA). Globalization is a welcome reality by both business and government, and so a widespread consensus exists as to the need for Mexican businesses to open up to foreign markets and to embrace digital technologies with an eye to modernize and improve company structures and management practices in order to survive in today's globalized and highly competitive business environment.

In sum, a favorable environment exists in Mexico for business over the Internet to prosper, all sustained by a rather healthy macroeconomic stability and a significant progress made in the last few years toward a more democratic political life. Moreover, a population of nearly 100 million and a surface area close to two million square kilometers whose main cities are connected by a reasonably efficient road system with over 100,000 kilometers of paved roads, jointly project a sense of potential for economic growth and the development of scale economies that adds to such an environment. The several programs in operation by both the federal and state governments, especially those by the Ministry of Economics and development banks like Nafin and BANCOMEXT, all aimed at providing technical and financial support for new and existing businesses, further contribute to nurture a business atmosphere auspicious to the growth of both B2C and B2B electronic commerce.

In support of the above perceptions, the 2001 Executive Report of the Global Entrepreneurship Monitor reported that Mexico showed the highest entrepreneurial activity prevalence rate among all the countries surveyed in 2001.[10] It was followed closely by New Zealand, and then by Australia, Korea and Brazil. Mexico showed a rate of 18%, while Belgium presented the lowest rate, 5% of the group (GEM, 2002)[11].

In other words, Mexico posted the highest number of persons per 100 adult individuals (18 to 64 years of age) who are in the process of starting a new company or else are the owner/managers of a business establishment less than 42 months old already (GEM, 2002). This is encouraging for it signifies that the overall level of development of a country does not necessarily imply a low entrepreneurial drive in its economically active population. It also means that the adverse factors that act as hindrances do not deter Mexican entrepreneurs from engaging in the creation of new business ventures and in the development of business activities in general, e-commerce included.

Unionization of workers is still controlled by old-style unions that were created and developed under the corporativist political and institutional regime, that in turn, was formed under the 71 year Pax of the PRI (Institutional Revolutionary Party). These are mainly Mexico's Workers Confederation (CTM) and the Regional Confederation of Mexican Workers (CROM), and other major unions all under the Labor Congress (CT). This old union system, created under a welfare state and Fordist regime of social regulation, has begun to be transformed over the last decade, as new organizations like the Mexican Workers Union have emerged. Ever stronger demands for reform of the existing Federal Labor Law are being raised by both individual companies and industrial chambers and business organizations, particularly the subsidiaries of the powerful multinational corporations with operations in Mexico. In this context, the coefficient of strikes that broke out every year has tended to decrease, as shown in Table 40.

[10] The total population of the 29 countries participating in GEM 2001 is about 2.5 billion. Approximately 56% (1.4 billion) are adults of working age. GEM surveyed random samples of at least 2,000 adults from each participating country to ascertain several measures of entrepreneurial activity. From the more than 74,000 surveys conducted with those 18 to 64 years of age, about 10% of the adults were engaged in entrepreneurial activities. Results were similar for the 21 countries participating in GEM 2000. This means that in the 29 GEM 2001 countries, at any point in time, approximately 150 million people are involved in starting and growing new firms.

[11] The whole group of countries included in the GEM survey was: Argentina, Australia, Belgium, Brazil, Canada, Denmark, Finland, France, Germany, Hungary, India, Ireland, Israel, Italy, Japan, Korea, Mexico, The Netherlands, New Zealand, Norway, Poland, Portugal, Russia, Singapore, South Africa, Spain, Sweden, the United Kingdom, and the United States.

TABLE 40
Labor Strikes Break-out Annual Coefficient

Year	Coefficient
1989	1.9
1990	2.4
1991	1.7
1992	2.4
1993	2.0
1994	1.4
1995	1.2
1996	0.6
1997	0.5
1998	0.4
1999	0.4
2000	0.3
2001	0.5
2002[a]	0.4

Source: De Buen (2001).
Note: It refers to the ratio of the number of strikes that actually broke out in the month in which they were announced to the total number of strikes announced in that month.
[a] Up to January.

As a result, Mexico's entrepreneurial culture has started to improve in the last decade, as individual companies and the Mexican economy in general have been more exposed to foreign competition, but at the same time to the ideas and know-how prevailing on the international business scene, to a large extent thanks to the advent of the Internet and its introduction and spread in Mexico.

Substantial drags have to be overcome, however, so that e-commerce, in particular, and economic activities in general can develop more fully in order to realize the potential Mexico offers for businesses to be born and thrive. Some of the more significant are an entrenched tradition of family-owned company structures and management systems that usually imply an inefficient way of using company resources. Another is the still widespread lack of a truly entrepreneurial vision and instinct, wide enough and strong enough to override the still predominant conservatism that manifests itself in a "natural" tendency to invest only in well-known business areas like traditional commerce and real estate.

Only in that way can a new business culture emerge in line with the new realities of the early 21st century. The Business Deputy Director of AcciTrade Banamex, an affiliate of Mexico´s second largest banking institution recently declared that "We are still building the foundations, although it should be recognized that the progress achieved so far is important. What is needed is that technology be more accessible and that its diffusion gives rise to a new financial culture", (Cámara Trejo, 2002).

IBM's Business Vice President for Latin America holds that, "The problem in Mexico will not be purchasing power, for that exists in operating systems to facilitate the purchase of a computer, but the lack of an informatics culture. Although, the advantage in this respect, is that there are nearly 35 million people less than 25 years of age who are receiving an education that will form them in that direction" (Notimex, 2002).

The question, nonetheless, is that less than 13% of Mexicans have a phone line and a bank account, a reflection of a highly skewed income distribution and an also highly skewed business size structure, as discussed in previous sections. An additional and significant drag that undermines the otherwise favorable business environment is the heavy paperwork and red tape that plagues Mexico's institutional systems for both the creation of new companies and the operation of existing ones, coupled with a highly complex, bureaucratic and adverse fiscal system that imposes a heavy tax burden on companies and individual tax payers alike.

To the extent that those hindrances can be overcome in the immediate future, Mexico's readiness for the development of e-business will be enhanced and consolidated so that this dynamic activity will find a propitious ground to arise and flourish in this Latin American country located in the southern part of North America.

NATIONAL POLICY

Policy Institutions and Organizations

Private Sector

The private sector has been an active participant in the promotion and facilitation of e-commerce growth in Mexico. A diversity of working groups, chambers and organizations in the field have been established over the last decade to coordinate activities aimed at fostering the development of e-commerce activities.

The most important of those is the Mexican Association for Electronic Commerce Standards (AMECE). Established in 1986, AMECE is devoted to promoting and managing the use of standards related to e-commerce through EDI implementation guides, product codification standards, and the development of an electronic catalogue. AMECE works through *ad hoc* committees composed of representatives of both the private sector and government agencies (AMECE, 2002).

The Mexican Committee on Electronic Commerce (COMECE), is a specialized body that works closely with, and practically inside, AMECE. It is organized in four working groups (e-payments, e-invoicing, security, and document certification), and is meant to be the official information center on e-commerce. Thus, COMECE groups the main actors of Mexico's e-commerce community and is a key liaison between government branches and private sector companies and organizations (COMECE, 2000).

Another important player is the Electronics, Telecommunications and Informatics Industry National Chamber (CANIETI), which participates actively in COMECE and in most government-led committees and coordination bodies aimed at promoting the development of e-commerce in Mexico. CANIETI's goals in this matter include the establishment of a long-term national policy for digital convergence on a single technological platform, including the creation of a specialized agency charged with the implementation of policies in this field; the development of a digital economy in Mexico backed by a sound an comprehensive legal framework; the promotion of competition among Internet service providers; and the permanent

increase of access and data transfer speed (CANIETI, 2002). In early 2002, CANIETI proposed a project for a new Federal Telecommunications Law, which is under discussion in Congress.

The Mexican Association for the Information Technologies Industry (AMITI) is still another organization that actively participates in the promotion of e-commerce both within AMECE's portmanteau and on its own; to this end, it has created specific departments to deal with e-commerce issues. The Mexican chapter of the World Information Technology and Services Alliance (WITSA), AMITI aims at promoting the creation and implementation of IT development policies, like the National Informatics Development Plan 1995-2000, and the adoption of standards that facilitate free access, interconnectivity and interoperability of IT infrastructure (AMITI, 2002).

Finally, the Promotional Group on E-Commerce Legislation (GILCE) was established in 1999 within AMECE as a working group charged with the specific responsibility of promoting and monitoring initiatives intended to formulate and implement a proper legal framework. GILCE is composed of representatives from AMITI, CANIETI, the Bank of Mexico, the Ministry of Finance and the then Ministry of Trade and Industrial Promotion (SECOFI), Mexico's Bankers Association, the Notary Public National Association, and the Telecommunications Federal Commission (COFETEL).

In addition to the work of the above organizations, major private companies have also contributed to the promotion of e-commerce in Mexico by setting up e-commerce divisions and/or departments. These companies include virtually all major banks and telecommunications giants like Telmex, as well as subsidiaries of top IT multinational companies like Microsoft, Compaq and Oracle; the latter have created Web sites offering e-commerce solutions to Mexican firms.

Public Sector

In parallel to the initiatives of private sector entities, the Mexican government has extended its involvement in the facilitation of e-commerce, thus creating a favorable national environment for the growth of the digital economy. This is being done mainly through the ministries of Transport and Communications (SCT) and Economics, and Nacional Financiera (Nafin).

As will be discussed shortly, SCT is the leading agency in the construction of the e-Mexico system, which is one of the flagship projects of the Fox administration, and is intended to provide a vast broadband telecommunications network that would substantially instigate the growth of commercial transactions over the Internet.

In addition to playing a key role in the e-Mexico project in collaboration with SCT, the Ministry of Economics has also contributed to create a propitious environment for e-commerce through programs intended to provide SMMEs the basic skills for the adoption of digital technologies and equipment, as discussed in other sections. It recently launched the Digital Economy Development Special Program (PEDED), which seeks to coordinate the different initiatives aimed at helping companies and public offices to go on-line for transactions and dealings, including the introduction of a new official norm that regulates the use of data messages by electronic means (AMECE, 2002, e-Mexico section).

Nafin, self-proclaimed as Mexico's Small and Medium Enterprise Bank, in turn set up a Directorship for Electronic Products charged with the responsibility of devising programs aimed at facilitating the use of IT by SMMEs so that they can get linked to larger companies as suppliers. One of the chief products of this directorship is called Production Chains, which aims at integrating the large companies and government agencies with all the businesses with which they have business relationships in a single electronic market, i.e., an e-marketplace. The former invite their suppliers into their supply chain, and Nafin sets up a Web site and links it with a common data base. Once the parties are electronically interlinked, Nafin approaches the SME supplier to provide it with technical advice and training, loans and other financial services via factoring, and shortly after with working capital (Hernández, 2002).

Finally, it is important to point out that a close collaboration has developed between the federal government and promotion bodies like AMECE, GILCE, COMECE and CANIETI. In May 2000, representatives from the Ministry of Finance, the then Ministry of Trade and Industrial Promotion (Ministry of Economics since December 2000), the Bank of Mexico, and COFETEL, established an Inter-ministerial Committee with AMECE and COMECE, in which the Notary Public National Association was also represented. This committee is the main interinstitutional body for coordinating all the activities related to e-commerce nationwide. The Ministry of Economics has the leading role in the committee, as it is charged with the responsibility of promoting and coordinating both foreign and domestic trade as well as all commercial matters.

Mixed Initiatives

A growing collaboration is taking place between the public and private sectors in joint projects that involve partners from both. One of the most representative is the collaborative network called bNexus, launched in March 2001, by Microsoft in collaboration with seven Mexican companies. BNexus integrates the services of third-party companies, organizations and government offices in a package enabling users to conduct on-line commercial dealings, money transfers, payments, and *IMSS From your Company* transactions; the package includes access to AMECE's product catalogues, e-mail services and the use of Microsoft's Office suite. Although it links companies of all sizes and large public institutions, one of the network's main objectives is to induce SMMEs to improve their productivity and engage in e-commerce transactions (García, 2001b).

Specialized mixed bodies and private IT firms alike have been instrumental to the emergence and development of e-commerce in Mexico by respectively devoting themselves to both its promotion and the formulation of a policy and legal framework that facilitates its operation and growth, as will be discussed in subsequent sections. They converge in their aims and initiatives, and collaborate closely by means of cross memberships in each other's committees and working groups. As noted, the latter also include the participation of representatives of government agencies, an arrangement that assures the coordination of the work of both the private and the public sectors in the promotion and facilitation of e-commerce with the public sector and override whatever overlapping that may exist in their respective activities.

Enabling Policies

Telecommunications Liberalization

Mexico's telecommunications sector was liberalized during the 1990s as part of the privatization and economic liberalization policies implemented by the Salinas and Zedillo administrations. The first steps were taken by the Salinas administration (1988-1994) with the privatization of Teléfonos de México (Telmex), the nation's telephone company and one of the most strategically important state enterprises. The Zedillo administration (1994-2000), in turn, liberalized, and thus opened to competition, both the long distance phone and the local calls market. The first new entrants were mainly joint ventures between top Mexican conglomerates and multinational telecommunications giants like AT&T and WorldCom. Since then, new private companies like Avantel, Alestra, Unefon, Vodafone Pegaso and Axtel have gradually entered both the long distance and local phone markets, which has widened the options and possibilities for Internet service providers.

The above was facilitated by the relaxation of foreign investment legislation enacted earlier by the Mexican government, especially the old 1973 foreign investment law. By 1989, the Salinas administration had already introduced the main reforms in a bylaw published that year (Palacios, 1992). Today there are virtually no restrictions for foreign concerns to invest in Mexico, either in joint ventures or in wholly owned companies.

In this way, a number of world telecommunications and IT leaders have made substantial investments in Mexico the last few years. Nortel Networks, the Canadian giant, has invested in Mexico over US$1 billion since 1999, funding the installation of wireless optic networks for Unefon and Axtel (García, 2001a). Sun Microsystems has funded several computer infrastructure projects for US$20 million in various higher education institutions (AMECE, 2002; *El Financiero, 25 enero 2002)*

The Ministry of Transport and Communications, in turn, announced that total investment in the telecommunications sector topped US$5 billion in 2001, 18% more than in 2000. In 2002, this will be higher due to the massive investments expected for the mega project e-Mexico (AMECE, 2002; *El Financiero*, October 22, 2001)

Financial Deregulation

The liberalization of the financial sector was part of the package of privatization policies of the last two federal administrations. By the end of the 1980s, the financial system was dominated by two domestic groups that owned the two largest banking conglomerates: BANAMEX AND BANCOMER. An echelon of medium-sized banks like Banco del Atlántico, Banco Internacional and Banca Unión, and a myriad of regional banks that operated alongside and complementing the two higher layers followed these. Among the latter were Banca Promex. Banco del Norte and Banoro.

The sector was liberalized during the 1990s and at the end of the decade foreign conglomerates bought major shares of domestic banks and entered the Mexican financial market. Top

examples are Banco Bilbao Vizcaya and Banco Santander from Spain and Citibank from the United States. This entailed the introduction of new banking technologies by the newcomers and occurred in parallel of a significant deregulation of the sector regarding international wire transfers and deposits, and the possibility of holding accounts in U.S. dollars.

Electronic Commerce Policies

Research and Development and Other Incentives to Private Sector

Research and development (R&D) on e-commerce is virtually absent at universities and research centers. Market research is conducted mainly at private consulting firms, mostly subsidiaries of foreign companies with offices in Mexico, like Select-IDC, and others like eMarketer, The Boston Consulting Group, and Forrester Research, Inc., which periodically conduct surveys among e-commerce practitioners.

The above is symptomatic of the fact that R&D, in general, is very limited in Mexico, particularly regarding IT and e-commerce. As shown in Table 41, expenditure in experimental R&D in Mexico is much lower than in countries like Brazil and Spain, let alone the United States, Germany, and Canada.

In response to the above, the Monterrey Institute of Technology, a leading private university, established a Center for Research on Electronic Business. Likewise, the Ministry of Economics announced in November 2001, the imminent creation of an Institute for the Development of Electronic Commerce in Mexico, in a partnership between the business and the public sectors, which would promote the development of this activity by increasing the connectivity of companies (Mejía Guerrero, 2001a). However, up to mid-2002 this project had not materialized.

TABLE 41
Expenditure in Experimental Research and Development as a Proportion of GDP, 1999

Country	ERD/GDP
USA	2.65
Germany	2.44
Canada	1.58
Brazil[a]	0.91
Spain	0.90
Mexico[b]	0.40

Source: CONACYT (2002b), Table 1.3, p. 35, with data from OECD (2001) *Main Science and Technology Indicators*, No. 1.
[a] 1996
[b] 2000

The Ministry of Finance and Public Credit (SHCP) provides fiscal credits and incentives in the form of income tax deductions of up to 1.5% for research and development projects. Likewise, CONACYT operates a Research and Development Trust Fund for Technological Modernization (FIDETEC), for promoting domestic private investment in the development and implementation of innovation projects of high risk and "technological merit", to make up the deficiencies of financial markets for this type of projects. Projects should be in a "pre-commercial" stage, and

should encompass stages from the generation of the original idea to the construction of prototypes. FIDETEC funds can be provided in three forms: direct loans, financial guarantee for projects that already have support from a commercial bank, and shared risk loans (CONACYT, 2002).

The e-Mexico National System

This mega project was launched in early 2001 by the Fox administration, with the objective of providing connectivity to all of the country's 2,470 municipalities through a single nationwide, optic-fiber, broadband communications network that will also link the 9,500 telegraph outlets operated by the Ministry of Transport and Communications (SCT), the project's coordinator (Barros, 2001).

A technical committee was created in February 2001 to coordinate the process with representatives from several ministries, private organizations involved in e-commerce matters, and from the main telecommunication companies operating in Mexico. The committee is headed by SCT's minister; with the Minister of Economics ranking second in command. The telecommunication companies agreed to link their respective infrastructure and installations to assemble the projected macro network.

The goal is to transform SCT's telegraph outlets into so called Community Digital Centers, and establish Internet-enabled municipal sites in two years time. Similarly, local schools and health centers will be transformed with the same purpose, so that by the end of this administration 10,000 localities and about 85% of the Mexican population will receive the benefits of the project (SCT, 2002).

The system consists of four main subsystems: e-economy, e-education, e-government, and e-health. Each has its own objectives and working groups, all under SCT's coordination.

One of the key objectives of the e-economy subsystem is to manage a package of integrated services to help SMMEs to modernize and make use of the possibilities opened by the Internet and the digital economy in general, so as to eliminate intermediation chains and barriers to market entry and thus help them learn about suppliers, consumers, competitors and more efficient production and management systems (Margáin, 2001).

Nearly one year and a half after the launching of the initiative, the construction of the e-Mexico System has not yet taken off as was expected. Progress is limited, as Dr. Julio C. Margáin, its director general admits (Aguilera, 2002). It seems that it has turned out to be too ambitious and thus not as feasible as it might have appeared at the beginning. Although most of the resources to fund the project are supposed to come from the private sector, it seems that neither the government nor the private sector have been able to find the way to put together those resources, which are estimated to be at least US$70 billion. Some analysts think that the problem is the lack of a coherent plan to take the project to practice, so that it remains as a set of good but unfeasible ideas (Valdiosera, 2002).

Nonetheless, some important initiatives have been undertaken under the portmanteau of the e-Mexico System, including the launching of an electronic procurement system called Compranet (*www.compranet.gob.mx*), by means of which the Ministry of Auditing and Administrative Development (SECODAM) is managing all the procurement operations of the federal government. COMPRANET is also being adopted by public institutions like universities and national health institutes. Another is the program called *IMSS desde su empresa* (IMSS from your company) being implemented by the Mexican Institute for Social Security to conduct all its dealings with its suppliers (Pérez-Moreno, 2001).

One more is the collaborative network called bCentral designed and launched by Microsoft in alliance with seven Mexican companies. This network integrates the services of third-party companies, organizations and government offices including commercial transactions, electronic money transfers and payments, *IMSS From your Company* transactions, AMECE's product catalogues, e-mail services and the use of Microsoft's Office suite (García, 2001b).

National Policy

Last January 2002, representatives of the top companies in the telecommunications and informatics industries, joined forces for the first time to demand a nationwide policy and a national plan on the use and development of information technologies from the Fox administration. Such policy is thought of as a comprehensive coordination framework, which can provide certainty and operational support for IT related activities, including e-commerce. The proposal includes the creation of a leading central office responsible for the implementation and operation of the plan.

This initiative occurred right after Congress approved a fiscal package that considers computing equipment as a luxury item and charges an extra 5% tax on those whose sales value exceeds MX$25,000 (some US$2,700). Although it has been estimated that the impact of this tax will not be significant, its institution provided the excuse for the IT community to demand that the federal government formulate and implement the plan and policy detailed above (*El Financiero*, January 24, 2002; *www.amece.com.mx/emexico*).

In another important initiative, INEGI, Mexico's statistics think thank, is working on the design of a National Informatics Development Program, which is expected to complement the IT plan and policy referred to above (COMECE, 2001b).

Legal Framework

Although it is scattered in various laws and commerce codes, Mexico already has a legal framework that provides basic legal support for e-commerce operations.

Such a framework is contained in the package of reforms prepared by GILCE (the Promotional Group on E-Commerce Legislation referred to before) on a number of commercial laws and codes related to e-commerce, and a number of provisions that already contained such codes. GILCE submitted the package to Congress in December 1999, and it was promulgated on May 29, 2000. It gives legal recognition to electronic documents and signatures and therefore

constitutes the legal basis for the electronic contracts and transactions. Some of the main elements of this package are described in Exhibit 1.

EXHIBIT 1
Mexican Legislation on Electronic Commerce

Civil Code
- *Article 1803*. Consent will be explicit when the will of the parties is expressed verbally or by data messages. By Data Message will be understood the information generated, sent, received, saved or communicated by electronic or optical means, or through any other technology.
- *Article 1811*. Proposals and their acceptance made by means of a data message, will have full validity and obligatory force.
- *Article 1811*. The signatures on contracts written on data messages will be recognized when they can be attributed to the person acquiring the obligation and the related information can be accessible for future consultation.

Civil Procedures Federal Code
- *Article 210-A*. Data messages, understood the information generated, sent, received, saved or communicated by electronic or optical means, or through any other technology, will have legal effects, full validity and obligatory force. When the law requires that a document be presented and kept in its original form, the requirement will be satisfied if it can be proved that the message has been kept unaltered and can be accessible for future consultation.

Commerce Code
- *Article 47*. Companies are obliged to safely keep letters, telegrams, data messages and other documents they happen to receive in relation with their business dealings, including the copies they produce.
- *Article 642*. Mercantile contracts established by means of data messages, will become perfected right after they are replied accepting the matter and conditions stipulated therein. In the case of contracts in which the corresponding data message requires acknowledgement of receipt, the said contract will enter into force according to the provisions of Article 649 of this code.
- *Article 647*. Full legal effects, validity and obligatory force are recognized to every manifestation or agreement of will established by means of a data message.

Federal Consumer Protection Law
- *Article 1*. It is the objective of this law to effectively protect consumers in transactions made through electronic or optical means, and any other technology suited for the proper use of the data in question.
- *Article 24*. Promote the formulation, diffusion and use of ethic codes for suppliers that consider principles contained in this law with respect to transactions made by consumers through electronic or optical means, and any other technology suited for the proper use of the data in question.

The reforms considered existing international legislation on this matter, in particular the Model Law on Electronic Signatures and the Model Law on Electronic Commerce with Guide to Enactment, adopted in 1998 and 2001 respectively, by the United Nations Commission on International Trade Law (UNCITRAL). Other norms considered include those adopted by international bodies like the World Trade Organization, the Global Business Dialog on Electronic Commerce, and the World Information Technologies and Services Association (Bienvenu, 2000).

The purpose is to make sure that Mexico abides by the basic principles on which there is a wide international consensus: freedom, not regulation; technical and legal security; and technological neutrality. A consensus does exist in Mexico's e-commerce community as to a self-regulation approach based on standards and parameters adopted individually by companies and accepted by consensus, instead of a compulsory, outright regulatory framework (Álvarez, 2000).

Electronic Invoicing

The above package does not include norms on electronic invoicing, which is one of the most demanded issues by companies, industry chambers and other private sector organizations in Mexico. In 2001, the Ministry of Economics, in close collaboration with e-commerce promoting bodies like COMECE, AMECE, CANIETI and GILCE, started to work on the preparation of a Data Conservation Norm, which constitutes the first step toward the full recognition of e-invoices. The norm is intended as a long awaited response to the demands and interests of all groups and sectors committed to the development of e-commerce in Mexico. It is expected to enter into force in mid-2002 and will include regulations about electronic invoices and the legal validity of banking and credit card account statements as fiscal proofs (*Reforma*, June 18, 2001, www.amece.com.mx/emexico).

The project had been previously discussed in a forum on the Progress in the Legislation on Electronic Commerce organized by the Trade and Industrial Promotion Commission of the Chamber of Representatives of the Mexican Congress in August 2001 (COMECE, 2001a). In April 2002, this Chamber was already discussing a project to reform the Federal Fiscal Code to make legal the use of electronic means to submit tax returns, make notifications, present reports, conduct auctions, and produce fiscal invoices and receipts on electronic documents (Díaz, 2002). If and when approved, the reformed articles of the Fiscal Code will be part of the package that makes up the legal framework that regulates e-commerce activities in Mexico.

Cryptography and Electronic Signature

Electronic signatures are given partial recognition in the legislative package promulgated on May 29, 2000, as equivalent to autograph signatures. As described in Exhibit 1, the reformed Article 1811 of the Mexican Civil Code states that signatures affixed on contracts written on electronic messages "will be recognized when they can be attributed to the person acquiring the obligation and the related information can be accessible for future consultation".

However, the fact is that a legal framework that gives full security and recognition to digital signatures, including a system of certifying agencies that can provide public certification to the various types of signatures an individual can have for different purposes—paying taxes, buying on-line, establish contracts by electronic means, or doing e-banking—is still lacking in Mexico. Such a system will require a central certifying agency that plays the role of a sort of overall public notary entitled to give ultimate certification to digital signatures and will have two segments: one grouping all signatures in government-related transactions, and another comprising those used for private commercial deals (Empresa-E, 2002a).

A first step was taken in that direction with the May 29, 2000 legislative package, by giving an extensive role to both public notaries and public brokers for issuing digital certificates and allowing them to use electronic means to keep their books and protocols and register mercantile transactions at the Commerce Public Registry. These provisions are mainly contained in Article 210-A of the Civil Procedures Federal Code, and articles 90 and 93 of the Electronic Commerce chapter of the Commerce Code (Cornejo López, 2001).

As a result of the above, the Mexican Notaries National Association and the Mexican Public Brokers National Association established a Digital Certification Network for each guild. Each network is operated and managed by *Acertia*, a private firm based in Mexico City that is taking to market digital certification services derived from the implementation of the legal framework for e-commerce in force in Mexico. Thus, *Acertia* is the first certifying authority in Latin America, and as such manages the technological infrastructure used by public notaries and brokers. Backed by SeguriDATA, its cryptographic software supplier, *Acertia* has three service areas: Commercial (B2B), Financial (Electronic banking) and Government (B2G) (*www.acertia.com)*.

Under this system, electronic signatures are recognized by using an asymmetric, or Public Key Infrastructure, encryption method, which assigns a dual code to each participant in the transaction, one public and the other to be known only by each participant. A notary public certifies each transaction, which is thus given full security and legal value.

Toward an Integrated Legal Framework

Although the legal framework described in the preceding section already provides the basic conditions for conducting electronic transactions in Mexico, and as such is inducing more companies and individuals to engage in e-commerce, it lacks provisions regarding important issues like privacy, consumer and copyright protection, content regulation, taxation of goods sold over the Internet, and specific protection in the case of electronic frauds like misuse of credit cards and personal information.

Developments like the creation of a Data Conservation Norm and the provisions regarding digital certification by public notaries and public brokers referred to above, appear as part of a collective effort by both public agencies and private organizations engaged in promoting e-commerce—mainly the Ministry of Economics, AMECE, COMECE and GILCE—to create a sound legal framework that takes account of the many aspects still missing in the existing one and integrates all the required norms in a single package. This has also been a matter of discussion in Congress for at least the last year, particularly at the Chamber of Representatives (Cámara de Diputados). In early May 2002, the Democratic Revolution Party (PRD) presented the project for what is proposed to become a Federal Law on Electronic Signature and Commerce, Data and Service Messages for the Information Society, which aims at fulfilling the need for such a framework, and is said to provide the legal conditions for the development of e-commerce and other services offered via the Internet required by both suppliers and users of those services (*El Economista*, 2002).

Collectively, those developments give reason to believe that the first integrated and comprehensive legal framework required for e-commerce to fully take-off in Mexico may emerge in late 2002 or early 2003, by providing security and full recognition to electronic signatures.

The enthusiasm that underlies the above prospects should be pondered, though, with the consideration that e-signatures have not received the acceptance that promoters of e-commerce may have expected. In the United States, after nearly two years since the Electronic Signatures in Global and National Commerce Act took effect, business people are still reluctant and

skeptical about using e-signatures. An analyst concluded that "the promise of e-signatures has fizzled in the face of security concerns, competing e-signature standards, and the fact that, when it comes to big deals, people still like to handle paper". The reason, he continues, is that there may be greater risk with e-signatures than with the use of credit cards to buy on-line, for, contrary to the case with the latter, if someone were to steal a PIN or hack into a "signature page" on a Web site and sign up for a mortgage or purchase a car in another person's name with his/her electronic signature, the defrauded party would have little legal recourse (Wolverton, 2002).

In any event, the passing of legislation that gives full validity to e-signatures will be essential for e-commerce to fully take off in Mexico.

CONCLUSIONS

Inhibitors

Business-to-Consumer (B2C)

One of the most visible obstacles to the spread of B2C electronic transactions in Mexico is the prevailing digital gap, in the sense that only a small proportion of high-income, cultured potential consumers have access to the Internet. Most of these Internet users are less than 30 years old and thus have a low purchasing power; the most frequent users are in fact between 15 and 24 years of age, while only 20% are 44 years or older.

A related barrier is that over one-third of Mexican households are poor and do not have access to credit and other financial services. This is linked to the fact that over two-fifths of the employed population dwell in the informal economy, and that most of this floating mass of self-employed, underemployed and unemployed workers can be assumed to be members of poor households. In reflection of both circumstances, over two-thirds of the population are not likely to become on-line consumers.

The above is reinforced by the prevalence of a traditional shopping culture that makes Mexicans, in general, prefer to buy at the store in person, and so distrust purchases through catalog, let alone on-line. Moreover, Mexican consumers are distrustful of making payments over the Internet because, in their view, the use of credit cards is unsafe. This is not an unfounded perception; as discussed in this report, electronic fraud is common with credit cards when used personally in establishments, which leaves open the way for similar crimes in on-line transactions. This is one of the main deterrents for consumers to shop over the Internet and so further limits the growth of B2C e-commerce, for the credit card is the payment instrument par excellence over the Web.

One more factor limiting the spread of B2C transactions is the dispersion of a considerable part of the population in small communities of less than 2,500 people, which are not likely to have the minimum conditions for the introduction of IT and telecommunications infrastructure in the near future. As pointed out earlier, so far only 300 cities are connected, although physical

connectivity is being supplemented by mobile telephony networks, which have grown much faster than fixed phone lines.

In sum, all the above factors hinder the diffusion of B2C e-commerce transactions, thus further limiting the proportion accounted for by this modality in overall e-commerce flows. As discussed earlier, this proportion was estimated by Forrester to be only 7% in 2000. Its growth will depend on the extent to which income distribution is improved, in the sense of abating poverty, and Internet access is extended to reach a larger proportion of households, which, in turn, depends on how successful the efforts are by both telecommunications companies and the federal government in this regard, especially the e-Mexico project.

Business-to-Business

One of the most limiting factors of B2B e-commerce is the fact that 96% of Mexico's company population consists of SMMEs, most of which generally lack the resources and entrepreneurial culture to know about, and acquire, IT equipment and do business on-line. An additional drag in this regard is the considerable investment and the relatively long time required to install IT infrastructure and equipment and upload the company's business to the Internet.

The problem is complicated by the fact that the Mexican economy is not entirely made up of formal production activities. As official statistics report, informal activities account for 13% of GDP. A mass of precarious informal establishments operate in the underground, outside the circuits of the formal economy, and are thus unlikely to go public and set up a Web site to do business on-line. In order for informal businesses to become suppliers to "formal economy" customers, they also need some kind certification, increasingly an ISO, which is not within their reach.

Finally, as in the case of B2C, the still limited extent of telecommunications infrastructure is one more circumstance that inhibits the growth of B2B e-commerce. Although substantial progress has been made in this regard, Internet connectivity has not reached a large proportion of localities, many of which are very small towns and villages located far from the main networks.

All the above circumstances and factors, act jointly as barriers for e-commerce to grow more rapidly in Mexico. Their actual effect will depend on the extent to which they are counteracted by the enabling forces that are also in operation in this country, as will be discussed presently.

Enablers

Overall Forces

A variety of enabling forces act in opposition to inhibiting factors counteracting the effects of the latter. They include, first of all, the fair performance of the Mexican economy in the last few years, which has been able to maintain a low and declining inflation, and a relatively stable exchange rate with the U.S. dollar. As a result, a favorable environment for investment in new ventures, including Internet and e-commerce companies, and for doing business in general, has ensued, which has been reflected in the rapid growth of commercial Internet users discussed in

the section on Internet use. The liberalization of the telecommunications industry during the last two federal administrations has worked in the same direction, allowing the entry of new players, and so the introduction of competition in phone, television, and Internet provision markets.

Although still limited in extent and coverage, Mexico's telecommunications infrastructure already provides, nonetheless, Internet connectivity to the main cities where the bulk of e-commerce activity takes place. Since, both government agencies and private phone companies have been investing to extend telecommunications networks, and these are being increasingly supplemented by the wireless infrastructure that has been built for mobile telephony, Mexico's telecommunications infrastructure, coupled with a liberalized telecommunications industry jointly constitute a major driver and a solid enabling force for the spread of e-commerce. Although the e-Mexico system is still a project in search of both financial and operational feasibility, it is underway with the backing of the Fox administration's full political commitment, and so it gives ground to expect that the telecommunications infrastructure, in general, and Internet connectivity, in particular, will be extended and reinforced in the subsequent months and years. Thus, for the time being, the e-Mexico promise is acting as an additional enabling force for e-commerce.

Another important, perhaps crucial, enabler of both B2C and B2B e-commerce transactions is the existence of legal norms that grant legal value to electronic documents and signatures, and allow for notary public action on electronic grounds and through electronic means. The first steps toward legislation providing protection for consumers in the use of credit cards have been also taken in some states, which are expected to be extended to the rest in the following months. In addition, the Data Conservation Norm to be introduced soon, will give full validity to electronic invoices. Jointly, these instruments make up a legal framework that provides basic security and certainty to companies and individual consumers alike for conducting business on-line, thus improving the conditions for the spread of electronic transactions in Mexico.

Business-to-Consumer

The low penetration of B2C e-commerce—0.16% in 2000—is conversely indicative of the size of the growth potential that lies dormant in the Mexican economy for this activity. The very existence of this potential and the growing awareness by both new- and old-economy companies of the benefits it can provide constitutes a major driving force for the diffusion of B2C transactions.

In spite of the substantial proportion of people in poverty, the fact is that at least half of the Mexican population make up a potential consumer market, which in itself can be identified as another key driver of B2C e-commerce. This is reinforced by the observed growth of households getting connected to the Internet and the consistent increase of individual Web users, as can be inferred from the observed increase in the number Mexican homes with at least one PC. These trends are further propelled by the growing exposure of young generations to computers and the Internet in both at home and in the classroom. Most elementary and secondary schools include basic instruction courses and computer labs in their academic programs.

The growing number of portals and Web sites set up by the federal, state and municipal governments offering the possibility of using public services and conducting all kinds of dealings with government agencies and offices through the Internet, is also contributing to B2C e-commerce diffusion. The growth of e-banking discussed in previous sections is working in the same direction, as a wide and increasing array of services has been made available to customers by most banks operating in Mexico through comprehensive Web sites. The comfort and convenience offered by these options give grounds to expect that the number of customers preferring banking on-line will continue to increase significantly in the coming months and years, reinforced by the prospects of improved security for on-line transactions.

More generally, the spread of e-government and e-banking together, is inducing more and more Mexicans to use the Internet for shopping, and so to become e-consumers in a broader sense.

Business-to-Business

Although some of the factors driving the diffusion of B2C may also influence that of B2B, in the case of the latter the forces at work are specific to this modality, which, as elsewhere, is nowadays the most common and widespread kind of electronic commerce in Mexico.

The fact that B2B has penetrated 38 times further than B2C in the Mexican economy, and that B2B accounts for at least eight out of 10 e-commerce transactions, indicate that B2B has greater growth potential vis-à-vis B2C, at least in the short run.

The low penetration in SMMEs and large companies alike, and the growing perception by both that they can gain and profit by optimizing organization structures and management methods speak of such potential. This perception has been largely the result of the work of specialized organizations like AMECE, COMECE, AMITI, and CANIETI as well as high-tech and IT companies like Microsoft, Gedas, SAP, IDC, Oracle, IBM, and others, through working groups and permanent promotion campaigns.

These actions have been a critical enabling element, for those organizations are the ones that come up with new ideas and initiatives to promote e-commerce, and push them through government circles for their approval and implementation. Very close to this is the key role played by government offices, especially the Ministry of Economics, for several programs it operates geared at helping SMMEs to modernize and adopt IT and venture into e-commerce. A most important initiative in that regard is the one related to the development of the *e-Mexico* National System, which is cutting across all areas of the Mexican economy and society, and is potentially one of the most important enablers of IT-related activity, B2B e-commerce included.

In addition to government agencies, like the Ministry of Economics and Nafin, makers, developers and marketers of IT equipment and computer software have made SMMEs the target of their marketing campaigns with an eye to tap this substantial and dynamic part of the Mexican economy. The traditional limitations of SMMEs to acquire digital technologies and venture into the Internet are being eliminated with the introduction of services of a growing number of ASPs offering low cost access to software and Internet-based business solutions to SMMEs. This is also being reinforced by the increasing demands SMMEs face for modernizing their structures and upgrading their equipment and business capabilities as a condition to

become suppliers of larger, more developed firms, especially subsidiaries of multinational corporations (MNCs).

MNCs are the carriers par excellence of high technologies in general and of IT in particular, and so are the leading practitioners of e-commerce. As dynamic nodes of continental and global production and business networks, MNCs and their domestic affiliates extensively and increasingly use the Internet to manage their operations via B2B practices like e-procurement, e-logistics, and overall supply chain management. In this sense, MNCs, together with large domestic firms like Peñoles and Grupo Vitro, can be said to be the main drivers of B2B in Mexico. As pointed out above, they are pulling SMMEs into their business networks as domestic suppliers, pushing them to upgrade their plant and equipment and their management practices.

The fact that the most dynamic industries—electronics, computing, automobile, telecom, and banking—are composed of and/or dominated by subsidiaries of MNCs, constitutes one more driving factor, as it opens more possibilities for B2B e-commerce to grow in Mexico. Moreover, the large presence of MNCs, plus the close geographical vicinity to the United States, and the partnership of Mexico with its northern neighbor under NAFTA, provide the conditions for the development of strong exchange and collaboration links with Silicon Valley and, by extension, with other high technology hotbeds, which further open the possibilities for technological upgrading and innovation development akin to e-commerce in Mexico's top high tech centers, like Guadalajara, Mexico City and northern border cities such as Tijuana and Ciudad Juarez.

Overall Balance

The complex interplay of the two sets of opposing forces referred to in the foregoing discussion will define the pace and extent of e-commerce growth in Mexico in the coming years. Although it is difficult to predict such an outcome, it might be ventured nonetheless that enabling factors are more likely to prevail over those inhibiting the process, so that e-commerce is likely prosper in a dynamic fashion over the first half of the present decade. The active and decided commitment of both the public and private sectors to this endeavor, and the more objective existence of rather favorable economic conditions do not seem to lead one to think otherwise.

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