Globalization and E-Commerce: Diffusion and Impacts in Mexico

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SUMMARY

- E-commerce began in Mexico in the early 1990s and has already extended into the main sectors of the economy, generating from its inception high optimism in both business and government circles.
- A number of factors, though, have dragged the process, which include a high degree of "informality" of the Mexican economy, a skewed income distribution, a traditional shopping culture, an also skewed business size structure, and a low level in the companies' technological development and organization structures.
- Nonetheless, e-commerce has taken its hold in Mexico. A critical set of enabling factors have prevailed over inhibiting forces, which include the large presence of multinational corporations, the liberalization of the telecommunications industry, the improvement of the country's telecommunications infrastructure, the creation of a basic legal framework, and the emergence of both e-banking and e-government.
- All indicates that such overall balance will continue to hold in the foreseeable future, so that the development of e-commerce in Mexico stands as a lasting phenomenon that may eventually lead to the rise of an economy significantly based on the Internet and other digital technologies, not just to the formation of an isolated "e-sector".
- The GEC survey discussed in this paper revealed that as much as 74 per cent of the business establishments included in the study use the Internet by for commercial purposes. This figure is far larger than the ones estimated on the basis of e-commerce revenues for the country as a whole, and thus changes the usual perception that e-commerce in Mexico has grown only to a limited extent.
- Accordingly, business establishments operating in Mexico outperform those in other countries included in the GEC survey regarding key aspects such as the use of e-mail, the construction and management of websites, the deployment and operation of EDI networks, and the improvement in their competitiveness, efficiency, and productivity.
- In a fundamental finding of this study, finance was found to be the most advanced sector in e-commerce adoption and development in Mexico. Financial firms and banking institutions proved to be the most globalized companies, the ones that use most extensively the Internet and Internet-based technologies for commercial purposes, the most advanced in systems integration, and the ones that spend the highest proportions of their operating budget in information systems.
- Conversely, and contrary to expectations, manufacturing establishments turned out to be the least advanced sector regarding e-commerce adoption and development, with distribution companies lying in the middle.
- The influence of size does not follow a regular pattern across all the sectors and aspects of e-commerce diffusion and impacts examined in this paper. Nonetheless, the size of business establishments does matter in most of those aspects.
- Five general propositions were tested with the results of the GEC survey, which condense the substance of the way e-commerce has developed in Mexico given the particular environmental factors playing out in this country: 1) global, more than domestic factors drive the spread of e-commerce in Mexico; 2) micro and small enterprises are the least likely to engage in e-commerce vis a vis larger establishments; 3) B-to-C e-commerce has grown more at the sectoral level than at that the national level; 4) government policies are essential for e-commerce growth; and, 5) the existence of an adequate legal framework is a crucial condition for e-commerce to develop. Propositions 1, 3, and 5 were confirmed, while 2 and 4 were only partially supported by the evidence provided by the GEC survey.

INTRODUCTION

As the Internet has empowered both consumers and producers around the world over the last decade with information, data and tips about a vast array of product and services, competition has intensified in both domestic and international markets. As a result, companies of all sizes and in all industry sectors have found the need to renovate and improve their business practices in order to find new, more efficient ways to create value as a vital condition for survival in this highly competitive environment. A growing number have opted for using the World Wide Web as a marketing weapon to expand their market reach, or even as an integration tool for managing their entire supply chains.

Electronic commerce (e-commerce) was thus born, spreading swiftly into different corners of most economies around the world. The pace and features of this process have varied depending on the economic, legal, and technological setting of each country, which presents particular conditions for embracing this new way of doing business and the technologies on which it rests.

In Mexico, e-commerce began in the early 1990s and has since extended into various sectors of the national economy. Its inception and initial development have generated optimism in both business and government circles, due to the seemingly boundless possibilities opened by this new tool for conducting commercial transactions. Its development, though, has proceeded rather slowly. A combination of factors has dragged the process, which include the skewed income distribution, traditional shopping culture of its population, the also skewed size structure and low level of technological and organizational development of its business establishments, and the relatively high degree of "informality" of its economy.

The fact, nevertheless, is that in spite of those adverse circumstances, e-commerce has taken its hold in Mexico over the last decade. As in most countries, transactions between businesses (B-to-B) have overwhelmingly predominated over those between businesses and consumers (B-to-C) (Palacios and Kraemer, 2003). This is in part due to the large presence of multinational corporations (MNCs) in the Mexican economy, which has facilitated the introduction of new technologies and management practices based on the Internet. Therefore, it was only natural that MNCs soon became some of the most active users of the Internet for conducting business in Mexico, and even the key drivers of the growth of B-to-B e-commerce in this country.

Other environmental factors have also contributed significantly, although in a more indirect way, to the spread of e-commerce in this country. These mainly include the liberalization of the telecommunications industry, the improvement of the country's telecommunications infrastructure, the creation of a basic legal framework, and the emergence of both electronic banking and electronic government in recent years (Palacios and Kraemer, 2003).

Overall, enabling factors have prevailed over inhibiting factors, and it can be expected that they will continue to do so. Therefore, and as it was argued in Palacios (2003a), the development of e-commerce in Mexico is not a mere passing boom but a more lasting phenomenon that may eventually lead to the rise of an economy significantly based on the Internet and other digital technologies, not just to the formation of an isolated "e-sector". This may even occur along the

lines of the New Economy model heralded by the United States in the late 1990s (Palacios, 2003a).

In order to substantiate such a claim, it is necessary to examine in detail the extent and nature of the penetration of e-commerce into the different sectors and industries of the Mexican economy, and to assess the related impacts on their organizational structure and business practices in terms of efficiency, cost reduction, and market expansion. As pointed out before, market pressures coming from both domestic and international competition are leading companies of all sizes and sectors to probe into new business models and strategies using the Internet for performing key company operations. The increase in Internet connectivity and the spread of promotion campaigns by industry associations that praise the marvels offered by e-commerce are positive complements of such pressures.

To date, no formal studies appear to exist that provide a detailed and comprehensive view of e-commerce diffusion at both the national and sectoral levels in Mexico. The first steps in that direction have been taken in works by Palacios (2001b; 2002; 2003a), and Palacios and Kraemer (2003). These are previous reports on the Mexican economy within the Globalization and E-Commerce Project (GEC Project) coordinated by the Center for Research on Information Technologies and Organizations (CRITO) at the University of California at Irvine, of which the present paper is also a partial product. Other works like that by Curry, et al. (2001), have also pointed in the same direction.

The present paper intends to contribute to fulfill such a need. It aims to shed light on the nature and extent of diffusion of e-commerce at the country and industry sector levels in Mexico. It largely draws on the results of a comprehensive survey to be described in the next section.

Based on the foregoing review of the particular characteristics of Mexico's economic and political environment, five general propositions are put forth as the axes around which the analysis and discussions presented in this paper are organized:

> *Proposition 1: Global, more than domestic factors drive the spread of e-commerce in Mexico*
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> *Proposition 2: Micro and small enterprises are the least likely to engage in e-commerce vis a vis larger establishments*
>
> *Proposition 3: B-to-C e-commerce has grown more at the sectoral level than at that the national level*
>
> *Proposition 4: Government policies are essential for e-commerce growth*
>
> *Proposition 5: The existence of an adequate legal framework is a crucial condition for e-commerce to develop*

The paper is structured as follows: The first section describes the methodological approach followed in the paper, as well as further details of the survey on which it is largely based. The

propositions posed above are then elaborated and explained in a second section, where some general remarks are made and some key expectations explained (the section also includes a brief description of the sectors on which the survey is focused). A third section presents an assessment of Mexico's readiness for e-commerce at both the country and the sectoral levels, considering topics like IT infrastructure and the main enabling and inhibiting factors on its diffusion. A fourth section addresses this latter aspect at the same two analytical levels, including the diffusion of the e-commerce industry proper. A final section assesses the impacts of e-commerce diffusion in general. The paper concludes with some general remarks on its major findings and insights.

An appendix complements such findings, which contains an in-depth examination of the electronics industry, as one of the sectors where Internet-based technologies are used most extensively in Mexico.

BACKGROUND AND A PRIORI EXPECTATIONS

Extent and Nature of Diffusion

Electronic commerce began in Mexico around 1993, and has extended steadily since then over the Mexican economy. Its overall penetration, though, has been rather limited so far, estimated at only 0.17 percent in 2000 (Palacios and Kraemer, 2003).

Nonetheless, such a low penetration is by no means specific to Mexico, but rather a common phenomenon elsewhere. In the United States, e-commerce amounted to just 1.3 percent of all retail sales in the last quarter of 2002 (Woods, 2003). Therefore, it can be expected that the penetration of e-commerce into the different sectors and industries of the Mexican economy will continue in the upcoming years. This will be the case also in a geographic sense, as Internet connectivity is now restricted to large and medium-sized cities.

Concerning sectoral diffusion, the sectors known to have adopted e-commerce more extensively are finance, distribution, services, and manufacturing (Palacios, 2003a). The highest proportion of companies that had a website in mid 2000 was in the finance and public service sectors (Esquenazi, 2000). However, what is required is an in-depth examination of the nature and actual extent of e-commerce adoption in those sectors, especially finance, distribution, and manufacturing, the most relevant for the purposes of this study will be explained later. The basic characteristics and trends presented by these sectors follow.

Key Characteristics of Relevant Sectors

According to the 1999 Economic Census, the private sector company population in Mexico is composed of 2.8 business establishments, of which 95.7 percent correspond to micro units,[1] 3.1 percent to small businesses,[2] 0.9 medium-sized enterprises,[3] and only 0.3 percent to large firms[4] (INEGI, 2000; *Diario Oficial de la Federación*, March 30, 1999).

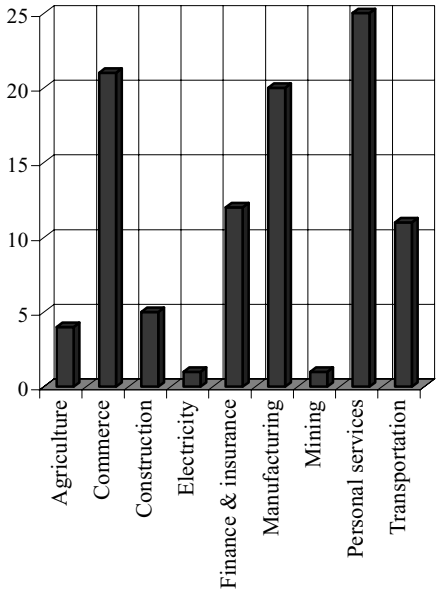
[1] Up to 30 employees in industry, up to 5 in commerce, and 20 in services
[2] From 31 to 100 employees in industry, 6 to 20 in commerce, and 21to 50 in services

Commerce (distribution) accounted for the largest proportion of those establishments—1.44 million— posting a workforce of 4.2 million employees. Manufacturing in turn topped 344,000 units, showing the largest employed workforce: 4.23 million. Finally, a total of 3,610 firms and institutions were reported in the financial services sector, which employed only 230,000 people (INEGI, 2000).

In a broader perspective, distribution and manufacturing jointly account for over two fifths of gross domestic product (GDP), followed by finance and insurance which takes account of over one tenth (Figure 1). Jointly, these sectors not only generate the bulk of GDP but also have the highest economic significance regarding the adoption of information technologies, and e-commerce solutions.

Manufacturing has traditionally been one of the most dynamic sectors in the Mexican economy. Over two thirds of the establishments in this sector are in the food, tobacco and beverage industries, followed by those producing metallic products, machinery and equipment, textiles, apparel, and leather articles (INEGI, 2000). Jointly, these three sectoral divisions account for 68 percent of GDP (INEGI, 2000).[5] At a more specific level, automobiles and electronic products are the most dynamic industries; they account for 28 per cent and 20 per cent of manufacturing exports (INEGI, 2002a).

FIGURE 1
Sectoral Structure of the Mexican Economy
(Percent of GDP)



Source: INEGI, 2002b

[3] From 101 to 500 employees in industry, 21 to 100 in commerce, and 51 to 100 in services
[4] Five hundred and one or more employees in industry, 101 or more in commerce, and 101 or more in services
[5] The rest corresponds to wooden manufactures; non-metallic minerals; paper, printing, and publishing; chemicals, plastic, and rubber; basic metallic products; and other industries.

Manufacturing is the sector most likely to use information and communication technologies (ICTs), and to engage in e-commerce transactions, specifically the B-to-B type, which, are by far the most common. Therefore, it can be expected that it is in the manufacturing firms where e-commerce accounts for a larger proportion of commercial transactions.

Distribution (retail and wholesale), presents a highly skewed structure. As much as 92 percent of its establishments are in the retail business (sell to homes and individual consumers, but exclude businesses with no premises), which can be assumed to mean that they are mainly small shops. On the other hand, only 8 percent perform wholesale commercial activities (deal with companies and other wholesalers, and exclude brokers), and chiefly correspond to large companies (INEGI, 2002).

The permanent entry of new competitors facilitated by the Internet can be expected to force channel distributors to become more efficient and competitive, and to look for business solutions that can make goals more feasible. In recent years, a visible trend has been the spawn of furniture and office supplies stores, and particularly of convenience stores open 24 hours. Likewise, a new kind of drugstores called super-pharmacies (*super-farmacias*) has been rising, which combines some of the basic features of both convenience stores and supermarkets. All these establishments vie for tapping night drug and grocery markets. Another trend is the emergence of large wholesale distributors of electronic products, which also assemble PCs with their own brand. A major example of the latter is Mexmal and its Alaska computers, which are among the top selling PCs as will be discussed later.

Even in the 1990s when the Internet was seen as a threatening competitor, wholesale distributors have now been basing their strategies on the design and operation of web pages focused on other distributors or final users. Some channel distributors have in fact been implementing strategies to sell directly to the final user, similar to those of Dell Computer and other computer makers like Gateway (retailers are also going online to get their customers into their e-commerce transactions).

However, the fact is that so far both retailers and wholesale distributors have generally used the Internet more for advertising rather than as a sales tool, as they see the Internet as a cold way of doing business and prefer to deal directly with their customers or suppliers (Esquenazi, 2000). This trend is changing as a growing number of both retailers and particularly wholesale distributors are discovering the benefits and potential of doing business online.

Financial services in turn constitute, the sector that performs one of the most critical functions for the Mexican economy to work: financial intermediation. It is composed of more than 3,600 institutions and companies that employ over 230,000 people (INEGI, 2002). Banks are by far the largest and most important players in this sector. They account for 84 percent of financial establishments, followed by stock exchange and insurance firms with 9 and 7 percent, respectively. Traditionally dominated by domestic firms, since the mid 1990s, this sector has been penetrated by foreign concerns from Spain, the United States, Canada, and, Japan. It can be expected that this trend will continue in the coming years.

A visible trend in this sector is the growth of people's savings unions (*cajas de ahorro popular*) and foreign exchange companies, the former given the increase in the cost and virtual suspension of loans by most banks since the second half of the 1990s. Another is the closing down of credit unions, financial leasing companies, and financial factoring firms because of the entry of foreign financial institutions via merger-*cum*-takeovers of domestic firms.

In general, finance is the sector where e-commerce is most likely to develop in Mexico. Since financial services are data intensive and do not require actual deliveries, the Internet is making possible "new entrants to build substantial businesses, go up the value chain, and compete on price" (Sato et al., 2001: 64). This occurs particularly in the case of banking. All major banks operating in Mexico have built comprehensive websites with all the necessary resources to offer their customers this option. Multinational banking firms have been a major driving force of this process, as they have introduced new Internet-based management practices that are leading to the development of true electronic banking. For example, after its take over by Citigroup, Banamex set its top priority to gradually replace its existing branches with virtual service centers, and created an e-banking arm called Artikos to coordinate the effort (Flores, 2002). All this is leading to the development of a new banking culture in Mexico based on the use of digital technologies.

Factors Influencing Diffusion

Diffusion of e-commerce transactions and practices in Mexico has been propelled by a diversity of factors. One of the most influential has been the rapid growth in the number of personal computers in homes, businesses and public offices. Another has been the fast advances in Internet penetration in both homes and companies in major sectors of economic activity, such as manufacturing, retail, wholesale, banking, and finance.

A key precondition for the above to occur was the liberalization of telecommunications markets carried through by the Salinas (1988-1994) and Zedillo (1994-2000) administrations, which opened the way for an explosive growth of both public and private domains from the mid 1990s on.

One further key factor has been the consistent work of a number of private organizations specifically devoted to the promotion of e-commerce practices, which have been formed within industrial chambers and other industry associations. The most important include the Mexican Association for Electronic Commerce Standards (AMECE), the Mexican Committee on Electronic Commerce (COMECE), the Electronics, Telecommunications and Informatics Industry National Chamber (CANIETI), the Mexican Association for the Information Technologies Industry (AMITI), and the Promotional Group on E-Commerce Legislation (GILCE).

Other factors influence e-commerce diffusion in another way. Based on a recent survey, Select reported that the main factors hampering the diffusion of B-to-C e-commerce in Mexico include: lack of a credit card by most Mexicans; the fact that consumers like to see products before buying; reservations as to delivery services; and, distrust in providing their credit card number over the Internet. This is reflected by the fact that only 2.6 percent of home Internet users make

purchases online, this figure being 7.3 percent in the case of those using the Internet at work (Select, 2002). Most of those web surfers use the Internet mainly to search for information, entertainment, and communication via e-mail.

Such barriers to B-to-C e-commerce diffusion are similar in other countries. In the United States (Woods, 2003), the most common ones include:

- Consumers are using retailers' web sites just to search for products
- Shoppers prefer going in person to malls or stores to interact with other people
- Consumers tend to prefer to see and touch products in person before completing a purchase
- A large proportion of consumers do not have a broadband connection

Regarding B-to-B transactions, the main drivers are the operations of the large subsidiaries of multinational corporations located in Mexico, which, dominate the country's most dynamic industries, notably electronics, computers, and automobiles. The fact that these subsidiaries constitute major nodes of continental and global production networks, given Mexico's strategic geographic location, facilitates the introduction of new technologies based on the Internet into companies operating in its territory and thus the development of e-commerce between and among businesses (B-to-B), which accounts for the great bulk of electronic commercial transactions in this country.

Foreign subsidiaries are pulling domestic small and medium enterprises into their supply networks, requiring some type of certification given that their own ISO certification requires subsidiaries to do so. The growth of production networks is thus propelling the expansion of B-to-B transactions, as key operations and business dealings among companies are carried out inside the networks using Internet-based solutions.

In general, according to a PriceWaterHouseCoopers associate, there are four great triggers of B-to-B worldwide. One is the emergence of so-called "macrointegrators", consisting of virtual communities of banks, airlines and large companies that come together to conduct e-commerce, pulling their suppliers into their online networks. Another is the formation of e-markets, that is, virtual marketplaces where the players of a given industry are connected with suppliers and distributors to do business online. A third is the emergence of Application Service Providers (ASPs), which provide companies with access to digital technologies at an affordable cost. Lastly, according to Gedas' International Director, is the explosion of Personal Digital Assistants (PDAs), which are expected to surpass PCs in number in the wake of a few years (Pérez Moreno, 2000).

Since these trends are already visible in Mexico, a fair assumption can be made that they will continue in the upcoming years, and that more and more companies, domestic and foreign alike, will use e-commerce as an ordinary business tool as they are hooked into virtual marketplaces and e-buyers' coalitions.

Impacts on Efficiency, Industry Structure, and Competition

As a result of enabling factors, e-commerce has been adopted by a growing number of companies as a business tool that has induced visible changes in the mindset of Mexican executives and managers. This has occurred due to the possibilities the Internet has opened for expanding markets and business potential, and for making companies more flexible, specialized, and efficient. As a result, some managers have extended their market reach while others have undertaken a thorough transformation of their production methods and organizational structures, thereby developing new and more efficient forms of intermediation. It is significant that this has occurred first in the case of some of Mexico's largest conglomerates.

Grupo Industrial Vitro, Mexico's top glass maker and one of the largest domestic industrial conglomerates, built an Internet-based marketing arm to respond to the exigencies of global markets and is in the process of transforming its internal structure and organization to become a full-fledge e-corporation. In early 2000, Vitro signed an agreement with IBM aimed at developing an e-business strategy for each of Vitro's business units. The objective was also to reshape the conglomerate's culture and operating processes through a wider use of e-commerce applications. The agreement also includes the implementation of an e-procurement strategy (FINSAT, 2000; Vitro, 2001).

Cemex, Mexico's top cement maker and one of its largest domestic, multinational, industrial conglomerates, launched an e-businesses strategy in September of the same year. To this end, Cemex created CxNetworks, a new subsidiary responsible for developing an overall e-enabling strategy for the entire firm to extend its reach into marketplaces valuable for its core business (Cemex, 2000). In a similar move, Peñoles, Mexico's leading mining conglomerate, decided to manage all of its procurement operations through an Internet-based solution to reach into global marketplaces (*El Asesor de México*, August 15, 2001, *www.amece.com.mx/emexico*).

Other companies are undertaking similar initiatives. This is the case, for example, of Roshfrans, a major domestic firm producing petroleum-based lubricants for motor vehicles. In mid 2002, the company embarked on a comprehensive transformation of their organizational structures and business procedures similar to the model embedded in Oracle´s E-Business Suite (Hernández, 2003).

It is likely, therefore, that such a trend will continue and even intensify in the coming years. A survey of 71 companies that had migrated to the new economy found that one third had reformulated their entire business strategy and product mix, and 13 percent had already used the Internet as a marketing tool (Select-IDC, 2001a), which reinforces such an assumption.

In addition, the improvements in the companies' efficiency and productivity achieved by the adoption of e-commerce solutions are surely having a demonstrative effect, which will further reinforce that trend. This is even more so as the Mexican government continues to extend and improve telecommunications infrastructure, and to expand its programs to support small and medium-sized businesses to enable them to adopt digital technologies, and e-commerce.

Based on the foregoing discussion, a set of five propositions are put forth in the following paragraphs, to be tested in the ensuing sections on the basis of the results of the GEC survey referred to in the previous section. The propositions are the following:

Proposition 1: Global, more than domestic factors drive the spread of e-commerce in Mexico

Multinational corporations (MNCs) have historically had an extensive presence in the Mexican economy, mainly from the United States. By the end of the 1960s, the subsidiaries of U. S.-based MNCs already controlled most of Mexico's key industries (Cockcroft, 1983). More recently, over two thirds of Mexican exports were made in 2001 by those subsidiaries, according to the U.S. Department of Commerce, while companies with a majority of Mexican stock account for only 15 per cent (Palacios and Kraemer, 2003). Only a handful of foreign car assemblers like General Motors, Ford, Daimler-Chrysler, and Volkswagen account for as much as 18 percent of total exports (Orozco, 2002).

Mexico's close vicinity to the USA and its incorporation into the North American Free Trade Agreement (NAFTA) in 1994 have facilitated and reinforced the above trends. Both circumstances have led to a substantial increase not only in the volume of trade with the USA, and to a lesser extent with Canada, but also in the inflow of direct investment coming from its northern neighbor. Foreign direct investment (FDI) averaged 2.4 percent of Mexico's Gross Domestic Product (GDP) and 12.3 percent of gross capital formation between 1994 and 2001, the former getting as high as 8% in 1998 (Palacios and Kraemer, 2003).

By definition, MNCs are widely connected to global and production networks, as their value chains are spread across several countries, where key operations are performed in production sites that not only are the nodes of each company's own network, but are also linked to other companies' networks. Since MNCs have always been the carriers *par excellence* of new technologies through their domestic subsidiaries, it is only natural to assume that they were among the first to use the Internet and related information technologies in Mexico.

Therefore, since B-to-B constitutes the large bulk of e-commerce activity in Mexico and MNCs are among its main drivers, there is ground to say that it has been global more than domestic forces which have propelled e-commerce growth in Mexico.

Proposition 2: Micro and small enterprises are the least likely to adopt e-commerce

More than nine out of ten business establishments are micro and small shops (Palacios and Kraemer, 2003). Although this is a feature common to most economies, in Mexico, it generally means that the vast majority correspond to small and very small shops that lack both the resources and the business culture to invest in and adopt new technologies, and by extension to go online. In addition, a considerable proportion of these shops dwell in the underground circuits of the informal economy (Palacios and Kraemer, 2003), which aggravates the condition.

From that perspective, small enterprises appear to be less likely to adopt e-commerce solutions and practices, compared to medium-sized and large businesses. On the other hand, they have proved to be more flexible in adopting new business strategies in response to market challenges and accordingly have transformed their structures and organizational schemes.

The fact, therefore, is that SMEs represent a doubled-edged sword for the development of e-commerce in Mexico, as observed in Palacios and Kraemer (2003). In the short run, they possess as a major barrier given their lack of resources and business culture to use the Internet to conduct commercial transactions. In the long run, their massive presence constitutes a large pool of opportunities for e-commerce to thrive due to their flexibility to adopt new business models and transform their structures, and the growing access to business solutions offered by ASPs at low costs. Moreover, the tendency for large firms to pull small ones into their supply chains further reinforces the possibilities for SMEs to adopt Internet-based business solutions.

In any event, since the above potential is yet to be tapped, the argument presented here is that the likelihood for small businesses to engage in e-commerce practices is much lower, compared to larger enterprises.

Proposition 3: B-to-C e-commerce has grown more at the sectoral level than at the national level

Over one-third of Mexican households are poor and do not have access to credit and other financial and banking services. This is compounded by the fact that a considerable proportion of the population lives dispersed in small localities of less than 2,500 people, which lack the minimum conditions for introducing telecommunications infrastructure, and thereby Internet connectivity (Palacios and Kraemer, 2003).

Until recently, Mexican consumers, as most consumers in the world, have shopped in traditional ways that involve in-store, face-to-face contact, giving them the ability to physically inspect items before buying them. Therefore, most Mexican consumers are still reluctant to shop through a catalog either in print or online. The lack of confidence in providing their credit card data over the web, given the high risks of fraud and misuse that exist in Mexico, further complicates the latter option.

These factors significantly hinder the use of the Internet for shopping by individual consumers, and thereby explain the sluggish growth of B-to-C e-commerce and, by extension, the small proportion this latter represents vis a vis B-to-B. Nevertheless, factors like the spurt of websites, the increase in the installed PC base, the spread of Internet use, and the growth of e-banking, and even e-government, are all inducing reluctant Mexican consumers to buy online, and they are thus becoming e-consumers in a broad sense.

Proposition 4: Government policies are essential for e-commerce growth

Although in a more indirect way, the actions of government bodies, both at the local and federal levels, can prove decisive to create the conditions for the introduction of digital technologies that require an adequate telecommunications infrastructure such as the Internet, which are in turn the basis of new business solutions such as e-commerce.

Although some private phone companies are investing heavily to extend telecommunications networks, including wireless infrastructure for mobile telephony, the federal government has taken the lead, beginning with the liberalization of the telecommunications industry by the last three federal administrations. In the last two years, the present administration has gone further by launching a very large, ambitious project called the E-Mexico System, whose primary and immediate purpose is to provide Internet connectivity in the country's 2,400-plus municipalities (Palacios and Kraemer, 2003).

In addition, a number of federal entities and ministries have been actively involved in projects and initiatives aimed at promoting e-commerce undertaken by industry associations and chambers (Palacios, 2003a).

Proposition 5: The existence of an adequate legal framework is a crucial condition for e-commerce to develop

A legal framework that grants full value to electronic transactions and documents and provides legal protection against electronic fraud and other digital crimes is an indispensable condition for e-commerce to become a trustful activity. Over the last five years, industry chambers and associations, together with government branches and legislative bodies have taken consistent steps to build a framework with those characteristics in Mexico. As a result, one is in place that bears the basic elements required for conducting commercial transactions via electronic means (Palacios and Kraemer, 2003). It consists of a package of reforms and additions to exiting legislation on commercial matters, which even allows for notary publics to act on electronic documents and through electronic means. Likewise, a Data Conservation Norm is about to be introduced, which will give full validity to electronic invoices. In addition, a number of states have taken the first steps toward the passing of legislation to protect consumers against online credit card fraud; it is likely that other states will take similar steps in the near future.

Although this legal framework provides basic security and certainty to companies and individual consumers, it still does not constitute a single, comprehensive law on e-commerce, whose absence still represents a major barrier to the spread of electronic transactions in Mexico.

DATA AND METHODS

The results reported in this paper were reached following a methodology that combines two major levels of analysis. The diffusion and impacts of e-commerce are assessed first for the country as a whole, and then at the level of individual industry sectors focusing on three: manufacturing, distribution, and finance.

The first part is carried out by examining published reports and official statistics, mainly national censuses and reports published by the Statistics, Geography and Informatics National Institute (INEGI). Another major source is the database on e-commerce and related data compiled and updated by the Center for Research on Information Technologies and Organizations (CRITO) at the University of California at Irvine. In addition, information gathered by the author through personal interviews was also used, as well as sources such as Mexican newspapers, phonebook yellow pages, industry chamber directories, and company reports and statistics published by consulting firms like IDC, eMarketer, Kearny, McKinsey, IDG, and especially Select.

The second part was accomplished using a national survey conducted at the firm level in 201 companies operating in Mexico in the manufacturing, wholesale and retail distribution, and banking and insurance sectors, classified by size as defined by the number of employees. Interviews were conducted only with companies that used of the Internet for doing business.

The survey was conducted between February and April, 2002 and is part of a broader survey encompassing 10 countries: Germany, France, Denmark, USA, Brazil, Taiwan, China, Japan, Singapore, and, of course Mexico[6]. CRITO designed the questionnaire and coordinated the entire survey, and IDC, Inc. planned and managed its conduction and Market Probe carried out the application of the questionnaire. IDC used a list source representative of the entire Mexican population prepared by Kompas. The survey reached a 95 percent confidence interval. A national sampling approach was used in data collection, that is, companies were selected regardless of geographic location within the country.

The results of the survey are examined and discussed in the following sections, in reference to the five propositions formulated and the a priori expectations made in the first section, and vis a vis the analyses and data at the country level presented in various sections of the paper.

E-COMMERCE READINESS

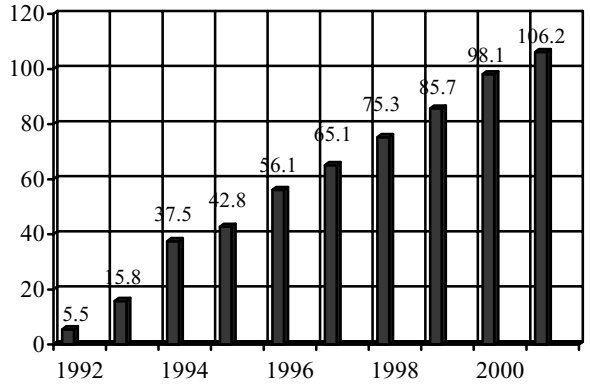
Readiness at the Country Level

The Mexican government has extended and significantly improved the country's telecommunications infrastructure over the last decade. The national fiber optic network increased from only 5,500 kilometers in 1992 up to over 106,000 in 2001 (Figure 2).

Likewise, the number of fixed phone lines in operation increased from 5.35 million in 1990 to 8.83 million in 1996; then it almost doubled to 14.62 million in 2001, the year in which the digitalization of 100 percent of those lines was completed. The Mexican government intends to increase that total up to 25 million lines by 2006. The corresponding density has increased steadily from 6 in 1990 to 14 lines per 100 population in 2002, as Figure 3 illustrates graphically. Because of such rapid growth, in December 2001, 36.2 percent of private homes already had at least one phone line installed.

[6] For a full description of results see Kraemer, Dedrick and Dunkle (2002).

FIGURE 2
Fiber Optic Network, 1992-2001
(Thousand kilometers)

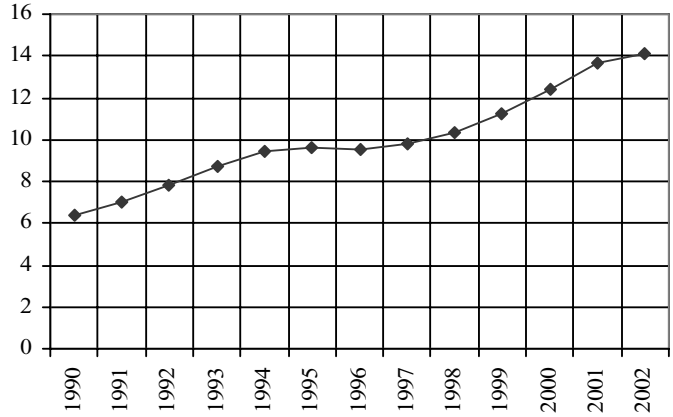


Source: COFETEL (2003)

The dynamism is even higher in the case of mobile telephony. The number of cellular phone users exploded in the 1990s, particularly in the second half of the decade and into the 2000s. As Figure 4 shows, from 64,000 in 1990, the number jumped to 27.4 million by June 2003, of which more than 20 million are subscribers of Telcel, a subsidiary of Telmex, Mexico's largest phone company.

Such rapid growth in the number of subscribers has resulted in a fast increase in the rate of penetration of mobile telephony in both businesses and households. From 0.1 in 1990, the number of users per 100 population increased to 0.8 in 1995 and up to 24.1 by November 2002 (*www.cofetel.gob.mx*).

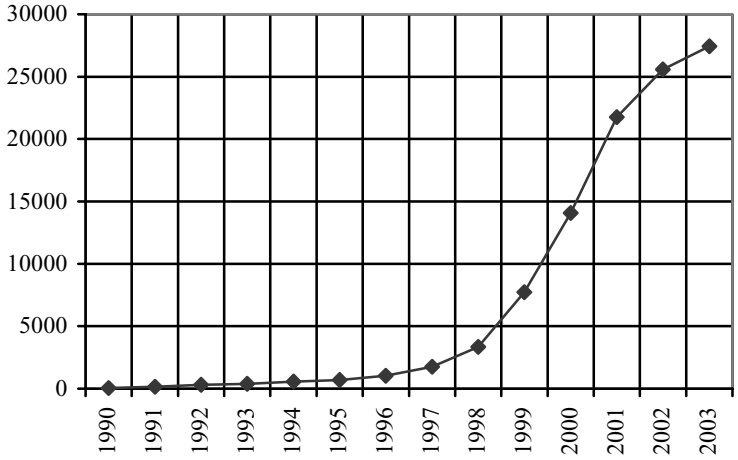
FIGURE 3
Telephone line density, 1990-2002
(Lines per 100 population)



Source: COFETEL (2003)

The imminent introduction of third generation (3G) technologies in Mexico will further propel the use of cell phones. This is a significant development if one considers that half the e-commerce estimated to take place in Mexico by 2006 will be conducted by mobile devices (m-commerce), and also that the number of users of those device is expected to increase to 40 million in that year (AMECE, 2002; *El Financiero*, June 21, 2001).

FIGURE 4
Number of Mobile Telephony Users, 1990-2003
(Thousand users)



Source: COFETEL (2003)

The above developments were possible by a solid investment in telecommunications infrastructure in the last years, especially in both fixed and mobile telephony. As Table 1 shows, the amount invested showed a steady increase over this period, as the figure for 2002 corresponds to February and so can be expected to end up being higher than 2001. The fact is that as much as $19 billion was invested in the whole period, which is a respectable amount at least by Latin American standards.

TABLE 1
Annual Investment in the Telecommunications Industry
(Million US Dollars)

Year	Telephony[a]	Other[b]	Total
1999	3,847	540	4,027
2000	4,649	516	5,165
2001	4,860	877	5736
2002[c]	3,434	586	4,020

Source: COFETEL (2003)
[a]Includes: wired and wireless local telephony, long distance, public telephony, and mobile telephony
[b]Includes: restricted TV (Cable, MMDS and DTH), radiolocation, specialized radio-communication, satellite transmission and value added services
[c]As of February.

More recently, investment in cable infrastructure by private companies has also increased. In an ambitious move to end a period of financial crisis, Cablevisión, a subsidiary of Televisa, Mexico's top television conglomerate, has just announced a US$100 million investment package

to complete the digitalization of its entire communications network. This way, Cablevisión will become the first cable television company in the world to have an entire digitalized distribution network, on the basis of which it will provide Internet—wired and wireless—and telephony services (Mejía, 2003).

Consistent with the above developments, the number of installed PCs increased from 4.9 million in 1999 (Select-IDC, 2000a) to 5.5 million in 2000, 7.0 million in 2001 and 8.1 million in 2002.[7] Twenty percent of the PCs installed in 1999 were in homes and 80 percent in offices. The PCs installed in homes in 2000 accounted for 10 percent of Mexican homes, still a rather low proportion when compared to the 50 percent observed in the United States in that year (Select-IDC, 2000b). In the case of PCs installed in private companies, over 70 percent had access to the Internet by January 2000 (Torres Chávez, 2000).

Comparatively, Mexico ranks fair in Latin America regarding the rate of PCs weighted by population size. Table 2 presents figures for a selected group of countries in the Americas, where Mexico's numbers are virtually on the Latin American average, outperforming Brazil and Venezuela, and practically equaling Argentina; Chile is the big outlier with an atypically high rate that triples the regional average.

The infrastructure for Internet service has been extended in the last few years, in large part under the E-Mexico System. As pointed out earlier, this project formally aims at providing Internet connectivity in the country's 2,400-plus municipalities (Palacios and Kraemer, 2003). An implicit, key objective of this project is to support and complete the development of an e-government, in which the present federal administration has made some progress, with all state governments following.

Although the project as a whole has not progressed much and it is still unclear whether it will have financial and operational feasibility, it is nonetheless underway, so there is ground to expect that it will result in the extension and improvement of Mexico's telecommunications infrastructure, in particular Internet connectivity.

By 2002 some 300 cities were already connected through fiber-optic cable networks built and managed by the main telephone companies operating in Mexico. Broadband, high-speed Internet access has been offered only in the last few years[8] manly via cable television networks and digital subscriber lines (DSL). As a result, Mexico ranked 24th in broadband network penetration by the end of 2000 (OECD, 2001).

In addition, an Internet 2 super broadband network is under construction, which will link all major universities and research institutions. An inter-institutional body established in April 1999, called University Corporation for Internet 2 Development (CUDI), manages this network.

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[7] Data produced by Select in July 2003.

[8] 'Broadband' is defined 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 a standard phone line, which runs at 56 Kbps or 64 Kbps (OECD, 2001).

TABLE 2
Number of PCs per 1,000 Population in Selected Countries of the Americas

Country / Region	No. of PCs
Argentina	51.31
Brazil	44.09
Canada	390.24
Chile	166.80
Mexico	50.57
United States	585.18
Venezuela	45.51
Latin America[a]	52.22
OECD[b]	312.01

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

As a result of all these enabling initiatives, the number of Internet users has increased rapidly since the mid 1990s. As Table 3 shows, from only 39 in 1994, the number grew exponentially to reach 3.6 million in 2001. The bulk of this growth corresponded to homes and businesses, where the key players of e-commerce transactions are located.

Other sources have produced estimates well above these figures recorded by COFETEL. *Empresa-e*, a magazine specialized in the development of a digital economy and e-commerce in Mexico, estimates that the number of web users had reached seven million in January 2002 (Empresa-e, 2002). Select, Mexico's top IT market analysis and consulting firm, estimates the following figures for the last three years: 7.4 million users in 2001, 10.03 million in 2002, and 12.25 for 2003.[9]

TABLE 3
Mexico: Internet Users, 1994-2001
(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
2001	284	354	1390	1608	3636

Source: COFETEL (2003)

The above is consistent with the fact that the number of commercial domains also showed an explosive growth over the 1990s. The figure jumped from just 5 in 1994 to 67,787 by February

[9] Data obtained by the author in an interview with Select's Research Deputy Director on July 3rd , 2003. The estimates are based on an Internet penetration survey on 20,000 people conducted by Select.

2003, followed far down by that of non-profit organizations which increased from zero to 3,118 in the same period (NIC-Mexico, 2003a).

The number of Internet hosts is a useful indicator of the extent of Internet use in a given country.[10] Table 4 shows the number of hosts in operation in Mexico in 1999 and 2002, where it can be observed that the figure increased tenfold in a wake of just three years, from 104,000 to a little more than one million! It is significant that most of this growth was in net.mx domains, indicating that companies and organizations likely to conduct commercial and business transactions via the Internet are using it.

Comparatively, Mexico ranked highest among Latin America's most advanced countries—Argentina, Brazil, Chile and Venezuela—regarding the number of Internet hosts per 1,000 inhabitants, according to the International Telecommunication Union (Table 5).

TABLE 4
Number of Internet Hosts in Mexico, 1999 and 2002

Domain	1999[a]	2002[b]
com.mx	19,318	53,506
edu.mx	1,540	1,441
.mx	38,120	45,280
gob.mx	1,187	881
org.mx	510	1,954
net.mx	38,811	870,215
Sum	99,486	973,277
.com	1,366	8,610
.net	3,302	56,870
.org	17	124
Other/errors	488	566
Sum	5,173	66,170
Total	104,659	1,039,447

Source: NIC-Mexico (2003b)
[a] As of January
[b] As of February

As Table 5 shows, the cost of off-peak Internet access in Mexico is lower than in Canada and the United States: $26 for 40 hours off-peak, as compared to $30 and $35, respectively. This is partially due to the fact that phone companies in Mexico only charge the number for local calls. Mexico's top Internet Service Providers is Megacable, which provides cable connectivity to 450,000 subscribers in 34 cities. It is followed by Cybercable, and Megared. These companies typically charge around US$40 a month, which is well within the range prevailing in OECD countries.

In 2000 Telmex, Mexico's top national phone company, introduced an ADSL (Asymmetric Digital Subscriber Line) service called Prodigy Infinitum, which offers three broadband Internet access options: at 256 kbps, 512 kbps, and 2.0 mega bytes per second. The monthly charge for each of these options is $52, $94, and $472; an extra, one-time charge is added to cover the

[10] A host is defined here as all equipment—servers, PCs, printers—connected to the World Wide Web that have a unique Internet Protocol URL assigned.

installation of the modem chosen by the customer. The charge can be $315 for a Bridge or $525 for a Router.

TABLE 5
Internet Infrastructure in Selected Countries in the Americas, 1999

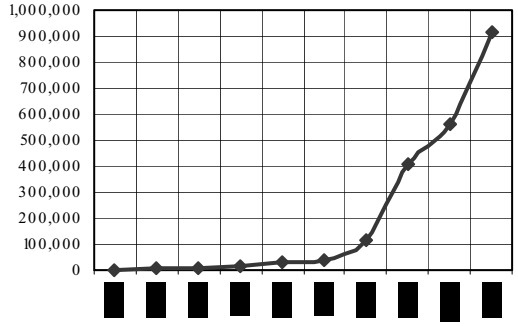
Country / Region	Internet hosts per 1,000 population 1999[a]	Access cost 40 hours off-peak US$ 2000[b]
Argentina	3.90	n.a.
Brazil	2.66	n.a.
Canada	54.75	$29.74
Chile	2.68	n.a.
Mexico	4.16	$25.89
United States	195.00	$35.40
Venezuela	.60	n.a.
Latin America[c]	3.08	n.a.
OECD[d]	62.63	n.a.

[a]Source: International Telecommunication Union, World Telecommunication Indicators. Geneva: International Telecommunication Union, March 2001. ITU definitions: *internet hosts* refers to the number of computers that are directly connected to the worldwide internet.
[b]Source: OECD, Working Party on Telecommunication and Information Services Policies, Local Access Pricing and E-Commerce, July, 2000, Table A6. The 40-hours, off-peak refers to 40 one-hour calls with the measurement taken at 20:00.
[c]Argentina, Brazil, Chile, Mexico and Venezuela. [d]OECD member countries, excluding Luxembourg, Slovakia and Iceland.

Each package includes a commuted access account, a 25 MB mailbox, and 10 MB of space for a personal web site (www.telmex.com.mx). One more option is the so called *Prodigy Hogar* (Prodigy Home), which includes the purchase of a PC, a $128 down payment, monthly installments of $36, and Internet access for three years during peak hours (6 p.m. to 8 a.m. on weekdays and 24 hours on weekends).

From a more extended temporal perspective, the number of Internet hosts have experienced an explosive growth in Mexico as depicted in Figure 5. This is in line with the rapid expansion of both Internet users and domains, as referred to before.

FIGURE 5
Mexico: Internet Hosts, 1992-2001



Source: Kearney Globalization Index, with data from the International Telecommunication Union Statistics Yearbook 2001

In turn, the absolute number of secure servers more than tripled in just two years between 1999 and 2001 (Table 6). This is also consistent with the fast growth of both Internet hosts and users.

TABLE 6
Web Servers in Mexico and in the World, 1999-2001

Year	Mexico[a]	World[b]
1999	14 968	8 972 063
2000	20 345	9 231 584
2001	52 896	26 386 934

Source: INEGI (2003) with data from Netcraft.
[a] As of August for 1999; as of February for 2000 and 2001
[b] As of December for 1999; as of January for 2000 and 2001

Mexico ranks lowest among the most advanced countries in Latin America, and thereby below the average for the region as a whole, as to the number of secure servers per 1,000,000 population (Table 7).

In general, it can be said that Mexico is fairly ready for embracing e-commerce as a new way of conducting business, at least if measured by Latin American standards. A 106,000 kilometer-long fiber optic infrastructure makes it possible for nearly 15 million fully digitalized fixed phone lines to be in operation—some 14 per 100 population—and 36.2 percent of private homes to have at least one phone line installed. Likewise, over 25 million people are active mobile phone subscribers, 24 per 100 population. Nearly five billion dollars are invested each year to expand and improve the country's telecommunications network.

TABLE 7
E-Commerce Infrastructure and Extent in Selected Countries in the Americas, 1998

Country / Region	Secure servers per 1,000,000 population	S. S. with strong encryption per 1,000,000 population
Argentina	.58	.11
Brazil	1.06	.38
Canada	30.66	21.82
Chile	1.28	.20
México	.27	.08
United States	54.29	38.39
Venezuela	.34	.04
Latin America[b]	.74	.24
OECD[c]	17.77	11.47

Source: Netcraf (http://www.netcraft.com)[11]
[b] Argentina, Brazil, Chile, Mexico and Venezuela.
[c] OECD member countries, excluding Luxembourg, Slovakia and Iceland.

As a result, Mexico ranks highest among Latin America's most advanced countries as to Internet hosts per 1,000 population; one out of 10 private homes has at least one PC; at least 300 cities are already connected to the Internet; broadband, high-speed access is available in most of them;

[11] Strong encryption is defined as one with 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.

and an Internet 2 super broadband network is under construction. This makes Mexico to rank 24th in regard to broadband network penetration among OECD countries.

A solid platform for electronic and telecommunications equipment is therefore in place for business establishments in Mexico to link to the web and conduct commercial transactions and be among the 12 million plus Internet users that are estimated to exist by the end of 2003. Since e-commerce cannot take place in the absence of that platform, it can be said that *Proposition 4* is confirmed.

Readiness at the Industry Sector Level

E-commerce readiness for the country as a whole is not necessarily the same as those prevailing in individual sectors. In line with the methodology discussed earlier, this section tests this assertion focusing on the three sectors described in the first section: manufacturing, distribution (which stands for wholesale and retail commercial activities), and finance (which includes insurance, banking and other related financial services). The propositions put forward in that first section will also be tested.

In this way, the present section examines the extent to which business establishments operating in those sectors make use of technologies required to adopt e-commerce solutions and conduct commercial transactions over the Internet. More concretely, what is to be explored here is whether firms have access to Internet, through either fixed or mobile means; use e-mail; have a website; have an intranet or an extranet installed; and/or, have an EDI network in operation. The survey described in the second section is used as the source of data for these aspects of each sector.

Before going into the details of the selected sectors, it should be pointed out that Mexico's general readiness has largely been defined by its geographical location in North America, particularly its vicinity to the United States. Hence *Proposition 1* posed at the beginning of this paper. Table 8 presents data for both Mexico and all the 10 countries in the full sample, which will serve to test this proposition.

As presented in Table 8, surveyed establishments in Mexico show figures above those of the full GEC sample with regard to three key indicators of degree of globalization: headquarters, total sales, and procurement spending abroad. The large percentage of procurement spending from abroad indicates a substantial reliance of these companies on imported inputs. These results are reinforced by the fact that, as expected, Mexican firms are more highly affected by competition from abroad, than the total sample. It can be said that *Proposition 1* is supported by the results of the GEC survey, in the sense that e-commerce practices are driven by global factors more than by domestic ones.

Firm size does matter by most indications, except in the case of the proportion of sales from abroad. As can be expected, large companies have more establishments and headquarters abroad, although more SMEs spend more on procurement in foreign countries.

TABLE 8
Globalization Indicators for Business Establishments in Mexico, 2002[12]

Indicator	Establishment Size[a]		Sector[b]			Total	
	SME	Large	Mfg.	Distrib.	Finance	Mexico[c]	Global[d]
Percent of companies with establishments abroad	18.5	39.1	33.9	7.5	46.6	19.1	23.9
Percent of companies with headquarters abroad	9.5	13.7	10.9	7.0	32.0	9.6	8.5
Mean percent of total sales from abroad	14.7	14.1	22.5	7.8	42.2	14.7	12.1
Mean percent of total procurement spending from abroad	39.8	27.7	35.3	43.4	24.3	39.4	20.3
Degree affected by competitors abroad[e]							
Low	60.8	58.5	25.1	86.4	37.7	60.7	68.3
Moderate	12.0	11.0	20.9	6.4	7.2	12.0	15.7
High	27.2	30.5	54.0	7.2	55.1	27.3	15.2

Source: CRITO Global E-Commerce Survey, 2002

[a] SME (small and medium sized establishments) are those with 25-250 employees; large are those with more than 250 employees.

[b] Manufacturing includes all establishments classified as SIC 20-39; distribution includes wholesale and retail (SIC 50-54, 56-57, 59); finance includes banking and insurance (SIC 60-65).

[c] Responses were weighted based on the total number of establishments by employee size within the sector for each country. Survey sample sizes for Mexico by sector are 69 establishments in manufacturing, 69 in wholesale & retail distribution, and 63 in banking & insurance; by size are 97 establishments classified as SME and 104 as large.

[d] Consists of weighted survey responses in 10 countries combined: United States, Mexico, Brazil, Germany, France, Denmark, Singapore, Taiwan, China and Japan. "Global" sample sizes by sector are 743 in manufacturing, 701 in wholesale/retail distribution, and 695 in banking & insurance; by size are 1,088 establishments classified as SME and 1,053 as large.

[e] Exact question wording: Using a 5-point scale where 5 is significantly affected and 1 is not at all affected, please tell me how much your establishment is affected by competitors from outside your country. Scores of 1 and 2 were classified as low, a score of 3 as moderate, and scores of 4 and 5 as high.

Finally, from a sectoral perspective, finance, which includes insurance and banking, turned out to be the most globalized sector, especially vis a vis distribution. It happened, though, that the latter showed the highest proportion of total procurement spending from abroad. This means that manufacturing establishments were the least globalized ones. Although this result is yet to be pondered and be discussed in subsequent sections, the fact is that it is contrary to the expectations set forth with respect to the previous section in the sense that manufacturing was the most globalized sector.

Focusing now on the technological capabilities of business establishments for conducting commercial transactions via the web, Table 9 presents a set of relevant results from the GEC sample survey for the Mexican case, organized by firm size and for each of the three sectors considered.

As can be observed, the surveyed companies in Mexico are pretty well equipped, concerning technologies required for e-commerce. They outperform the average figures for the 10-country sample in most of the items analyzed in the table, particularly with regard to e-mail, websites, and EDI. This means that, in spite of being operating in a developing country, firms in Mexico

[12] Notes "a" and "b", of this table are common to all tables presented and discussed in subsequent pages and sections of this paper. In addition, notes "c" and "d" are common to tables including columns for Mexico and the GEC survey's full sample.

see the Internet as a useful instrument for conducting their business, and EDI as a necessary complement, and used them both. This explains the fact that the use of intranets and extranets is not as generalized in Mexico as in the other sampled countries.

TABLE 9
Use of E-Commerce Technologies by Business Enterprises in Mexico, 2002
(Percentages)

Technology	Establishment Size		Sector			Total	
	SME	Large	Mfg.	Distrib.	Finance	Mexico	Global
E-mail	98.2	100.0	95.3	100.0	100.0	98.3	98.5
Web-site	79.2	71.9	86.6	75.1	68.0	79.0	74.1
Intranet	50.2	74.4	50.9	50.5	55.1	50.9	63.6
Extranet	30.9	36.6	28.2	31.1	52.9	31.1	32.7
▪ Accessible by suppliers/ business partner[a]	22.7	22.0	17.1	24.8	39.3	22.6	20.9
▪ Accessible by customers[a]	16.0	21.3	18.0	12.6	45.7	16.2	17.8
Electronic Data Interchange	58.1	68.6	53.4	62.5	47.9	58.4	44.3
▪ Over private networks only[a]	19.7	18.3	12.1	24.9	14.1	19.7	19.4
▪ Internet-based only[a]	28.9	12.1	27.7	30.8	6.7	28.5	8.4
▪ Both[a]	9.3	38.1	13.2	6.8	27.1	10.1	15.9
Electronic Fund Transfer	70.3	79.6	65.9	74.0	67.3	70.6	43.4
Call center	44.0	60.2	52.0	38.4	61.2	44.5	32.3

Source: CRITO Global E-Commerce Survey, 2002
[a] Percent based on total sample

With respect to size, it is worth pointing out that the figures for SMEs closely follow those for the global sample, thus giving their overwhelming weight in Mexico's business population.[13] Be as it may, establishment size in this case makes a mixed difference, with large establishments outperforming SMEs in most items. This occurs with regard to the use of intranet, call centers, and combined EDI. These results partially endorse *Proposition 2;* small enterprises are the least likely to adopt e-commerce vis a vis medium-size and large firms.

Sector wise, manufacturing establishments appear to be the least equipped with e-commerce technologies, particularly concerning e-mail, extranet, and electronic fund transfers. Financial firms and institutions, in turn, do better with most items in comparison with both manufacturing and distribution, which makes them the sector where e-commerce has been adopted more extensively.

It is intriguing, though, that a larger proportion of manufacturing firms have a website, compared to those in finance and distribution, given that the latter have more direct contact with customers and final consumers (B-to-C). The explanation may lie in that manufacturing firms use their websites for B-to-B dealings.

In general, it appears that business establishments operating in Mexico have a high confidence in electronic means for conducting commercial transactions, which reinforces the previous claim about the large potential for e-commerce growth in Mexico.

Regarding enterprise systems integration, surveyed firms in Mexico generally present low degrees, which are albeit higher than those for the full 10-country sample as a whole (Table 10).

[13] This occurs in most tables to be analyzed in the remaining sections of this paper.

It is also encouraging that the extent is far larger in the case of the integration between Internet-based applications with internal information systems (i.e., one of the bases of e-commerce).

TABLE 10
Internal and External Integration of Enterprise Systems and Databases, 2002
(Percentages)

Area and Degree of Integration	Establishment Size		Sector			Total	
	SME	Large	Mfg.	Distribution	Finance	Mexico	Global
Internet applications with internal databases & information systems							
- little to none	60.5	44.5	68.5	56.3	35.9	60.1	52.5
- some	12.1	18.6	8.0	14.7	17.8	12.3	23.6
- a great deal	27.4	36.9	23.6	29.0	46.4	27.6	23.9
Internal information systems with suppliers & customers							
- little to none	81.6	79.4	87.0	78.6	72.4	81.5	72.1
- some	9.3	14.6	1.2	14.3	18.0	9.5	18.3
- a great deal	9.1	6.0	11.7	7.2	9.6	9.0	9.6

Source: CRITO Global E-Commerce Survey, 2002

Financial firms turned out to be the most advanced in that latter respect, which is consistent with the fact that they are the best equipped with e-commerce technologies as observed in Table 9. They are followed by distribution establishments, with manufacturing units being the least integrated ones, regarding integration of both Internet-based applications and internal information systems.

Size does matter in this case, as large firms generally show higher degrees of system integration than SMEs, as can be expected, for the former tend to have more resources in Mexico and a more developed business culture than the latter. This applies in particular to the case of internal information systems with Internet-based applications, as is the case in general. This also gives support to *Proposition 2,* SMEs' likelihood for embracing e-commerce.

It can be said that the extent of systems integration of business establishments in Mexico is quite acceptable if assessed according to the figures for the global sample, which includes some of the world's most advanced countries in IT development, such as the United States, Germany, Japan, Singapore, France and Denmark. Therefore, this is a promising development, signaling a visible tendency for companies operating in Mexico to improve management systems and productivity tools supportive of e-commerce practices.

Investment in Information Technologies

At the country level, IT investment in Mexico is comparatively low, as it amounted to 1.4 percent of GDP in 2000, in contrast to a world average estimate of 4.1 percent (Notimex, 2002). Accordingly, Mexico ranks lowest in IT investment vis a vis other Latin American advanced nations, and of course even lower in relation to Canada and the United States (Table 11). Investment proper was estimated at $6.5 billion in 2002, one percent down from 2001 (Ramirez, 2003).

TABLE 11
Information Technology Infrastructure in Selected Countries in the Americas

Country / Region	IT as % of GDP, 2000[a]
Argentina	1.29
Brazil	2.38
Canada	3.83
Chile	1.67
Mexico	1.00
United States	4.56
Venezuela	1.30
Latin America[b]	1.60
OECD[c]	3.60

[a] Source: International Data Corporation, *The 2000 IDC Worldwide Black Book*.
Note: IT is defined as "the revenue paid to vendors (including channel mark-ups) for systems, software, and/or services."
[b] Argentina, Brazil, Chile, Mexico and Venezuela.
[c] OECD member countries, excluding Luxembourg, Slovakia and Iceland.

At the industry level, IT investment presents a different, and better picture (Table 12). Average spending tops 10 percent, which is a reasonable proportion for a developing economy like Mexico's. Accordingly, nearly two thirds of the surveyed establishments spend up to 10 percent of their revenues in information systems, and one fifth spends as much as 20 to 50 percent. In both cases, the figures are much higher than the estimated national average.

TABLE 12
Information Systems Operating Budget as a Percent of Revenue, 2002
(Percentages)

Percentage Range / Operating Budget	Establishment Size		Sector			Total[a]
	SME	Large	Mfg.	Distrib.	Finance	
Total	100.0	100.0	100.0	100.0	100.0	100.0
<10	60.6	78.3	56.0	63.0	66.1	61.0
10-20	17.2	13.6	28.8	12.7	1.4	17.1
20-50	21.6	3.8	13.0	24.3	32.3	21.2
Don't know/refused	0.6	4.2	2.2		0.2	0.7
Mean	10.3	5.0	7.9	11.1	11.6	10.2
Operating Budget ($)	915,514	9,997,859	1,180,013	859,263	4,641,701	1,119,803

Source: CRITO Global E-Commerce Survey, 2002
[a] Responses were weighted based on the total number of establishments by employee size. Survey sample sizes for Mexico by sector are 20 establishments in manufacturing, 27 in wholesale & retail distribution, and 22 in banking & insurance; by size are 36 establishments classified as SME and 33 as large.

From a sectoral perspective, financial firms are the ones spending the highest proportion of their operating budget in information systems, although at the same time, they present the highest proportion of those spending less (up to ten percent). Manufacturing establishment show a reverse situation, with distribution companies being in the middle. These results further reinforce previous observations that financial firms perform better in the areas of systems integration and use of e-commerce-related technologies.

Size does matter in this case too, as SMEs spend a significantly higher proportion of their revenues in IS than larger firms. Although this can be explained in principle by the relatively

larger size of the latter's revenues, it indicates that SMEs are on their way to increasing their use of information systems and engaging in business practices that may include e-commerce. This contradicts *Proposition 2*, but it is ultimately encouraging given the large potential lying in the vast ranks of the SME population.

The proportion of IS spending destined to web-based technologies and solutions is lower than that of total revenues spent in IS, although mean figures are almost double for all categories and sectors (Table 13). Size makes no significant difference here, as the proportions are roughly the same for both SMEs and large firms. By sector, finance shows the highest spending, as can be expected, since banks are among the companies that rely most on Internet-based tools in Mexico for providing their services as has been found in previous tables and in Palacios (2001a).

TABLE 13
Web-based Spending by Business Enterprises in Mexico Out of IS Operating Budget, 2002
(Percentages)

Percentage Range / Operating Budget	Establishment Size		Sector			Total[a]
	SME	Large	Mfg.	Distrib.	Finance	
Total	100.0	100.0	100.0	100.0	100.0	100.0
<10	51.0	50.8	57.2	49.6	39.1	51.0
10-20	1.4	19.0	3.8	0.2	19.7	1.9
20-50	23.6	15.8	18.9	25.2	19.7	23.4
50+	14.4	14.4	17.7	12.9	21.4	14.4
Don't know/refused	9.5		2.5	12.1		9.3
Mean	18.1	20.3	16.8	18.4	23.7	18.1
Web-based spending ($)	149,161	778,708	102,471	182,325	352,290	164,546

Source: CRITO Global E-Commerce Survey, 2002

[a] Responses were weighted based on the total number of establishments by employee size within the sector for each country. Survey sample sizes for Mexico by sector are 17 establishments in manufacturing, 26 in wholesale & retail distribution, and 20 in banking & insurance; by size are 33 establishments classified as SME and 30 as large.

KEY BARRIERS AND INCENTIVES

Incentives

With a fairly extensive telecommunications infrastructure, a sizeable and growing number of Internet users, and reasonable rates of investment in IT, Mexico offers an enabling national environment for e-commerce activity to take hold and thrive.

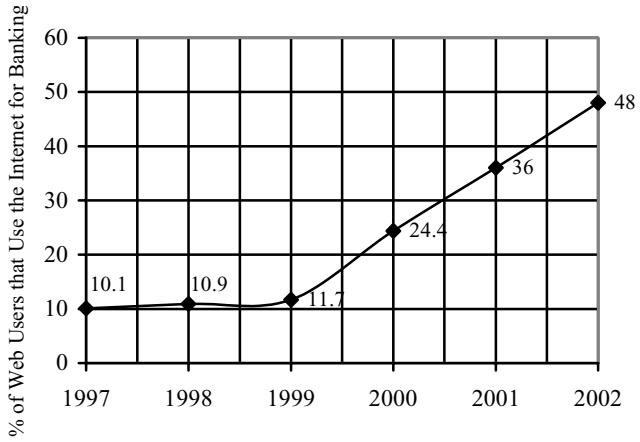
Other factors also act as incentives for the growth of economic transactions conducted over the Internet. One is transportation and delivery services. Over 200 logistics and delivery companies are in operation in Mexico, including the world's giants, DHL, UPS, and FedEx, and others like Redmond Systems, Emery Logistics, Span, and Kuehne & Nagel. Domestic firms include Grupo Pondisa, Estafeta, Multi-Pak, Mexico Express, and Speed Pak. A large number of local courier companies complement the services provided by the latter (Palacios, 2002). In addition, over 7,800 freight transportation companies are in operation with a fleet topping 370,000 trucks and trailers (INEGI, 2002). Most of these companies, especially those in the passenger bus business, provide delivery services.

On the other hand, all major banks have portals and major websites through which they offer most of their services to customers. Internet banking penetration has increased rapidly since the late 1990s. As Figure 6 shows, from 10 percent in 1997, the proportion of web users that use the Internet for banking jumped to nearly 50% of banking operations five years later.

Such fast growth in banking transactions via the Internet has been concomitant to a corresponding decline in both the number of bank office visits and the use of bank drafts as a payment mechanism (Select-IDC, 2002). In this respect, nearly seven million credit card accounts were in operation in 2000, which means that over 10 percent of Mexicans 15 years or older are credit card holders (Palacios, 2002). Although this proportion is still low, it is indicative of the growing tendency that for Mexicans to use credit cards as a common payment mechanism.

One more factor that is also inducing the growth of e-commerce is the Ministry of France's requirement to have corporate taxpayers settle their fiscal obligations with the federal government online. In the fiscal year ending in March 2002, as much as 33 percent of the tax returns—accounting for 99 percent of total tax revenues—were already made via the Internet (Carrillo, 2002).

FIGURE 6
Internet Banking Penetration, 1997-2002



Source: Select-IDC (2002)

Finally, another factor enabling the development of e-commerce in Mexico is the existence of a legal framework that provides basic legal support for electronic transactions. This framework has been the result of a series of reforms of federal legislation on commercial transactions; it provides legal status to digital documents and their certification by notary publics (Palacios and Kraemer, 2003), and, since December 2002, to digital signatures as well (Cervantes, 2002).

At the industry level, multiple factors act as direct incentives for businesses to engage in e-commerce. These factors range from government requirements and incentives, demands from customers and suppliers, and productivity and market expansion goals. As presented in Table 14, those are these most significant factors for companies to use the Internet for doing business.

The intention to improve coordination and communication with customers and suppliers is by far the strongest drive to engage in e-commerce. Other factors following this primary drive is entering new markets, expanding existing ones, and reducing production costs. All these factors are much weaker in the ten countries of the GEC sample taken as a whole. Government requirements, demands from customers or suppliers, and the entry of competitors into web markets are far less compelling.

In most cases, such behavior is more visible in large establishments. SMEs tend to respond less to those factors as drivers to use the Internet for commercial purposes. In general, size does not make much difference.

TABLE 14
Drivers Deemed as Significant Factors for Internet Use by Business Enterprises in Mexico, 2002
(Percentages)

Driver	Establishment Size		Sector			Total	
	SME	Large	Mfg.	Distrib.	Finance	Mexico	Global
Customers demanded it	35.4	41.4	44.0	31.0	27.8	35.6	36.9
Major competitors were online	38.9	38.0	40.0	37.8	43.3	38.9	31.3
Suppliers required it	32.5	41.4	28.1	37.8	7.7	32.8	22.3
To reduce costs	58.3	56.0	45.4	68.4	34.8	58.3	35.7
To expand market for existing products or services	64.4	69.4	51.0	74.6	47.5	64.6	47.9
To enter new businesses or markets	64.6	74.3	51.1	74.5	53.4	64.9	42.0
To improve coordination with customers and suppliers	74.0	78.9	67.7	80.9	40.9	74.1	43.7
Required for government procurement	33.4	27.1	28.7	37.1	19.8	33.2	15.2
Government provided incentives	12.7	17.5	12.6	12.9	13.2	12.8	8.3

Source: CRITO Global E-Commerce Survey, 2002

From a sectoral point of view, distribution establishments deemed the coordination with customers and suppliers as the most significant factor; manufacturing firms, in turn, deem customer demand and market pressures as a more compelling factor.

In sum, unilateral initiatives are stronger drivers than requirements, demands or incentives coming from outside, for business establishments in Mexico to engage in e-commerce.

Barriers

The various enabling factors considered in the foregoing discussion are counteracted by opposing forces present in Mexico's economic environment. Major barriers include the fact that over one third of Mexican households do not have access to credit or other financial services and over two fifths of the employed population dwells in the informal economy. In addition, over two thirds of the population are under the poverty line and so are not likely to become online consumers. As a result, only a small proportion of potential consumers have access to the Internet, as most Internet users are less than 30 years old and thereby have a low purchasing power (Palacios and Kraemer, 2003).

Another significant barrier is the absence of an integrated legal framework comprehensive enough to provide full security for commercial transactions over the web. Although the measures adopted so far are helping business people and managers overcome their innate distrust

for doing business online, they are still short of constituting such a framework. Others include the prevalence of a shopping culture marked by a preference to buy in person, distrust in impersonal purchases online, and lack of confidence in making payments over the Internet using a credit card. This latter is one of the main deterrents for consumers to shop over the web, for the credit card is the payment instrument par excellence over the web (Palacios and Kraemer, 2003).

Regarding electronic commerce between companies (B-to-B), limiting factors include the fact that 96 percent of Mexico's company population correspond to micro, small and medium enterprises, and that many of these are in the informal sector, which accounts for 13 percent of Mexico's Gross Domestic Product. In addition, the limited extent of telecommunications infrastructure also inhibits the growth of B-to-B e-commerce, as 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 (Palacios and Kraemer, 2003).

Although the actual effect of the above barriers will depend on the strength of the counteracting effect of the enabling forces discussed before, the fact is that the former constitute significant influences present in Mexico's national setting, and as such have to be considered for assessing the prospects for e-commerce to prosper in this country.

At the level of individual industry sectors and firms, barriers and incentives are more diverse and numerous (Table 15):

TABLE 15
Barriers Deemed as Significant Factors for Internet Use by Business Enterprises in Mexico, 2002
(Percentages)

Barrier / Inhibiting Factor	Establishment Size		Sector			Total	
	SME	Large	Mfg.	Distrib.	Finance	Mexico	Global
Need for face-to-face customer interaction	25.6	26.1	28.9	25.0	7.8	25.6	33.8
Concern about privacy of data or security	57.8	51.9	52.6	62.2	40.6	57.6	44.2
Customers do not use the technology	38.6	41.1	40.8	38.3	28.0	38.7	31.4
Finding staff with e-commerce expertise	31.2	28.3	33.4	31.6	7.5	31.1	26.5
Prevalence of credit card use in the country	19.6	28.1	23.1	18.8	7.7	19.8	20.3
Costs of implementing an e-commerce site	35.6	18.6	33.4	36.9	26.7	35.2	33.6
Making needed organizational changes	32.4	30.8	36.8	31.0	13.7	32.3	23.9
Level of ability to use the Internet as part of business strategy	28.9	34.0	28.2	31.2	7.9	29.0	24.8
Cost of internet access	3.1	18.5	7.6	0.8	7.6	3.6	15.1
Business laws do not support e-commerce	27.2	31.1	23.3	31.4	8.8	27.3	24.2
Taxation of internet sales	21.4	25.8	17.3	26.1	0.9	21.5	16.5
Inadequate legal protection for Internet purchases	44.9	51.3	39.9	49.9	27.3	45.1	34.1

Source: CRITO Global E-Commerce Survey, 2002

Substantiating *Proposition 5*, the various factors related to perceptions about the legal framework rank highest among the main barriers for companies in Mexico engaging in e-commerce practices. This holds more in Mexico than in the ten countries included in the GEC, which indicates that Mexican businesses are more concerned about legal protection than the other nine countries.

The above observation about the influence of the legal framework holds even more true in the case of distribution establishments, and, although in lower proportions, to that of financial firms and manufacturing enterprises. When it comes to establishment size, both SMEs and large firms perceive legal protection and support as the most significant barrier for them to do business online.

Size does matter in other respects, since SMEs perceive more significant factors such as the cost of building a website than large firms do, while the reverse applies in the case of Internet access. Likewise, other factors such as cost and spending required for adopting e-commerce solutions are more significant for SMEs than for large enterprises.

Taxation on e-commerce transactions is not perceived as a significant barrier, as concern about taxation of online sales is reported as the least influential factor.

In sum, the barriers identified at the level of individual industry sectors do not include some of the most significant a work at the national level. This is the case particularly of those related to the high proportion of people under the poverty line or with informal employment, as well as those related with telecommunications infrastructure or the overwhelming prevalence of SMEs in the country's business population. It can be concluded, therefore, that these latter are not as influential as is usually believed.

DIFFUSION OF E-COMMERCE

Diffusion at the Country Level

E-commerce was born in Mexico in 1993, when the first "com.mx" sub-domain was created and put into operation (Palacios, 2003a). A new era was then inaugurated, in which private companies began to use the Internet as a new means for conducting their business.

E-commerce practices soon started to spread into the Mexican economy, although they have not extended much thus far. In 2000, its overall penetration was estimated at only 0.17 percent; B-to-C transactions only reached 0.16 percent while B-to-B's as much as 6.1 percent. The overall figure is expected rise to 1.2 percent in 2004, two percent for B-to-C and 20 percent for B-to-B (Select-IDC, 2001b).

Although the extent reached can appear limited, the fact is that the above figures are not very different to those observed in other countries. In the United States, for instance, B-to-C e-commerce revenues amounted to just 0.7 percent of retail sales in the fourth quarter of 1999, the proportion getting only to 1.3 percent in the last quarter of 2002. The Census Bureau noted that it was unlikely to expect a dramatic shift in this proportion in the first months of 2003, even in spite of a robust Christmas holiday spending in those months (Woods, 2003).

The penetration has been more extensive at the level of individual consumers and companies. By mid-1999, 20 percent of Internet users were conducting some kind of transactions through the web. By December 2000, 19 percent of users were buying and seven percent were selling

products and services online. In early 2001, about 15,000 websites were in operation offering some kind of product or service (García, 2001).

Likewise, in a survey conducted in 2000 among 2,464 firms of all sizes and sectors, Select-IDC found that as much as 55 percent reported to have carried out sales via the Internet. Of those, just one fifth had adopted an e-commerce solution; the rest had only built a web page (Esquenazi, 2000).

Figures about diffusion were even higher in the GEC sample reported in this paper. As Table 16 shows, over ¾ of business establishments operating in Mexico in all sectors reported use of the Internet for conducting some kind of commercial transaction. The proportion was higher in the case of large establishments and, sector wise, in financial institutions and firms, where a little over nine out of ten reported to be engaged in e-commerce practices.

In sum, e-commerce is spreading overall at a good pace in Mexico, although the extent reached so far by the process is still very limited. This, however, is not exclusive to this developing country, as it is a common phenomenon worldwide. In any case, it can be expected that the volume of transactions via the Internet will continue to grow, possibly at a faster pace, and its penetration to increase in the next few years.

TABLE 16
Business Establishments that Use the Internet for Commercial Transactions, 2002

Category	Total	Establishment size		Industry			
		Small (Between 25 and 250)	Large (>250)	Manufacturing	Distribution[a]	Finance[b]	Other
	287	156	131	96	107	72	12
	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Use the Internet	77.0	74.4	80.2	72.9	74.8	90.3	50.0
Do not use it	23.0	25.6	19.8	27.1	25.2	9.7	50.0

Source: CRITO Global E-Commerce Survey, 2002.

[a] Includes retail and wholesale

[b] Includes banking, insurance, and other financial firms

In line with the extent of diffusion, e-commerce revenues are limited, and B-to-B transactions generate the great bulk of those revenues. In its 2000 Global eCommerce Model, Forrester Research estimated that the value of B-to-B revenues that year was a little over $3.0 billion, while that of B-to-C was $230 million. These figures are above those of other advanced Latin American countries, but way below those of Canada and the United States (Table 17).

As Table 17 shows, the predominance of B-to-B e-commerce is overwhelming in both developed and developing countries and regions. Revenues generated by this modality in all those included in the table exceed 90 percent, getting as high as 95 percent in the case of Argentina. This is a revealing finding that reflects the sharp decline of Internet retail business and the debacle of the e-tailing model in general that became apparent in 2000. As Taylor and Terhune (2001: 41) put it, “In just the last year, e-tailing went from being the hot e-commerce segment to being almost a

dirty word." They speak, too, of the bursting of the dot com bubble that followed: "Both the venture capital community and the stock markets have turned their backs on virtually any business idea that even smells like an Internet retail store" (Taylor and Terhune, 2001: 41).

TABLE 17
E-commerce Revenues in Mexico and Selected Countries by Major Modality, 2000
(Million US Dollars)

Country / Region	B-to-B		B-to-C		Total	
	Amount	%	Amount	%	Amount	%
Argentina	617.80	95.05	47.18	4.95	649.98	100.00
Brazil	2,232.63	92.90	170.50	7.10	2,403.13	100.00
Canada	15,867.52	91.38	1,496.00	8.62	17,363.52	100.00
Chile	142.50	92.91	10.88	7.09	153.38	100.00
México	3,018.52	92.90	230.51	7.10	3,249.03	100.00
United States	449,900.00	92.07	38,755.00	7.93	488,655	100.00
Venezuela	213.27	92.90	16.29	7.10	229.56	100.00
Latin America [a]	6,224.72	92.90	475.36	7.10	6,700.08	100.00
OECD [b]	588,900.80	91.86	52,184.17	8.14	641,084.17	100.00

Source: Forrester Research Inc., Global eCommerce Model, 2000
[a] Argentina, Brazil, Chile, Mexico and Venezuela. [b] OECD member countries, excluding Luxembourg, Slovakia and Iceland.

In the last few years, electronic transactions between business establishments emerged as e-commerce's undisputed predominant modality in most economies around the world (Table 17). In its 2002 February-March issue, *Empresa-e*, Mexico's leading magazine on the emergence of a digital economy in this country, established that the order of priorities in efforts to develop a Mexican Internet market was: first B-to-B; second B-to-E (business-to-employee); and third B-to-C (*Empresa-e*, 2002). The news here is that B-to-C e-commerce is seen as less important than business-to-employee deals. B-to-E, which is the most recently emerging modality of e-commerce, and still in its infancy in Mexico, has to do with the use of the web for building systems and solutions that facilitate communication and coordination between companies and their employees.

Therefore, the fact is that to speak of e-commerce nowadays in Mexico—and elsewhere—actually means to speak of transactions that take place between businesses. This holds for both practical and theoretical purposes, and has to be taken into account as an indispensable element for any serious analysis and conceptualization on e-commerce, and for deriving the corresponding conclusions.

Diffusion at the Industry Sector Level

E-commerce diffusion presents a different picture at the level of individual sectors and industries. The modalities are more diverse according to how and why the Internet is used as a means to conduct business transactions.

Nature of Use across Sectors

As Table 18 documents, the most common reason business enterprises in Mexico have for using the Internet is for advertising and marketing their products and/or services. It is much more compelling than in the 10 countries of the full GEC sample taken as a whole. Although business establishments may direct advertising and marketing campaigns either to other companies or to individual consumers, or even both, it is more common that they aim at the latter. This indicates in principle that companies use the web mainly for conducting B-to-C transactions, which would come to endorse *Proposition 3*. However, the fact that they also reported online sales being the least important purpose for Internet use, comes to undermine such a conclusion. Moreover, buying online is the second most important purpose for Internet use, which indicates that B-to-B deals are nearly as important as B-to-C ones.

In any event, the above implies that exchanging data with suppliers and customers and after sales support are not compelling reasons for businesses to use the web for commercial purposes in Mexico. This means that Internet-based business solutions for performing the crucial function of proper customer care such as Customer Relationship Management (CRM), have not gained acceptance by business enterprises in Mexico. This is not exclusive for this country, since it also happens in the other countries included in the GEC sample (Table 18).

TABLE 18
Uses of the Internet by Business Enterprises in Mexico, 2002
(Percentages)

Purpose	Establishment Size		Sector			Total	
	SME	Large	Mfg.	Distrib.	Finance	Mexico	Global
Advertising and marketing purposes	73.4	54.8	50.4	87.0	73.3	72.9	57.6
Making sales online	11.5	19.5	8.1	13.3	21.1	11.8	29.9
After sales customer service and support	40.4	35.1	32.9	44.3	47.9	40.2	43.7
Making purchases online	65.4	44.6	33.8	85.9	46.5	64.8	46.8
Exchanging operational data with suppliers	49.5	71.5	38.8	56.5	59.5	50.1	48.1
Exchanging operational data with business customers	6.0	69.7	59.4	38.1	54.1	46.7	50.7
Formally integrating business processes with suppliers or other business partners	55.0	47.5	25.0	74.3	46.4	54.8	33.9

Source: CRITO Global E-Commerce Survey, 2002

On the other hand, it is encouraging that the most influential purpose next to the ones discussed above is the integration of the firms' internal processes with their suppliers and business partners. This means that they perceive the Internet as a valuable instrument for integrating their entire supply chains. However, this contradicts the fact that exchanging data with suppliers and customers is one of the least influential reasons for using the web, as discussed in the previous paragraph. Therefore, the point may be that process integration is not desirable enough to make companies willing to exchange data with customers and business partners to make it a feasible endeavor.

The above trends are also visible in sectoral terms, with some particularities. Distribution establishments reported buying online (B-to-B) similar to advertising and marketing, but followed closely by process integration. The picture is different in finance, where, given the development of e-banking, data exchange with suppliers and business partners is next to advertising and marketing as the most important uses for the Internet. Manufacturing

establishments have a similar perception, although data exchange with suppliers and more significantly, process integration, are much less influential.

Size does matter, as the two most important reasons for Internet use—advertising and marketing, and buying online—are much more so for SMEs than for large firms. Large differences also exist regarding data exchange and process integration, with data exchange with suppliers being the most influential purpose for large firms. The data points to a conclusion that the smaller the firm, the higher the propensity for it to use the Internet as a commercial tool.

In line with the observation that after sales customer care is one of the least important reasons for using the web, less than one out of ten companies surveyed were providing service to customers using mobile devices such as Palms or Pocket PCs with access to content and services (Table 19). This is a low proportion even though more than two fifths intend to do so soon. In any case, businesses in Mexico are lagging behind in this respect, for the proportion is twice as high in the 10 countries of the GEC sample.

TABLE 19
Provision of Content & Services to Mobile Customers by Business Enterprises in Mexico, 2002
(Percentages)

Status	Establishment Size		Sector			Total	
	SME	Large	Mfg.	Distrib.	Finance	Mexico	Global
Already provide	7.0	12.7	15.9	0.2	26.2	7.2	13.7
Plan to provide within next year	46.2	41.7	43.0	50.1	20.8	46.1	18.2

Source: CRITO Global E-Commerce Survey, 2002

As expected, financial firms are the most advanced in providing access to customers using mobile devices. Distribution companies, in turn, have not advanced at all, although the highest proportion of firms that plan to do so within one year are in that sector. In this case, size does not matter significantly.

On the other hand, surveyed establishments in general use the Internet primarily to address traditional distribution channels (Table 20). The fact that competing with existing channels is the least compelling reason indicates that firms in Mexico perceive that there is still enough room in e-markets for everyone. This is reinforced by the observation that addressing new markets is the second most important objective.

TABLE 20
Form of Use of the Internet as a Sales Instrument by Business Enterprises in Mexico, 2002
(Percentages)

Form of Use	Establishment Size		Sector			Total	
	SME	Large	Mfg.	Distrib.	Finance	Mexico	Global
To address new markets only	25.3	12.3	5.8	32.9	19.3	25.0	15.3
To address traditional distribution channels only	48.2	56.9	52.2	49.1	21.6	48.5	44.1
To compete with traditional distribution channels	8.9	16.1	21.3	0.7	57.3	9.1	27.4
To replace traditional distribution channels	17.5	14.8	20.8	17.3	1.8	17.4	13.2

Source: CRITO Global E-Commerce Survey, 2002

It is not encouraging that manufacturing firms are the most inclined to keep operating within well-known, traditional channels, given that they are the ones that create new products and perform the crucial functions of both technology and process innovation. Distribution companies follow closely, with the particularity that they are the least inclined to compete with existing channels. This goes against common-sense views about retail and wholesale enterprises always being actively competing for markets. The fair development of e-banking in Mexico again explains the fact that financial firms show the highest propensity to use the Internet for competition purposes.

Size wise, there are significant differences. Large firms tend to compete more with traditional channels and address new markets than SMEs. Size does not matter with regard to the other aspects.

The provision of mobile access, the exchange of data with business partners, and the use of the Internet in general depend on the extent to which private companies are aware of the existence and the benefits of electronic markets. In this respect, it is encouraging that most establishments in the survey (practically nine out of ten) already knew about trading communities as virtual places where they can not only buy and sell goods and services, but also exchange commercial information essential for decision-making (Table 21).

TABLE 21
Extent of Participation of Business Enterprises in Internet-Based Trading Communities, 2002
(Percentages)

Awareness on E-Markets & Type of Participation	Establishment Size		Sector			Total	
	SME	Large	Mfg.	Distrib.	Finance	Mexico	Global
Have heard of the concept of an Internet marketplace	88.6	91.8	91.2	87.3	87.0	88.7	80.0
As a buyer only[a]	20.0	22.9	6.4	28.3	29.4	20.1	6.7
As a seller only[a]	7.1	11.9	6.5	7.1	15.8	7.3	12.2
As both a buyer and a seller[a]	23.4	13.9	17.0	28.4	8.2	23.1	16.9

Source: CRITO Global E-Commerce Survey, 2002
[a] Percents based only on those establishments that have heard of the concept of an Internet marketplace

It is likely that manufacturing firms will deal through virtual markets, because it is common that manufacturers tend to form groups that collectively buy inputs at convenient prices and conditions. However, the financial and distribution companies have participated more extensively in e-markets, and mainly as buyers. This is not quite typical in the case of financial firms, since banks and insurance companies have used the web more intensely to sell their products and services. The same can be said about distribution because its constituent establishments are sellers par excellence.

Size does make a difference. SMEs participate more as both buyers and sellers than as large firms in e-trading communities do; their smaller size leads them to multiply and maximize their limited resources. Large establishments tend to be more akin to act as sellers than SMEs.

Extent of Use across Industry Sectors

The methods and purposes for Internet use were examined, and now it is in order to learn about the extent to which Mexican companies have used e-commerce in its two basic modalities, B-to-C and B-to-B. In this way, the broader trends and figures discussed earlier for the country as a whole can be assessed and placed in a proper dimension.

As Table 22 shows, the proportion of total sales via the Internet in each of the two modalities is notably low in both cases (5.7 and 5.8 per cent respectively), although it is three times as high when the two modalities are considered jointly (18.3 per cent). The proportions are low in reference to both the average for the full 10-country GEC sample and to the figures for the country as a whole discussed earlier in this paper. A caveat on this should be that national figures refer to revenues, and are in monetary terms, while those of Table 22 refer to number of establishments. In any event, the fact is that the differences are notably large.

TABLE 22
Online Sales by Business Enterprises in Mexico, 2002
(Percentages)

Modality [a]	Establishment Size		Sector			Total	
	SME	Large	Mfg.	Distrib.	Finance	Mexico	Global
B2B only	5.6	7.3	11.9	0.3	19.4	5.7	12.9
B2C only	5.9	3.2	5.1	6.7	1.2	5.8	7.1
Both B2B and B2C	18.2	21.1	6.3	26.8	13.5	18.3	15.0
Mean percent of total consumer sales conducted online (all establishments)[b]	2.4	3.2	2.5	2.4	2.2	2.4	3.8
Mean percent of total business sales conducted online (all establishments)[c]	4.5	4.5	3.0	5.1	8.3	4.5	4.0
Mean percent of total consumer sales conducted online (only those doing B2C sales online)[b]	10.1	13.5	22.0	7.2	14.9	10.2	18.6
Mean percent of total business sales conducted online (only those doing B2B sales online)[c]	20.3	16.4	21.1	19.1	29.4	20.2	15.1
Percent of web-sites that support online payment (only those doing online sales)	10.6	14.2	26.0	0.5	41.8	10.7	33.6

Source: CRITO Global E-Commerce Survey, 2002

[a] Percents are based on the full sample (all establishments). Exact wording of question: Are these online sales to other businesses or to consumers or to both?

[b] Exact wording of question: What percent of your establishment's total consumer sales are conducted online?

[c] Exact wording of question: What percent of your establishment's total business to business sales are conducted online?

The figures are even lower when considering the proportion of sales to consumers and to businesses conducted online by all the surveyed establishments (2.4 and 4.5 per cent respectively). However, they are higher when referring to those engaged exclusively in either B-to-B or B-to-C. In both instances, the proportions accounted for by B-to-C are half those by B-to-B. This is consistent with *Proposition 3,* in the sense that B-to-C accounts for a proportion of total e-commerce, arger than the figures implied by the overwhelming predominance of B-to-B over B-to-C at the country level.

From a sectoral perspective, Table 22 confirms trends pointed out and observations made in previous sections. Distribution companies are the most actively engaged in e-commerce in the

two modalities combined, and predominantly in B-to-C, given the predominance of retail over wholesale establishments. The predominance of B-to-B over B-to-C sales in the case of financial firms, in turn, substantiate the fact that e-banking and other financial online services are provided primarily to other businesses more than to individual customers.

Also as expected, financial firms show the highest proportion of websites supporting online payments (42 per cent); a rather more unexpected result is that the next highest proportion is presented by manufacturing establishments (26 per cent), given that distribution companies are supposed to have a closer and more direct contact with customers. Lastly, the fact that manufacturing companies account for the lowest proportion of online sales in the B-to-C and B-to-B modalities combined (6.3 per cent) is in line with the finding that manufacturing is the sector showing the lowest proportion of firms using the Internet for doing business vis a vis distribution and finance, as discussed for Table 16.

Finally, size is not a relevant feature here, for the proportion of online sales in both B-to-C and B-to-B is roughly the same for SMEs and large establishments. This applies to most of the other items, except perhaps for the proportion of websites that support online payment, of which large firms tend to have more in operation.

The picture is different in the case of services provided online. As Table 23 documents, business establishments in Mexico see the Internet as a tool for providing services much more than as a means for selling products. The proportion of services provided online to both consumers (B-to-C) and to other businesses (B-to-B) together (63 per cent) is three and a half times larger than in the case of online sales (18 per cent). That proportion is even twice the corresponding figure for the entire 10-country GEC sample (33 per cent).

However, the proportions of online services provided separately to consumers (6.1) or to other businesses (6.3) are roughly the same as in the case of online sales. This result is not consistent with the much higher figure for the two modalities combined and does not make much sense, for it means that nearly two thirds of the surveyed establishments do not provide services online separately to neither consumers nor to other businesses regardless of the industry sector they belong to.

On the other hand, as in the case of online sales (Table 22), the proportion of services provided online to consumers (11.4 per cent) is less than half that of services provided to other businesses (26.4 per cent). This result is also consistent with *Proposition 3*, for this proportion is much larger than the aggregate estimates for the country as a whole referred to in page 30 (0.16 per cent for B-to-C and 6.1 for B-to-B).

The results on Table 23 also confirm previous expectations about the proportion of services provided online by companies in each of the three industry sectors considered in the survey. Advertising via product catalogues is the service *par excellence* provided by distribution companies, while in the cases of manufacturing and financial firms the bulk is accounted for by product specification and access to account information, respectively. In all three instances, the results are similar for the full GEC sample, this meaning that the use of the Internet by business firms in Mexico for providing services is developing on a right track as they describe patterns similar to those followed by their counterparts in other more developed countries.

TABLE 23
Online Services Provided by Business Enterprises in Mexico, 2002
(Percentages)

Type of Online Service[a]	Establishment Size		Sector			Total	
	SME	Large	Mfg.	Distrib.	Finance	Mexico	Global
B2B only	6.1	12.9	13.8	0.1	14.3	6.3	23.1
B2C only	5.6	23.0	12.8	0.5	14.5	6.1	12.9
Both B2B and B2C	64.3	31.3	59.1	68.9	36.3	63.3	33.3
Mean percent of total consumer services conducted online[b]	11.4	10.6	4.6	13.5	18.4	11.4	7.6
Mean percent of total business services conducted online[c]	26.9	14.0	12.0	35.4	22.4	26.4	11.0
Manufacturing web sites which support[d]							
Product configuration	37.5	50.5	38.3	n. a.	n. a.	38.3	54.7
Order tracking	4.2	60.4	7.8	n. a.	n. a.	7.8	21.5
Service and technical support	37.5	70.3	39.6	n. a.	n. a.	39.6	54.4
Product specification	95.8	100.0	96.1	n. a.	n. a.	96.1	79.9
Account information	33.3	60.4	35.1	n. a.	n. a.	35.1	17.0
Wholesale/retail distribution web sites which support:[d]							
Gift certificates and/or registry	0.0	3.0	n. a.	0.1	n. a.	0.1	20.6
Product catalogue	100.0	100.0	n. a.	100.0	n. a.	100.0	69.8
Product reviews	33.9	35.3	n. a.	34.0	n. a.	34.0	48.6
Individual customization	32.9	0.0	n. a.	32.4	n. a.	32.4	21.3
Account information	32.1	51.5	n. a.	32.4	n. a.	32.4	21.7
Banking and insurance web sites supporting:[d]							
Online services such as filing applications, filing claims, paying bills, transferring funds	34.0	67.3	n. a.	n. a.	35.9	35.9	53.9
Access to account information	67.0	73.5	n. a.	n. a.	67.4	67.4	57.3
Online tools such as research tools, planning tools, etc.	67.0	32.7	n. a.	n. a.	65.1	65.1	52.0

Source: CRITO Global E-Commerce Survey, 2002

[a] Percents are based on the full sample (all establishments). Exact wording of question: Are these online services to other businesses or to consumers or to both?

[b] Percents are based on the full sample (all establishments). Exact wording of question: What percent of your establishment's total services to consumers are conducted online?

[c] Percents are based on the full sample (all establishments). Exact wording of question: What percent of your establishment's total services to businesses are conducted online?

[d] Percents are based on only those establishments which have a web-site and conduct business within the specified sector.

The extent and variety of the services provided does vary with establishment size. SMEs are twice as active as large firms are in providing B-to-B and B-to-C jointly. This is in line with the results of surveys conducted in Mexico by Select-IDC in the sense that the smaller the company the more prone and able it is to engage in e-commerce given its greater flexibility and manageability vis a vis large corporations (Palacios, 2003a). The fact, however, is that it does contradict *Proposition 2*. When it comes to provide either of the two modalities of e-commerce separately, large firms are substantially more active than SMEs. By sectors, a pattern defines itself in the sense that the proportion accounted for by online services is consistently higher in large firms than in SMEs in the three sectors.

The above conclusions are reinforced by the results presented in Table 24, which shows that substantially more SMEs use the Internet for purchasing their inputs, supplies and equipment

than large establishments. In general, the use of the Internet for procuring inputs is much more extended in Mexican companies than in the other countries in the study as reflected in the global mean.

On a sectoral perspective, Table 24 shows that distribution is the sector where e-procurement is practiced most extensively, which means that retail and wholesale establishments use the Internet much more regularly for purchasing their wares than manufacturing and financial firms. They do so at an extent that actually appears very large—nearly twice that for the full GEC sample—for a developing country that has reached only a limited development of e-commerce like Mexico. Conversely, manufacturing is the sector where online procurement shows the lowest proportion, which is not consistent with the fact that it is also the sector where procurement is a typical function, far more than in finance and distribution.

With regard to size, SMEs are more active in e- procurement than large establishments, except in the case of the proportion of money spent in direct goods for production ordered online. This also contradicts *Proposition 2*.

TABLE 24
Online Procurement by Business Enterprises in Mexico, 2002
(Percentages)

Category	Establishments					Total	
	Size		Sector				
	SME	Large	Mfg.	Distrib.	Finance	Mexico	Global
Establishments doing online purchasing[a]	71.4	55.9	39.0	92.1	59.6	71.0	50.8
Mean percent of money spent for direct goods for production is ordered online (all establishments)[b]	8.9	13.6	9.2	n. a.	n. a.	9.2	8.3
Mean percent money spent on goods for resale is ordered online (all establishments)[c]	19.3	8.4	n. a.	19.2	n. a.	19.2	6.8
Mean percent of the money spent on supplies and equipment for doing business is ordered online (all establishments)[d]	12.8	12.7	10.1	15.1	6.4	12.8	8.3

Source: CRITO Global E-Commerce Survey, 2002

[a] Percent based on all establishments.

[b] Question asked only to those in the manufacturing sector; percent based on all manufacturing establishments Exact wording of question: What percent of the money your establishment spends on direct goods for production, such as parts and components, is ordered online?

[c] Question asked only to those in the wholesale/retail distribution sector; percent based on all wholesale/retail establishments. Exact wording of question: What percent of the money your establishment spends on goods for resale is ordered online?

[d] Percent based on all establishments. Exact wording of question: What percent of the money your establishment spends on supplies and equipment for doing business is ordered online?

In sum, e-commerce has spread to a varied extent and in different modalities over Mexico's major industry sectors. Although the extent is limited in general, it is encouraging that in many respects it is equal or above the figures corresponding to the 10-country GEC sample. This is an encouraging finding that is at odds with the belief that e-commerce has reached only a limited extent in Mexico, as indicated by national estimates. It is therefore a valuable insight for assessing the efforts to develop this new way of doing business in this developing country.

Diffusion of the E-Commerce Industry

The spread of e-commerce practices so far has resulted in the creation of diverse companies specializing in business solutions based on the Internet, as well as other web-based systems such as EDI and extranets, e-retailing, web development, consulting, web hosting, and web applications. All these ventures and business initiatives have jointly given raise to the emergence of a whole new e-commerce industry as a separate sector in the Mexican economy. The ensuing pages describe this fledgling industry.

E-Retailing Companies

In the heat of the dot com boom, a large number of e-companies were created in Mexico in the second half the 1990s. Many failed and disappeared, while others learned the lessons and were able to survive the burst of the dot com bubble at the turn of the century.

In spite of the explosive growth those years of U.S. based world icons like Amazon, eBay, and Yahoo, a good number of virtual retail stores and search engines were set up in Mexico. Table 25 lists some of the most successful of those companies that are presently operating (mid 2003).

TABLE 25
Domestic E-commerce Engines and E-tailers, 2003

Commercial Name	URL
Acambio.com	www.acambio.com
CompraVirtual	www.compravirtual.com.mx
Recompras	www.decompras.com
El Palacio de Hierro	www.totalmente.com.mx
E-Shop	www.tecnofin.com.mx/eshop
Esmás	www.esmas.com
Esmás Compras	www.esmascompras.com.mx
Infocity	www.infocity.com.mx
Libros Jovellanos	www.j-libros.com
Mercado Libre	www.mercadolibre.com.mx
Mexico Web	www.mexicoweb.com.mx
Mexmal	www.mexmal.com
Mexplaza	mexplz.mexplaza.com.mx
MiCiudad.com	www.mensajeroweb.com
Sanborn's	www.sanborns.com.mx
Todito	www.todito.com
Virtual Plaza	www.virtualplaza.com.mx

Source: Various local and national newspapers, phonebook yellow pages, CANIETI Directories, and Curry et al. (2001)

Some of these companies—e.g. DeRemate, which has a direct link to T1msn, to be discussed shortly— either are part of a larger portal or offer links to portals. Others are only a website set up and operated by large distribution firms like El Palacio de Hierro, one of Mexico's largest department store chains, or Sanborn's, a restaurant/department store chain that is part of Grupo Carso owned by Carlos Slim, the richest man in Latin America who also owns Telmex. Others are quasi-portals, like Mexplaza and Mexmal. Mexmal is a wholesale distributor of PCs, maker of Alaska computers, and owner of the brand. Its website includes links to a business center and to other subsidiaries owned by NextRed, which provides web hosting, Internet access, and private service networking services, and Metrix, which offers connectivity support services.

A number of advertising engines complement the services of the above companies. Table 26 lists some of the most important, including their respective URLs.

In addition to e-tailers and search engines, a large and growing number of individual companies have set up and now operate websites and even portals for both B-to-C and B-to-B transactions. As noted before, some 15,000 websites were estimated to be in operation in early 2001 (García, 2001).

Given their size and potential, and the fact that they are quasi portals, the websites set up by the major banks operating in Mexico deserve a special comment. The most comprehensive and sophisticated of those portals are those developed and run by the two main banking institutions: Banamex, virtually owned by Citigroup, and BBVA Bancomer, owned by Spain's Banco Bilbao Vizcaya Argentaria. Other relevant cases include Bital, Scotiabank-Inverlat, and Santander, the last two owned by the corresponding Canadian and Spanish corporations.

TABLE 26
E-Advertising Engines, 2003

Commercial Name	URL
Anuncios de Ocasión	www.anunciosdeocasion.com.mx
Avisos El Norte	www.avisos.elnorte.com.mx
Avisos La Palabra	www.avisos.palabra.com.mx
Avisos Mural	www.avisos.mural.com.mx
Avisos Reforma	www.avisos.reforma.com.mx
Clasificados Terra	www.clasificados.terra.com.mx
Enlace Avisos	www.enlace.net/avisos
Inter Clasificados	www.anuncios.interware.com.mx
Sección Amarilla	www.seccionamarilla.com.mx
Usadito	www.usadito.com.mx

Source: Various domestic newspapers and phonebook yellow pages.

Banamex's portal was originally named Pl@za and later renamed Mercado Empresarial Banamex. It is primarily an online sales and marketing channel, which provides members access to the bank's more than 200,000 customers, organized in a company directory (mercadoempresarial. banamex.com).

In turn, BBVA Bancomer is even more comprehensive, because in addition to e-banking, this portal offers business solutions to companies, corporations, and governments. This includes access to services that can enable customers to provide e-commerce and e-banking services to their own customers at a cost less than one tenth of that which they would bear if they were to provide the service directly (www.bancomer.com.mx).

Online services provided by banks typically include: access to account balance information, transfers between accounts, payments to suppliers, payment of taxe, basic service bills (e.g., phone, electricity, cable TV), payroll payment and management, credit card and account management, and portfolio investment management.

As to portals proper, T1msn is perhaps the most comprehensive. A joint venture between Telmex and Microsoft, T1msn's reach transcends Mexico and extends into Latin America and

the Caribbean, including the large and rapidly growing Spanish-speaking market in the United States. In 2000, T1msn signed an agreement with Fiera.com, a major provider in South America. Since signing, it has been the exclusive e-commerce channel in Chile, Colombia and Argentina, where Telmex has been expanding its telecomm business (Guadarrama, 2000). Table 27 lists the names and URLs of the most comprehensive portals in operation in Mexico, including T1msn.

E-Commerce Development and Support Activities

Parallel to Internet-based retail stores, portals and search engines, a large number of companies have been created in Mexico in the last decade that provide specialized services in: business consulting, web hosting, web development, web applications, business solutions, Internet access, e-commerce solutions, data mining, market research, and, more recently, business intelligence. Home grown, domestic start ups run by Mexican engineers and business specialists predominate over subsidiaries and affiliates of multinational firms that also vie to tap Mexico's growing e-commerce and business solutions markets.

TABLE 27
Domestic Portals and Advertising Engines

Commercial Name	URL
Esmás	www.esmas.com
Mexico Web	www.mexico.web.com.mx
Mexplaza	mexplz.mexplaza.com.mx
Terra	www.terra.com.mx
Todito	www.todito.com
T1msn	www. t1msn.com.mx
Universo Online	www.uol.com.mx

Source: Various local and national newspapers, phonebook, yellow pages, CANIETI Directories, and Curry et al. (2001)

The top market research firms are Select and IDC de México, which up to August 2002 used to form a joint venture called Select-IDC. These are the main providers of consulting services and market research studies in Mexico, in competition with international firms like eMarketer, Gartner, the Boston Consulting Group, and PricehousewaterCoopers.

Table 28 presents a listing of the top players in the e-commerce, business solutions, and applications provider markets in Mexico. It includes world leaders like Microsoft, Oracle, Ariba, and SAP, as well as major domestic competitors like NetSolutions, PSINet, Softtek, and Tecnofin. As can be observed, six out of ten are domestic start ups, a proportion that seems to be growing.
Most of these companies offer more than one of these services. A typical package of services include: web hosting, e-commerce solutions (website design, set up, and operation), Internet access and connectivity, web security, and business applications.

One particular case that illustrates the nature and quality of the services provided by domestic companies is that of Net Solutions, a subsidiary of Internetworking Solutions, a consulting Mexican firm specializing in IT environment integration. Net Solutions is an Internet service provider and solutions integrator, and a leader in corporate telecommunication services and integrated e-business solutions (www.netsolutions.com.mx). The services it provides include:

dial-up connection, leased lines, DirecPC, Lan-modems, server hosting, web hosting, web design, e-commerce, e-mail services, domain registration, and network creation and administration. Its e-commerce solutions (priced at $650.00) include a shopping cart supporting:

- Multiple languages
- Multiple payment methods (credit card, bank deposit, wire transfer)
- Multiple shipment methods (programmable database with information from FeDex, UPS, DHL)
- Discount system on the basis of volume or coupons
- Internal search engine
- Unlimited simultaneous buyers
- Automatic shipment costs & taxes calculation
- Order notification via e-mail
- Online order tracking system
- Statistics of access and sales
- SSL security support
- Encrypted order information
- Detailed product specification
- Business appearance control

TABLE 28
Major E-Business Solutions and Applications Providers, 2003

Domestic companies	Affiliates of foreign firms
areaB2B	AdNet
Aspel	Ariba
BIS Soluciones	Cognos
Blendo	DSS de México
bNexus	eBrainstorm
Cosmocomunicación	IDC de México
Datavisión Digital	J D Edwards
e-Advice Consulting	KPMG Consulting
EMC2	LatinB2B
Grupo Mac's	Microsoft
Internetworking Solutions	MicroStrategy
Kybos	Modus Media International
Levicon Sistemas	NetValue
Online Systems	Oracle
Optima Technology	PeopleSoft
Net Solutions	PriceWaterHouseCoopers
PSINet	SAP
Punto.com	
Select	
Simbiótica	
Softtek	
SSA Global Technologies	
Tecnofín	
Via Net.Works México	
Vox México	

Sources: *Empresa-e*, *Mundo Ejecutivo*, and *Mural*, various numbers; CANIETI directories; and, direct web searching by the author

At the alleged higher end of the IT pyramid, Business Intelligence (BI) is one of the hottest segments of the business solutions market in Mexico. It generated revenues of $18 million in 2002, a figure that is estimated to top $26 million by the end of 2003 (*Empresa-e*, 2003). The main players of the BI market include affiliates of foreign firms like DSS, Cognos, Oracle's BI Division, and MicroStrategy. Domestic competitors, and in many cases partners of the

latter, include Softtek Consultores, SSA Global Technologies, Kybos, BIS Soluciones, and e-Advice Consulting Group**.**

Finally, Table 29 lists the major providers of web hosting services presently in operation according to Nic-Mexico. Others like NextRed, a subsidiary of Mexmal, and a number of those listed on Table 28 are to be added to this set. As in the previous listings, most of the companies included provide a wide variety of services besides web hosting.

TABLE 29
Major ISPs Providing Web Hosting Services by Number of Hosts (descending order) (as of March 2002)

Telmex (Prodigy - Triara)	Urbano Web Hosting	Web Comunicaciones
Inter Planet	Espacios de México	CNC Hosting Services
Terra (Infosel - Terra b2b)	Net Corps	Quik México
AT&T - Alestra	Grupo Busca	Axtel
Via Net.Works México	Asinet	Ragnatela Internet
Network Solutions Inc.	Nameserve Systems	Megared
Rapidsite	Inter.net México	PSInet México
Podernet	InterVAN	Enternet
Register.com	MPS net	Avantel
Adetel	Secure Network	Red Tecnológica Nacional

Source: NIC-Mexico (2003b).

In synthesis, Internet use in general and e-commerce in particular have spread over the Mexican economy to an overall limited extent, which is nonetheless not much different to that reached in more economically and technologically advanced countries. Moreover, the extent reached at the level of individual industry sectors is significantly larger than that indicated by national figures.

On the other hand, a greater proportion of websites built and run by business establishments operating in Mexico support a wider variety of services in the three sectors considered in the study. Likewise, the volume of sales via the web conducted by companies doing B-to-B, accounts for a higher proportion as compared to the rest of the 10-country sample. The same occurs in many other results of the survey.

In other respects, though, Mexico is lagging behind in customer care and after-sales services and support. Nonetheless, Internet use is more common in the provision of services than in the sale of products. Here, too, the proportion reached in Mexico is twice that of the global average. A similar case occurs with regard to online sales. This supports the idea that the Internet is evolving from a mere advertising tool (still is so for over 70 percent of the surveyed establishments) to a new market weapon for competing with existing distribution channels.

Finally, diffusion is not homogeneous across industry sectors and so does not show a regular pattern. These rather erratic results can be explained in principle by the incipient character of e-commerce development in Mexico, as well as by the limitations the GEC survey may have with sampling scope, as do all surveys.

IMPACTS OF THE INTERNET AND E-COMMERCE

Although the development of e-commerce in Mexico so far has been rather limited, the process has already left an imprint on the firms and industries where it has flourished. More specifically, there is ground to say that the use of the Internet exerts a significant and positive influence on the companies that use it for conducting business. This occurs in the form of both improved productivity and an enhanced flexibility to respond to demand signals; all this is reflected in a visible expansion of sales volume and revenues. Table 30 shows the results of the GEC survey on this issue.

TABLE 30
Impacts of Doing Business Online, 2002

Impact[a]	Establishment Size		Sector			Total	
	SME	Large	Mfg.	Distrib.	Finance	Mexico	Global
Internal processes more efficient	53.6	50.5	33.1	68.0	34.0	53.5	33.9
Staff productivity increased	37.3	45.3	37.4	37.4	40.2	37.5	27.2
Sales increased	36.9	14.2	25.8	43.0	33.7	36.2	20.5
Sales area widened	25.6	21.0	17.1	31.1	20.4	25.4	31.4
Customer service improved	55.0	54.7	43.3	61.8	60.3	54.9	34.8
International sales increased	19.9	15.7	31.0	12.7	19.7	19.7	19.5
Procurement costs decreased	19.8	29.3	21.5	19.1	20.4	20.0	17.7
Inventory costs decreased	13.5	21.5	15.5	13.2	7.4	13.8	14.0
Coordination with suppliers improved	50.6	55.0	34.2	62.1	39.9	50.7	29.8
Competitive position improved	45.3	40.0	38.1	49.9	40.3	45.1	29.8

Source: CRITO Global E-Commerce Survey, 2002

[a] Exact wording of question: Using a 5-point scale where 5 is "a great deal" and 1 is "not at all", please rate the degree to which your establishment has experienced the following impacts since it began using the Internet for business. A score of 4 or 5 was classified as "high impact".

First, it is significant to observe that the practice of e-commerce in Mexico has had a stronger impact than in the 10 countries of the full GEC sample taken as a whole. Such an impact has consisted in improvements in crucial company functions such as customer service, internal business processes, coordination with suppliers, and the companies' competitive position, in decreasing order.

A similar pattern is seen when assessed by sector. Such is the case of financial firms and distribution establishments, with the difference being the latter. The greatest impact of e-commerce has been on the improvement of internal processes, followed by the improvement in the coordination with suppliers. It is relevant that this occurred largely irrespective of size in the case of the four areas where the impact of e-commerce has been strongest as discussed in the previous paragraph. This result, though, is not consistent with the idea that the smaller the company, the easier is for new technologies and business models to induce changes in their organizational procedures and structures.

The fact that the strongest impact has been on the improvement of customer services conflicts with the finding on Table 23 in the sense that order tracking is the second least developed service provided online, thereby revealing a limited capability of Mexican websites for supporting customer care services. In any event, it is positive that the use of the Internet is resulting in an improved capability of businesses to perform this important function.

It is also positive that almost half of the surveyed establishments reported that doing business online has resulted in a sizeable improvement in their competitive position in general, because it means that their structures and capabilities have all improved.

Finally, *Proposition 1* is endorsed by the fact that the impact on the increase of international sales in Mexico has been the same as in the 10 countries of the GEC sample. This means that Mexico-based businesses respond to global demand in the same proportion as those based in some of the most developed countries in the world, e. g. the United States, Germany, Japan, Denmark and Singapore.

The other areas where the effects of e-commerce have been as strong, and also stronger than the full 10-country sample, are related to the number of distribution channels and competitors, including the intensity of the competition faced by the companies interviewed in the survey (Table 31).

TABLE 31
Impacts of Doing Business Online, 2002

Area of Impact[e]	Establishment Size		Sector			Total	
	SME	Large	Mfg.	Distrib.	Finance	Mexico	Global
No. of distribution channels increased	55.8	52.1	43.6	62.5	65.6	55.7	40.2
No. of suppliers increased	50.8	57.9	41.9	56.4	56.9	51.0	29.9
No. of competitors increased	37.8	36.3	29.0	43.7	33.3	37.8	27.9
Intensity of competition increased	56.7	43.4	39.8	68.1	40.5	56.3	41.5

Source: CRITO Global E-Commerce Survey, 2002

[e] Exact wording of question: Please indicate whether the following have increased, decreased or stayed the same in your establishment since it began using the Internet for business.

The use of the Internet for commercial purposes in Mexico has led, above all, to the intensification of competitive pressures for companies and an increase in the number of distribution channels; in both instances, much more than in the 10 countries in the GEC survey taken as a whole. This confirms the notion that the Internet generally leads to a reduction of entry barriers, thus opening the way for new competitors to enter existing and new markets, as it provides access to information on existing products and services, as well information on producers and providers on a global scale. Therefore, both the intensity of competition in local and global markets and in the number of competitors can be expected to increase. However, as Table 31 shows, this latter expectation is not met in this case, since this is the area where the impact of e-commerce is lowest in Mexico. A mixed occurs in this case.

Distribution is the sector where the impacts of e-commerce have been most significant, and manufacturing being the one where impacts have been lowest in all areas vis a vis both distribution and finance. The intensification of competitive pressures has occurred mainly in markets where distribution establishments operate. This explains why the second largest impact of e-commerce on the latter has translated itself into an increase in the number of distribution channels. This is the area where the impact has been strongest in the case of financial firms, a rather odd result given that banks and insurance companies do not have distribution channels but only service outlets.

Establishment size makes a difference only in the two areas related to competition, where SMEs have been more reactive and as a result have seen both the intensity of competition and the number of competitors increased as they have adopted e-commerce solutions.

In sum, the impacts of e-commerce in Mexico have been significant in themselves and in reference to the corresponding figures for the full 10-country GEC sample. This means that this new way of doing business is delivering the expected benefits, particularly by intensifying competition and improving key company functions such as customer service, internal business processes, coordination with suppliers, and the companies' competitive position.

Therefore, these results show that the Internet is fulfilling its purpose of providing access to information on products and markets, and thereby reducing entry barriers for new competitors. They are paradoxical, though, concerning the number of competitors, which on the one hand can be expected to decrease as competition intensifies, but at the same time to increase as entry barriers are reduced and even eliminated by the Internet.

In any event, the foregoing observations provide ground to the observation that the practice of e-commerce results in substantial improvements in all areas and functions of the companies that use the Internet for doing business, instead of just helping them to expand sales volume and enhance marketing capabilities.

CONCLUSIONS

The practice of electronic commerce in Mexico has spread over the last decade into an already sizeable and growing number of companies of all sizes across various industry sectors of the Mexican economy. Mexico's telecommunications infrastructure has been extended over this period constituting a solid platform for the deployment of Internet-based technologies that has made such spread possible. The consistent growth observed in Internet hosts and users, as well as in installed PCs, attests to this assertion. Mexico is now prepared thus for the growth of e-commerce and seems to be so for the continuation of the process into the near future.

The above is reflected in the finding that the use of the Internet by business establishments in Mexico is much more extensive than what the estimates of e-commerce revenues for the country as a whole indicate. This changes the usual perception that e-commerce in Mexico has grown only to a limited extent, and thus should serve to orientate accordingly promotion campaigns and government policies aimed at the development of e-commerce.

In line with the above, it is significant that business establishments operating in Mexico outperform those in other countries included in the GEC survey regarding key aspects such as the use of e-mail, the construction and management of websites, the deployment and operation of EDI networks, and the improvement in their competitiveness, efficiency, and productivity.

According to the expectation put forward in the second section, it was confirmed that finance is the most advanced sector in e-commerce adoption and development. This constitutes a fundamental finding of this study. Financial firms and institutions turned out to be both the

most globalized ones and those accounting for the highest proportion of business establishments that use the Internet for conducting commercial transactions. They also present the highest figures concerning the use of Internet-based technologies like e-mail, extranet, and electronic fund transfer and are the most advanced in areas such as systems integration and spend the highest proportion of their operating budget in information systems.

Conversely, and contrary to the expectations posed in the second section, manufacturing establishments turned out to be the least advanced sector regarding e-commerce adoption and development, with distribution companies lying in the middle. Therefore, the point is that finance stood out as the sector where e-commerce has developed most in Mexico vis a vis manufacturing and distribution, similar to the Brazilian case (Bastos Tigre, 2003).

On the other hand, although the influence of size does not follow a regular pattern across all the sectors and all the aspects of e-commerce diffusion and impacts discussed in the paper, it was found that the size of establishments does matter in most of those aspects. The main exceptions are the proportion of IS budgets spent in web-based technologies and the proportion of IS budgets spent on web-based technologies and solutions, where size makes no significant difference. The other exception concerns the use of e-commerce technologies where it makes a mixed difference. These results indicate that private sector promotion campaigns and government policies and projects should be differentiated by establishment size in order to be effective.

Based on the foregoing discussion and on the results of the GEC survey discussed in this paper in general, the test of the propositions set forth in second section can now be summarized in the following paragraphs.

Proposition 1: Global, more than domestic factors drive the spread of e-commerce in Mexico

This proposition was endorsed by the indicators of the degree of globalization shown by business establishments operating in Mexico (percent of companies with headquarters abroad, of total sales from abroad, and of total procurement spending from abroad), which are above those for the 10 countries in the GEC sample taken as a whole (Table 8). Likewise, the fact that Mexico-based businesses respond to global demand in the same proportion as those based in the other countries included in the survey, which include some of most developed in the world further support this proposition. Moreover, the results reported on Table 31 about the impact on the increase of international sales in Mexico being the same as in the GEC survey's global sample also attest to this trend.

The overwhelming predominance of B-to-B transactions in Mexico is indicative of the important role played by MNCs as one of the main drivers of e-commerce in this country. Their subsidiaries were among the first and appear to be the most active users of the Internet for commercial purposes. The participation of these subsidiaries in continental and global production networks further reinforces the importance of MNCs.

Therefore, there is ground to conclude that it has in fact been global more than domestic forces which have driven e-commerce growth in Mexico, and that *Proposition 1* is confirmed by the

evidence in this respect discussed in this paper. This proposition is further supported by the fact that the most advance sector in e-commerce practice is, at the same time, the most globalized one, i.e. finance.

Proposition 2: Micro and small enterprises are the least likely ones to engage in e-commerce vis a vis larger establishments

As argued in Second section, SMEs represent a doubled-sided phenomenon in Mexico. On the one hand, they are presently an inhibiting factor for e-commerce given the precarious resources and conditions most of them face, which is aggravated by the fact that a large proportion operate in the informal economy. On the other hand, SMEs constitute a large pool of opportunities given the flexibility allowed by their small size and the possibilities open to them by ASPs to have access to Internet-based business applications at a low cost. Nevertheless, the former side was considered more likely and so the proposition was advanced that SMEs have less chances for embracing Internet-based technologies and solutions.

The results of Tables 9 and 10 endorsed this proposition. Large establishments outperform SMEs in most items related to the use of Internet technologies, mainly regarding the use of intranets, call centers and combined EDI. Likewise, large firms show higher degrees of system integration in general, given that they have more resources and a more developed business culture than SMEs. This applies in particular to the case of integration of internal information systems with Internet-based applications.

However, data on Table 12 does not seem to support *Proposition 2*, at least for the time being. SMEs spend a significantly higher proportion of their revenues in information systems than larger firms, which indicates that they are increasing the use of these systems and extending use of Internet-based technologies like e-commerce at a pace faster than large firms. Moreover, the proportion of their IS budget spent by SMEs in web-based technologies and solutions is already roughly the same as that spent by large firms (Table 13).

A similar case occurs in Table 23, where SMEs appear twice as active as compared to large firms in conducting B-to-B and B-to-C deals jointly. Although, large firms are substantially more active than SMEs when considering the two modalities of e-commerce separately. As such, the former result is reinforced by the fact that many more SMEs use the Internet for purchasing their inputs and equipment than large establishments, and that SMEs are more active in e- procurement than large establishments (Table 24).

The above results are quite encouraging and indicative of the vast potential lying in the SME population for e-commerce to grow in the end. However, they also illustrate the double-sided character of the SME phenomenon and the fact that testing *Proposition 2* cannot be conclusive, but rather of a mixed nature, as it is the phenomenon it alludes to.

Proposition 3: B-to-C e-commerce has grown more at the sectoral level than at the national level

To begin with, this proposition is substantiated by the fact that the proportions of sales conducted online by all the surveyed establishments accounted for by B-to-C are half those by B-to-B (Table 22). This proportion is larger than the one implied by the figures on total e-commerce activity at the country level discussed in Fourth section.

Likewise, B-to-C transactions represent about half the proportion accounted for by B-to-B deals regarding the provision of services to both businesses and consumers via the Internet (Table 23), which is a proportion much larger too than the estimates for B-to-C for the country as a whole, referred to in fourth section.

In addition, as observed in Table 18, the most common reason business enterprises in Mexico have for using the Internet is for advertising and marketing their products and/or services to individual consumers, much more than in the 10 countries of the GEC sample. It follows, then, that companies use the web mainly for conducting B-to-C transactions. This is reinforced by the inference made when discussing Table 18 that the smaller the firm the higher the propensity for it to use the Internet as a commercial tool for advertising and marketing purposes, a view that SMEs account for the large bulk of business establishments in Mexico.

A limiting circumstance for the above arguments endorsing *Proposition 3*, however, may be that online sales (B-to-C) were reported as the least important, and that buying online (B-to-B) the second most important reason for businesses to use the Internet (Table 18).

In any event, it can be concluded that the evidence at the level of industry sectors examined in the previous sections does confirm *Proposition 3*.

Proposition 4: Government policies are essential for e-commerce growth

The information at the country level examined in the first part of Third section of this paper validates in principle this proposition. It showed that a solid telecommunications infrastructure is in place, thereby making Mexico ready for e-commerce.

At the level of industry sectors, however, companies did not report government policy measures such as requirements and incentives as compelling factors to use the Internet to do business (Table 14). The surveyed companies deemed the following much more powerful drivers: improving coordination and communication with customers and suppliers, entering new markets and expand existing ones, and reducing production costs. They did not even mention telecommunications infrastructure, and thus Internet connectivity, as a significant factor.

This latter point can be interpreted in the sense that business establishments in Mexico do not realize the importance of infrastructure because they take for granted that one already exists extensive enough for Internet connectivity not to be an inhibiting factor for e-commerce to take place, as discussed in Third section. More specifically, the results in Table 14 can be

interpreted as implying that government policies on telecommunications infrastructure do constitute an essential, although passive element for businesses to engage in e-commerce activities.

In sum, there is not sufficient ground to assert that government policies in general are essential for business establishments to engage in e-commerce in Mexico; they are only in an indirect, implicit way and mainly regard Internet infrastructure. Therefore, *Proposition 4* is only partially supported by the evidence examined at the level of industry sectors in Third section.

Proposition 5: The existence of an adequate legal framework is a crucial condition for e-commerce to develop

The evidence presented in Table 15 clearly substantiates this proposition. The factors related to the legal framework were deemed as the highest barriers for companies in Mexico to use the Internet for commercial purposes. Concern about security and/or privacy of data, and inadequate legal protection for Internet purchases were ranked as the most significant barriers by the surveyed establishments, while others like taxation of Internet sales and the perception that business laws do not support e-commerce practices were also considered as significant factors.

Moreover, the above occurs with more intensity in Mexico than in the ten countries included in the GEC. This indicates that businesses are more concerned about legal protection in this country than in the other nine in the sample, which further reinforces the argument that *Proposition 5* does hold.

In synthesis, and based on the foregoing discussion, it can be stated that the use of the Internet for doing business has been working in the expected direction in Mexico and has so far lived up to its promises. By providing equal access to all market players, it is eliminating entry barriers and intensifying competition. At the same time, it is leveling up competitiveness in domestic markets insofar as it is a new technology available to all companies in all industries.

As discussed in the second section of this paper, the adoption of e-commerce solutions and strategies is exerting a substantial impact on both the corporate structure, efficiency, and productivity levels of some of Mexico's top industrial conglomerates, which is projecting a strong demonstration effect over the rest of the country's business population. SMEs, in turn, are investing more in information systems and are thus progressing rapidly in the adoption of Internet-based business solutions. Pointing in the same direction is the fact that the highest impacts of e-commerce practices were in the improvement of the companies' competitive position and in the efficiency of their internal processes, which implies that the Internet has allowed them to create unique advantages in products, content, and processes.

In spite of the Janus-faced character of the SME phenomenon, the prospects for this segment of Mexico's business population are encouraging according to the results of the GEC survey examined in this paper. In consequence, it will be sound to place small and micro businesses

among the main targets of both promotion campaigns and government policies, for it is in this segment where the largest potential for e-commerce growth lays in Mexico. This confirms the arguments advanced in this regard in previous reports by the author (Palacios, 2003a; Palacios and Kraemer, 2003). The possibilities are therefore wide and open for government policies providing direct support to SMEs.

What is required, though, is that SMEs, and businesses of all sizes, realize that the benefits of using the Internet cannot be reaped by adopting it just as a new technology, but by using it correctly tapping the business opportunities it brings along. Also required is the realization that it is not enough to set up a website and wait for profits and success to come, but that in order to have the latter it will be necessary for companies to embark on a thorough transformation of their organizational structures and business outlook and culture.

As Ricardo Zermeño, Director General of Select and one of the most informed and capable specialists in IT markets in Mexico has observed, the problem has been on the supply side, since demand has continued to thrive and grow. What is lacking, he argues, is a sound idea of what organizational change is about in the Internet era; a more comprehensive business outlook that allows them to take into practice that idea and transform accordingly their businesses; a modern entrepreneurial vision that lets them understand the true role of technology and how it can help improve the companies' strategic positioning and competitiveness.[14]

The keyword, therefore, is transformation. As John Elkington (2001: xi) has put it, "…the global economy is entering a protracted period of profound metamorphosis. Economic, social and environmental pressures are converging at a time of growing global interdependence to create the conditions for an era of dramatic technological, corporate and market transformation."

This statement is consistent with the news that e-commerce has become a dirty word, in the sense that what is in order now is to talk about e-business instead, which implies a more comprehensive, transformative approach. As a keen analyst observed:

> "….e-commerce is a dirty little word we used to use to describe transactions made online. We also used it to lump in what companies did in their networks to make themselves e-ready….E-business, on the other hand, sounds more like a complete infrastructure approach….Somehow e-commerce has gotten itself latched onto the failing dot-com economy. Tell your execs you want to beef up your e-commerce network right now and they'll probably offer you a pink slip. However, tell them you want to make a strategic move into e-business and you might be promoted" (Gittlen, 2001).

Looking to the future, the development and eventual maturation of e-commerce will require broadening current, conventional views about what this word means to widen the concept behind it and think of e-business instead. Only in this way, will companies of all sizes take all the required steps to effectively transform their structures, strategies and organizational practices, and go beyond the limited tactic of simply setting up a website.

In the same way, it will require the implementation of aggressive promotion and information campaigns by both the public and the private sectors about the benefits of Internet use. They

[14] Interview with Dr. Zermeño on July 02, 2003.

will have to make clear to businesses of all sizes that the Internet is nothing more than a technology, although one that may become a powerful instrument enabling them to improve their entire corporate structure, resources, and organizational practices, and making them more competitive and able to generate value more efficiently. As Porter (2001: 6) put it: "The creation of true economic value once again becomes the final arbiter of business success."

Moreover, and drawing further on Porter, it can be said that the Internet is still a source of advantage in Mexico, since only a limited number of companies use it so far. This advantage will tend to disappear, however, as more businesses embrace it. This should be made clear too in the campaigns suggested above, so that managers and entrepreneurs become aware of the benefits the adoption of this technology can produce, especially for early adopters. They will also have to be aware of the fact that the use of the Internet as a business tool tends to erode profits as it shifts power to consumers. As Taylor & Therune (2001; 7) have pointed out: "Internet-enabled consumers [are] some of the most powerful people in the world."

Finally, it seems to be in order to conclude raising some critical questions about the implications and impacts of the Internet, which may help to set the stage for both furthering the findings presented in this paper and for opening the way for future studies in this direction. We should then ask who is actually capturing the benefits created by e-commerce? Are profits actually shrinking with e-commerce? To what extent are companies able to reap part of the value they create by using the Internet for commercial purposes? Can value creation be compatible with sustainable business development? What are the benefits of e-commerce for society at large?

APPENDIX

THE CASE OF THE ELECRONICS INDUSTRY SUBSECTOR[15]

Background and Evolution

The electronics industry has experienced a rapid growth in Mexico over the last decade, and has become a major player in the country's economic landscape. It accounts for 0.5 per cent of the Gross Domestic Product (GDP), as well as 26 percent of total exports and 20 percent of total imports, thereby constituting Mexico's top exporting and importing industry (SECOFI, 2000).

Moreover, this industry accounts for as much as 5.8 percent of GDP and nearly one third of exports in the manufacturing sector (Table A1). It is therefore the top exporting manufacturing activity, followed by automobiles and textiles and apparel, with 22 and 8 percent, respectively (Secretaría de Economía, 2002a: 13).

TABLE A1
The Electronics Industry in the Manufacturing Sector, 2001
(Percentages)

Variable	Share
Gross Domestic Product	5.8
Employment	9.2
Exports	30.0
Wages & salaries	9.0
Investment	10.0
No. of companies	1.0

Source: Secretaría de Economía (2002: 8)

In 1999, the electronics company population exceeded 1,400 establishments, up from 1,267 in 1992, of which over half operated under the in-bond (*maquiladora*) regime and the rest under other regimes. The figure grew consistently over the 1990s, except for the slump in 1995 caused by the crisis unleashed by the peso devaluation of December 1994 (Table A2).

Most of the maquiladora plants in the electronics industry are subsidiaries of foreign firms: 40 percent are from the United States, 27 from Japan, and the rest from other countries. Of the non-maquiladora companies, four fifths have majority Mexican capital and the remaining 20 percent are either wholly-owned or joint ventures where domestic capitals account for a minority share (CANIETI, 2000).

[15] The data and materials used in this appendix were gathered through personal interviews and direct research conducted by the author between 2000 and 2003 at a diversity of consulting firms, electronics companies, public institutions, and industry chambers in various cities. The two latter include: the National Institute of Statistics, Geography and Informatics (INEGI) both at its headquarters in Aguascalientes and its Guadalajara regional office; the Ministry of Trade and Industrial Promotion (renamed to Ministry of Economics in 2000), Grupo Expansión, and the Electronics, Telecommunications and Informatics Industry National Chamber (CANIETI), all three in Mexico City; and, the Jalisco State Information System and the Jalisco State Department of Economic Promotion, both in Guadalajara.

TABLE A2
Mexico: Electronics Company Population by Operation Regime, 1993-1999

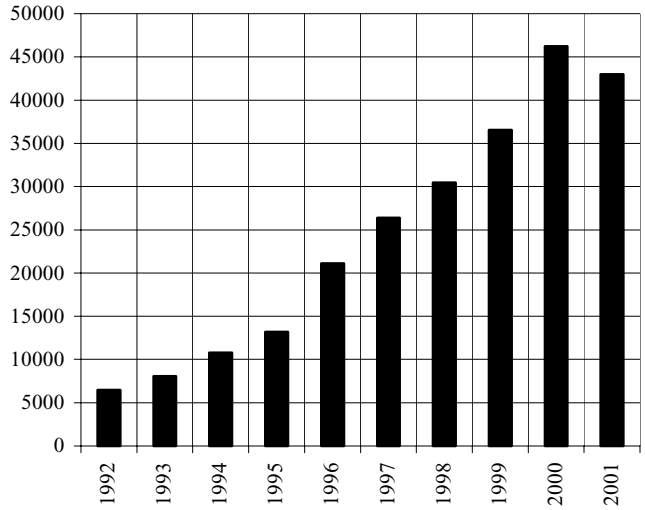
Year	Operation Regime		
	Maquiladora	Other	Total
1992	528	739	1267
1993	560	721	1281
1994	532	541	1073
1995	558	586	1144
1996	669	545	1214
1997	728	529	1257
1998	795	582	1377
1999	837	582	1419

Source: CANIETI (2000) for 1992 and SECOFI (2000) for 1993-1999

Nearly half (48 percent) of electronics establishments correspond to micro and small firms and 29 percent to medium-sized enterprises; 23 per cent are then classified as large (CANIETI, 2000: 3).

Exports of electronic goods also grew rapidly over the 1990s. From $6.4 million in 1992, the value of exported goods jumped to $46.2 million in 2000, though subsiding in 2001 to $43 million (Chart A1).

CHART A1
Mexico: Electronics Industry Exports, 1994-2001
(Million US dollars)



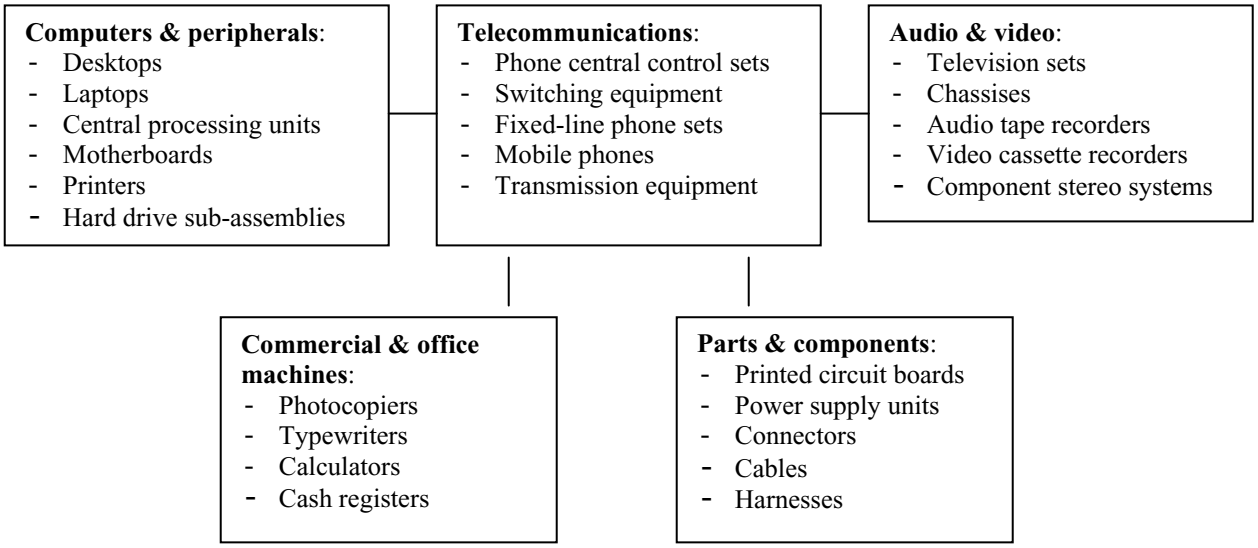
Source: SECOFI (2000) for 1992-1993; Secretaría de Economía (2002) for 1994-2001

The electronics industry is structured around five main product categories: computers and peripherals, telecommunications equipment, audio and video appliances and parts, commercial and office machines, and parts and components. Figure A1 details the products in each category.

A regional division of labor is visible in the production of those items. Audio and video equipment, including TV sets and PC monitors, are produced in sites along the Mexico-U. S. border. Production of home appliances is concentrated in the country's central and northeast regions, while computers and telecommunication equipment in the state of Jalisco, mainly in the Guadalajara metropolitan region, dubbed as the Mexican Silicon Valley. Nearly two thirds of Mexico's computer output and as much as 95 per cent of telecommunications equipment were generated in Jalisco by 2000 (Dedrick, Kraemer, and Palacios, 2001).

TV sets are mainly produced by Asian companies, followed by a few European firms. Matsushita, Panasonic, Canon, Sony, Sanyo, Hitachi, JVC, and Samsung are located in Tijuana; Mitsubishi, Goldstar, and Sony have facilities in Mexicali; Toshiba, Thomson, Philips and Zenith in Ciudad Juárez; Daewoo in San Luis Río Colorado; and, another Zenith plant in Reynosa. Major home appliance makers such as Pioneer, Nippon Denso and Vitromatic are located in Monterrey, while other like Clarion, Mabe, Acrotec and Sanyo-Mabe have their installations in Querétaro, Celaya, and San Luis Potosí.

FIGURE A1
Mexico: Electronics Industry Product Categories



Source: (SECOFI, 2000; Secretaría de Economía, 2002a).

In terms of industrial output value, computers and peripherals are the most significant item, as they account for nearly half of the electronics output value; telecommunications ranks second. All this is illustrated in Table A3, which pulls together the other three categories into a single "Other" group.

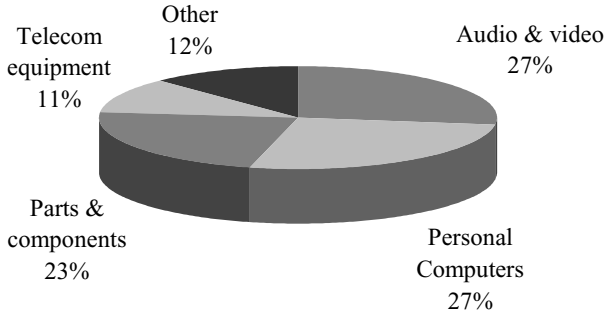
TABLE A3
Mexico: Electronics Industrial Output Value by Product Category, Selected Years
(Percentages)

Sector	1991	1992	1993	1994	1995	1996	1997	1999	Average
Computers[1]	37.28	44.39	38.58	47.44	36.57	48.44	62.05	40.00	44.86
Telecom	48.27	47.10	43.46	45.67	41.95	31.85	27.62	34.00	40.85
Other	14.45	8.51	17.96	6.89	21.48	19.71	10.33	26.00	14.20
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Sources: Calculated by the author with data from SECOFI (1998) for 1991-1997, and from SECOFI (2000) for 1999
[1] Includes peripherals

Computer systems and their peripherals are, therefore, the main product category in Mexico's electronics industry. They are also the top exporting items in this industry, along with audio and video appliances (Chart A2). In particular, the PCs produced in Mexico are exported to more than 25 foreign countries in three continents, and are among the main exporting products in the entire manufacturing industry (CANIETI, 2000)

Chart A2
Mexico: Electronics Exports by Product Category, 1999
(Percentages)



Source: SECOFI (2000: 21)

Computer exports showed a fast and consistent growth throughout the 1990s, which further indicates the high dynamism of this sub-sector within the electronics industry (Chart A3).

The Mexican PC Market

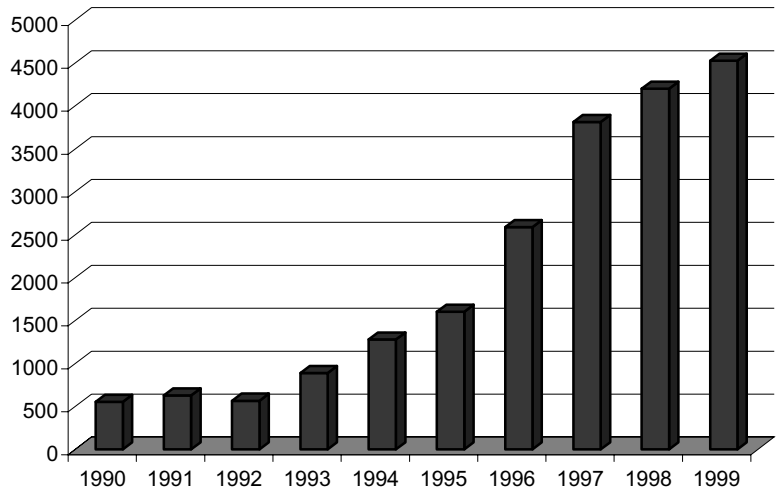
The Mexican computer market presents three layers or categories of players.[16] The first includes the most established brands of some of the world's largest original equipment manufacturers (OEMs) in the PC business: IBM, Hewlett-Packard, Dell Computer, Acer, and Sony. The second layer corresponds to domestic companies that carry their own brands,

[16] Interviews on December 1st , 2002 with Laura Cano, Senior Analyst, and Edgar Fierro, Consulting Manager, at IDC de México.

the most important being Lanix, Printaform, Texa, Ecoin, and, Alaska, with the latter as the largest and most successful one. The third echelon groups the myriad of non-branded white boxes assemblers, distributors, and retailers that offer the customer either parts and components or completely assembled PCs under configure-to-order schemes. Their number is uncertain but it was estimated by CANIETI to exceed 3,000 by 1999 (Dedrick, Kraemer, and Palacios, 1999), a figure that has been on the rise since then.

Ever since computers were introduced in Mexico, the top vendors have been foreign brands, although at least one domestic brand has also been among them. First IBM and Burroughs dominated the market up to the early 1990s, then, Printaform, a domestic brand, took the lead in the 1980s. Other local brands joined in, mainly Lanix, Gama, and Logix; Wind, the product of a successful but short-lived local start up was also popular. IBM and Hewlett-Packard were the only foreign brands in the market during that decade, operating under the provisions of the so-called Computer Program then in force in Mexico (Dedrick, Kraemer, and Palacios, 1999).

CHART A3
Mexican Computer Industry Exports, 1990-1999
(Million US Dollars)



Sources: SECOFI (1998: 8) for 1990; SECOFI (2000: 18) for 1991-1999

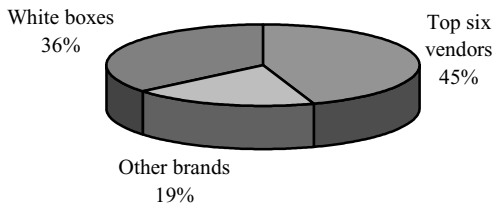
After the PC market was liberalized in 1990, foreign brands such as Acer, Compaq and AST soon took the lead. Acer was the leader from 1991 to 1996, until it was surpassed by Compaq in 1997. The top vendors by that year, in order of importance according to market share size, were: Compaq, Acer, IBM, Hewlett-Packard, Lanix, and Dell, which jointly accounted for 69 percent of the market. Alaska, a domestic brand, energetically entered the picture in 1998 taking nine percent of the market (Dedrick, Kraemer, and Palacios, 2001).

By the end of 2002, Acer and Compaq had lost part of their shares to Hewlett-Packard, IBM, Dell, and, to Alaska, which is produced by Mexmal.[17] The newcomer was Sony, which broke into the Mexican market with great force with its Vaio product line. By December 2002, the top vendors in Mexico were: Hewlett-Packard, Alaska, IBM, Dell, Acer, and Sony.

Jointly, these companies accounted for 45 percent of the Mexican market and 70 percent of total sales by branded PC companies (Chart A4).[18] Lanix and Printaform are still around trying to preserve their limited shares, catering to homes and small companies.

In the first quarter of 2003, the picture had changed, with Dell surpassing Alaska and Toshiba and Lanix surpassing Acer.[19] The ranking was as follows: Hewlett-Packard, Dell, Alaska, IBM, Sony, Toshiba, and Lanix.

CHART A4
Mexican PC Market Shares by Vendor Category, 2002



Source: Data obtained by the author at IDC de México

Alaska ranks fourth in the Latin American PC market accounting for 3.3 percent, just below IBM (6.6 percent), Dell (6.7 percent), and HP (16.5 percent) (*Infochannel*, 2003, with data from Dataquest). White boxes accounted for 36 percent of the market in 2002, up from 20.5 percent in 1997.

Contours of the Mexican PC Industry

As in the case of the domestic PC market, from its inception the Mexican computer industry has been dominated by subsidiaries of foreign multinational firms, mainly from the United States. It mostly consists of assembly operations and so it is highly dependent on imports not only of parts and components but also of advanced production equipment.

[17] Monterrey-based Mexmal is one of Mexico's largest wholesale distributors of computer parts, components and peripherals; it provides products and solutions to assemblers, distributors and retailers of computer equipment.
[18] Interviews with Laura Cano, Senior Analyst, and Edgar Fierro, Consulting Manager, at IDC de México.
[19] Interview with Dr. Ricardo Zermeño, on July 02.

Most PC production is concentrated in the state of Jalisco, and more specifically in the region centered on its capital city, Guadalajara, which is known as the Mexican Silicon Valley. This region houses the largest cluster of companies in the electronics and telecommunications industries, including the manufacturing plants of the largest PC makers in Mexico, i.e., IBM and Hewlett-Packard.[20] In addition, Guadalajara is also home to the manufacturing facilities of over a dozen of the world's top contract manufacturers (including Sanmina-SCI, Celestica, Solectron, Flextronics, Jabil Circuit, USI, Avex Electronics, Benchmark Electronics, Pemstar, MTI Electronics, and Omni Electronics), many of whose production lines are devoted to assembling components and complete PCs (Palacios, 2003b).

In sum, electronics is one of Mexico's most dynamic industries, with computers and peripherals being its chief product category. Its most visible characteristic is that the large majority of its constituent companies are subsidiaries of foreign multinational corporations, which have thus been the main players in both the industry and the domestic market for electronic products. These subsidiaries have been hooked to continental and global production networks almost by definition from the outset. This condition has made them particularly akin to the use of the Internet for conducting their key operations, as they are only individual segments of larger supply chains, which are managed with the aid of the most advanced communication and integration tools, as only MNCs can afford.

Key Environmental and Policy Influences

The environmental factors that have more directly influenced the development of e-commerce in the electronics industry include the country's macroeconomic performance and its impact on income distribution, as well as the policies implemented by the Mexican government, especially tariffs, trade and telecommunications infrastructure.

As for all industries and sectors, the performance of the Mexican economy and the overall macroeconomic environment, including pressures coming from international markets, constitute a major influence on the development of the electronics industry, and so on the possibility for B-to-C e-commerce to spread among its company population. The slowdown-*cum*-recession recently experienced by the U. S. economy has caused a similar slump in the Mexican economy, which has in turn led to the relocation of projects and production lines, massive layoffs, and even plant closures in the electronics and computer industries. The resulting fall in the purchasing power of a large part of the population has put pressures on the demand for PCs and consumer electronics products. The expected decline in PC sales in 2003 will not be higher thanks to the various credit options offered by most major vendors in recent years.

[20] Of the other top PC vendors, only Acer has production facilities in this country: one plant in nearby Mexico City, and other in Ciudad Juarez, Chihuahua, on the Mexico-US border. Alaska's are located in Monterrey, Nuevo León, also near the border.

As to government policies, three interconnected policy instruments now regulate the electronics industry in Mexico. One is First section of the so-called Sectoral Promotion Program (PROSEC) established on December 31, 2000.[21] Under this program, companies that market and/or manufacture electronics goods in Mexico can import parts, components and inputs with an *ad-valorem* preferential tariff. Another is the so-called ITA-Plus tariff scheme instituted in September 2002 as Mexico's response to the subscription of a general Information Technology Agreement (ITA) by 56 member countries of the World Trade Organization (WTO). Under the ITA-Plus, all the tariffs on IT goods (parts, components, materials, and final consumption items) will be entirely eliminated in Mexico from January 2004 on[22] (Secretaría de Economía, 2002b).

Both schemes are contained in, and actually complemented by the Electronic Industry Competitiveness Program (PCIE), designed and operated by the Ministry of Economics. This program aims at the design of a competitive fiscal policy, the promotion of a fair tariff structure, the development of supply chains in the industry, the support of technological development, the improvement of human resources, and the creation of an adequate infrastructure (Secretaría de Economía, 2002a).

These policy schemes have jointly encouraged and facilitated in recent years the inflow of U.S. investments to build assembly plants and others in supporting industries like metal stamping and plastic injection, or in the product design business. All these subsidiaries are closely linked to their parent corporations through EDI networks and/or Internet-based interfaces, as will be discussed later in this appendix.

In contrast to such a passive role regarding industrial policy, the Mexican government has been very active as far as telecommunications infrastructure is concerned (Third section). Infrastructure for Internet service has been extended the last couple of years as part of the E-Mexico project, one of whose implicit objectives is to develop an efficient e-government in this country. The progress made so far in the latter respect has been reflected in the creation of an environment that induces businesses to use the Internet, through the expansion of online service outlets.

Since the telecommunications infrastructure built so far already reaches most major cities where practically all electronics companies are located, it is only natural that their managers consider that it is most adequate for them to operate world-class communications equipment that complies with the high requirements of their respective parent corporations.[23]

As federal and state agencies, and even some municipal governments increasingly offer these services, private companies in all industries, electronics included, are being induced to

[21] It was reformed on March 1st, May 18, and August 7, 2001.

[22] These include computers and peripherals (monitors, printers, scanners), telecommunication equipment (modems, cell phones, phone commuters, phone central panels, TV sets, and radio equipments), and other electronic goods (calculators, photocopiers, cash registers).

[23] View expressed by Federico Lepe, senior executive at Hewlett Packard and Vice President of CANIETI's Regional Office in Guadalajara, on March 3, 2003.

use the web to comply with their fiscal obligations and carry out other government dealings, a practice that in turn induces them to use the Internet to conduct commercial transactions.

Key Barriers and Incentives

Barriers

Given their condition as subsidiaries of foreign firms that send and/or sell most of their output abroad, the main players in the electronics industry in Mexico tend to practice e-commerce in its B-to-B modality. The factors enabling or inhibiting the spread of e-commerce in this industry are, therefore, related to the conditions required for those transactions to take place. Also influential, are some of the factors that hinge on the growth of B-to-C deals, which are similar to those that hold for companies in other industries and sectors that perform these kind of activities.

One of the main barriers for B-to-B is the fact is that as much as 96 percent of Mexico's company population consists of micro and small enterprises, most of which are unable to acquire IT equipment or do business over the Internet. Since a large proportion of these small shops operate in the informal economy, this mass of business establishments are not likely to go public and do business online with "formal" companies (Palacios and Kraemer, 2003).

A related, particularly inhibiting barrier is the persistence among Mexican entrepreneurs of a business culture that perceives technologies such as the Internet and Internet-based tools like e-commerce, as activities alien to their traditional business and so, are not likely to invest in it.[24]

Another major barrier for B-to-B e-commerce among electronics companies is that telecommunications infrastructure is still limited. Only 300 cities are connected to Internet networks so far. Although these networks are being extended under the E-Mexico project, as referred to above, Internet connectivity still does not reach most localities, many of which are in rural areas far from the main networks.

In turn, the factors inhibiting the spread of B-to-C transactions in the electronics industry, has to do with the highly skewed structure of income distribution, the still wide digital gap, the prevalence of a traditional shopping culture, and the lack of security in online transactions.

As pointed out earlier in the paper, most Internet users in Mexico are less than 30 years old and thus tend to have low purchasing power, so that only a small proportion of high-income, cultured consumers can afford to buy a computer and have access to the Web. Likewise, over one third of Mexican households are poor and do not have access to credit and other financial services. Moreover, over two-fifths of the employed population works in the informal economy, most of which can thus be assumed to be members of poor households

[24] Interview with Federico Lepe on March 3, 2003.

(Palacios and Kraemer, 2003). In consequence, these substantial segments of the Mexican population cannot be considered as online consumers of electronics goods for the time being.

On the other hand, the fact is that most Mexicans still prefer to buy in person instead of through an online catalog. Besides, they are distrustful of making payments over the Internet because they perceive it as unsafe to give their credit card data over the web, given the risk of electronic fraud. In fact, the threat of electronic fraud is one of the main deterrents to the growth of B-to-C e-commerce. In general, the lack of a comprehensive and sufficiently binding legal framework is a significant barrier for the growth of B-to-C e-commerce in electronics firms, as *Proposition 5* states in this paper.

Incentives

The factors that most directly influence the growth of e-commerce among electronics companies include the large presence of MNCs and the actions of private organizations and government agencies regarding the support for the improvement and upgrading of businesses and the promotion of Internet use for commercial purposes.

As discussed in Second section, the consistent work of organizations specifically devoted to the promotion of e-commerce like AMECE, COMECE, CANIETI, AMITI, and GILCE has been one of the strongest positive influences for the growth of B-to-C activities in Mexico. This is especially the case for the electronics industry given that companies in this industry are among the most familiar with the use of digital technologies and Internet-based business solutions.

The work of government offices, especially the Ministry of Economics and Nacional Financiera, complements the initiatives of those organizations. The Ministry of Economics in particular operates several programs aimed at helping SMEs to adopt modern business solutions and to engage in e-commerce. Some of the most important of these programs are embedded in the E-Mexico project.

The marketing campaigns of major manufacturers, developers and marketers of IT equipment and computer software targeting SMEs, and the growing supply of software and Internet-based business solutions at low cost by ASPs, are also important enabling factors for the growth of B-to-B e-commerce among smaller electronics companies, especially white-box assemblers.

Finally, the heavy presence of MNCs in the Mexican economy is another significant factor enabling the spread of B-to-B transactions in the electronics industry. The possibility for them to become suppliers of MNCs' subsidiaries is inducing SMEs to modernize their structures and upgrade their business capabilities, including the adoption of Internet-based solutions. Industry associations like CANIETI and CADELEC (Electronics Supply Chain, which operates in Guadalajara), together with Nacional Financiera and the Ministry of Economics, are aiding this process by promotion campaigns and financial support programs.

Although B-to-C transactions account for a much smaller proportion of e-commerce in the IT industry as compared to B-to-B, the former can be positively influenced by a number of favorable factors. This is particularly so for companies operating in the consumer electronics segment, which include PC makers that cater to the domestic market and both "branded" and "non-branded" white-box assemblers.

One favorable factor is the fact that about half of the Mexican population constitutes a potential consumer market for PCs, electronic appliances and other IT products. The continued increase in the number of households connected to the Internet, of individual web users, and of homes with at least one PC attest to this claim. Another is the consistent demand for PCs and other IT products that has continued to exist over the last decade, even in spite of the recessive environment of the last couple of years, as observed by Ricardo Zermeño, director of Select.[25]

The progress in the improvement of security conditions for online transactions and the existence of a basic legal framework for e-commerce in general, are other strongly enabling factors that induce the spread of B-to-C transactions between consumer electronics companies and their respective consumers. Echoing the perceptions of the managers of the companies making up the electronics industry in Mexicos' Silicon Valley, Federico Lepe holds that "with this legal scheme any electronic transaction can be completed."[26]

As for the country as a whole, enabling factors have prevailed over barriers and inhibitors in the case of the electronics industry. As will be described shortly, its constituent companies have been early adopters of Internet-based solutions to manage key operations such as logistics, procurement, inventory control, and supply chain management. Much of this progress is a necessary consequence of the fact that most of these companies are subsidiaries of foreign corporations, which assures that they use leading-edge technologies and business solutions, including those based on the World Wide Web.

Readiness for E-commerce

As discussed in the third section of this paper, nearly five billion dollars are invested a year in Mexico to expand and improve the country's telecommunications networks. As a result, a 106,000 kilometer-long fiber optic infrastructure is already in place, nearly 15 million fully digitalized fixed phone lines and 25 million mobile phone lines are in operation, and 36 per cent of private homes have at least one phone line installed. The installed PC base increased from 4.9 to 8.1 million between 1999 and 2002; as a result, Mexico ranks fair by Latin American standards, as it outperforms Brazil and Venezuela and practically equals Argentina regarding the rate of PCs weighted by population size.

Therefore, Mexico is sufficiently ready to both hatch and support e-commerce activities, since the basic material conditions exist for electronics companies to engage in e-commerce practices in both the B-to-B and the B-to-C modalities.

[25] Interview on July 02, 2003.
[26] Interview on March 3, 2003.

The above is reflected at the level of individual industries like electronics. In a previous study (Palacios, 2001a), Palacios found that electronics plants in Mexico's Silicon Valley typically operated EDI systems for communication with customers and suppliers, videoconferencing systems and T-I phone lines for communication with headquarters, and Internet connection, and, Intranet as a tool linking all the companies' functional areas. These included both foreign subsidiaries (OEMs and contract manufacturers) and domestic companies (domestic OEMs, parts and component suppliers, and auxiliary materials suppliers). In contrast, about one third, which mainly corresponded to foreign companies, used advanced tools like Material Resource Planning (MRP), Vendor-Managed Inventory (VMI), and Supplier-Managed Inventory (SMI) systems to manage their inventories (Palacios, 2001a).

This continues to prevail today, as it is illustrated by the case of Hewlett Packard in Guadalajara. This subsidiary is a world-class manufacturing and R&D facility with fully operational Intranet, Extranet, and EDI networks using standardized protocols and formats for data exchange, these in addition to a major website and Internet connection for both e-mail and commercial purposes.[27]

Diffusion of E-commerce Practices

E-commerce practices have spread widely among the companies in the electronics industry in Mexico. This is particularly the case for subsidiaries of foreign corporations, which make up the bulk of this industry, and for major domestic companies, especially PC makers like Alaska and Lanix. Although a number of non-branded white-box assemblers address their markets through websites, it is less clear whether they use the Internet for conducting B-to-B transactions or for managing their main business operations.

IBM's plant in Jalisco is one of the most advanced in the adoption of e-commerce solutions. A comprehensive e-business model was implemented in the late 1990s to handle most of the plant's operations through the Internet, including payments, procurement, logistics, and international invoicing. Representatives of local suppliers are given access to the plant's procurement information system from which they learn instantly about its requirements (Palacios, 2001a).

Hewlett-Packard presents a similar picture. The local subsidiary uses the Internet for handling a wide range of operations in the areas of research and development, engineering, manufacturing, procurement, logistics, and supply chain management. In turn, sales are not handled online, given that most of its output is sent abroad. Finally, the subsidiary does not participate in virtual market communities or in mobile e-commerce, although it has the required technological capabilities to do so.[28]

Developments in leading OEMs are mirrored in others such as Kodak and Siemens, as well as in the contract manufacturing plants that are also located in Jalisco: Solectron, Celestica,

[27] Information provided by Mr. Federico Lepe, March 03, 2003.
[28] Interview with Federico Lepe, March 3, 2003

Sanmina-SCI, Flextronics, Jabil Circuit, Avex Electronics, Benchmark Electronics, MTI Electronics, USI, and Omni Electronics. These latter are all world-class facilities using leading-edge technologies and management models, as required by the highly competitive environment in which they do their business, and the correspondingly high requirements from their demanding customers.

The same can also be expected to occur in other foreign electronics OEMs located elsewhere in Mexico such as Acer, Xerox, Texas Instruments, Matsushita, Panasonic, Canon, Sony, Sanyo, Daewoo, Hitachi, JVC, Samsung, Mitsubishi, Goldstar, Toshiba, Thomson, Philips and Zenith.

In general, since they are required, and virtually all have been awarded at least one ISO certification, electronics companies in Mexico use the Internet as a matter of course for both handling key operations like procurement and logistics and for managing their entire supply chain. They have to do so in order to be in the highly competitive markets of the electronics business. This can also be expected from the SMEs that become their suppliers, which have to meet similar requirements in order to be eligible for that condition.

Impacts on Performance, Structure and Competition

The practice of e-commerce is showing managers and entrepreneurs in Mexico that it is a business tool that can enable them to not only expand their companies' markets and business potential, but to even completely transform their corporate structures, organizational practices and production methods, thus making them more flexible and more efficient.

As referred to in Second section, the first to learn and acknowledge the above have been some of Mexico's largest industrial conglomerates. Likewise, one third of the companies in a survey had reformulated their entire business strategy and product mix while just a little over one tenth had used the Internet as a marketing tool (Select-IDC, 2001a).

It remains an open question whether the mass of SMEs, especially white-box assemblers and small suppliers in the case of the electronics industry, will follow the lead of large firms, both foreign and domestic, to realize the benefits the practice of e-commerce can potentially bring about. It is more likely that small suppliers of materials, parts, and simple components will do so, provided they become part of the big foreign subsidiaries' supply base.

More generally, growing domestic and international competitive market pressures are inducing companies of all sizes and sectors in Mexico to adopt new business models and strategies increasingly based on the Internet. From this perspective, it can be expected that small enterprises will gradually adopt such models and strategies and thus begin do business online in the near future.

The results of the GEC survey discussed in Fourth sectionI confirmed the above, as they showed that one of the greatest impacts of e-commerce in Mexico has been the intensification of competition in the respective markets and industry sectors. Significantly,

other impacts have been in the improvement of both the companies' competitive position, which in turn supports the common claim in this regard, and the efficiency of internal processes.

Those trends are also present in the case of the electronics industry. Illustrating the views of the companies operating in Mexico's Silicon Valley, Hewlett Packard Senior Executive and CANIETI Western Region's vice president holds that the practice of e-commerce has resulted in a substantial increase in the efficiency of all the HP plant's operations, as well as in considerable cost reductions in the areas of procurement and supply chain management. Mr. Lepe also acknowledges a "high and positive impact" on productivity levels in all the operations performed in the plant. Likewise, he considers e-commerce as an essential tool not only for improving competitiveness in individual companies but also for reducing the gap between the Mexican Silicon Valley and similar clusters in Asia and Europe.[29]

The impact will be different depending on whether it is a large foreign subsidiary or a small domestic company, and whether it is B-to-B or B-to-C that is the modality considered in each case. In any case, the practice of e-commerce in Mexico is generally resulting in an increased internal efficiency and an enhanced ability for electronics companies to perform key corporate functions and do business with the aid of the immense possibilities offered by the World Wide Web.

Such benefits brought about by the use of the Internet are common in other latitudes, as Ernst (2001) documents for Asia. Mexico is, therefore, no exception.

[29] Interview with Federico Lepe, March 3, 2003.

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