The Critical Role of the Software Industry in Economic Growth:

Focus Mexico

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EXECUTIVE SUMMARY

Thesis: Software is an engine of economic growth. Faster growth in annual gross investment in commercial software is necessary in Mexico to promote faster development of the country's information technology (IT) infrastructure, increase total IT capital, stimulate employment growth, and increase gross domestic product (GDP). In order to more aggressively stimulate the economy, governments should target policies to enhance the growth of a commercial software industry.

Major Findings:

- A direct correlation exists between investment in IT infrastructure and economic performance; the economies of countries where IT investments represent greater than 7.5 percent of total capital investments far outperform the economies of countries where investment in IT infrastructure represents less than 2.1 percent of total capital outlays.

- **Mexico is under invested in IT capital.** IT capital as a share of total capital is 1.5 percent.

- The mix of investments in countries with low levels of IT investment differs from the mix found in countries with high levels of IT investment.

    - Currently, in countries with low levels of IT investment, most of the annual investment is in hardware (62.2 percent) and least is in commercial software (13.3 percent).
    - In countries with high levels of IT investment, the hardware share of total IT investment is much lower (36.3 percent) and the commercial software share is much higher (21.5 percent).

- **Software will drive growth.** By 2006, as countries increase IT investment, most countries currently under invested in IT will see less of the annual IT investment devoted to hardware and more devoted to commercial software.

- Mexico is not currently projected to capitalize on the growth-generating benefits of the commercial software sector. In fact, the commercial software share of total IT investment is expected to decline.
    - Between 2002 and 2006, the commercial software share of annual IT investment in Mexico will fall from its already low value of 10.3 percent to only 7.9 percent.
    - For the group of all countries currently under invested in IT capital, the commercial software share of IT investment will increase from 13.3 percent in 2002 to 15.3 percent in 2006.

- **Employment in Mexico will suffer.** The shift away from commercial software investments means employment will be less than what it would have been if the investment mix were not to change. If commercial software investments remain constant, instead of declining as currently projected, 80,419 jobs would have been added.

Conclusion: Faster growth of annual gross investment in commercial software is necessary to promote faster development of the country's IT infrastructure, employment growth, and GDP production.

Policy Prescription: In order to help promote economic growth, policy makers should target policies to stimulate IT economic infrastructure, particularly policies that stimulate the commercial software industry.

- Targeted policy to stimulate and increase IT infrastructure, particularly the commercial software sector, can have measurable impacts on GDP.

  - For example, stronger enforcement of intellectual property rights (IPR) in Mexico could reduce the software piracy rate in Mexico.
  - A moderate 10 percent decline in the piracy rate could increase IT capital 13.4 percent. If IT capital in Mexico in 2001 had been 13.4 percent higher, GDP could have been 0.75 percent higher.
  - A 10 percent reduction in software piracy could have added US$4.6 billion to the economy of Mexico.

- We recommend a combination of three approaches to stimulate the commercial software industry and offer a series of data to consider how Mexico may compare to other countries in these particular policy areas.

  Approach A: Use general investment stimuli, but gear them towards a commercial software industry.

  Principle 1: Eliminate barriers to trade and stimulate exports.
  - Mexican industry has identified export support as an important area to promote the local commercial software industry.
  - Fiscal incentives such as tax breaks through technology parks could help stimulate exports.

  Principle 2: Provide access to financial capital.
  - Foreign Direct Investment (FDI) represented 9.9 percent of gross capital formation in Mexico in 2000. By contrast, in 2000 in Ireland, a net software exporter, FDI represented 85.4 percent of gross capital formation.
  - Mexico has a good foundation of small and medium businesses and high quality management talent to begin attracting IT capital.

  Principle 3: Maintain an open and competitive government procurement process.
  - Mexico is not a member of the World Trade Organization's (WTO) Government Procurement Agreement.

  Approach B: Stimulate the intangible elements that are critical to promoting a commercial software industry.

  Principle 4: Enact and enforce strong protection of intellectual property rights.
  - Mexico is a signatory party to most major multilateral treaties on intellectual property protection.

  Principle 5: Develop telecommunications and Internet infrastructure.
  - Broadband access is limited.
  - The number of Internet users has grown by 200 percent from 1998 to 2000.
  - Telephone costs are some of the highest in the region.

  Principle 6: Invest in human capital and job creation.
  - A new World Economic Forum (WEF) indicator shows that Mexico's "quality of math and science education" is 77 of 82 countries surveyed.

  Principle 7: Ensure vibrant and accessible government research and development.
  - The WEF commends Mexican government programs to promote research and development (R&D).

- Mexican and Mexican-based industry representatives consulted for this paper strongly encouraged more active government support for university-based research and development projects, and fiscal incentives to spark private sector investment in R&D.

Approach C: Given the progressive move of software and services to the online environment, policy makers should create a legal and regulatory environment to stimulate e-commerce in new products and services.

Principle 8: Establish basic online legal structure.
- Mexico recognizes online contracts and e-commerce transactions.

Principle 9: Ensure network and information security.
- According to the World Bank, Mexico has 2.6 secure computer servers per 1 million people.

Principle 10: Build consumer confidence in the electronic world without hindering trade in online products and services.
- The Mexican Federal Law on Consumers Protection provides for a series of rights that consumers may assert in connection with online contracts and e-commerce transactions.

SECTION 1. INTRODUCTION

This report presents an analysis of the impacts of information technology (IT) investments in countries around the world and, in particular, in Mexico. Based on our analysis, recent economic trend data, and the current outlook for IT capital investments in Mexico, we present a detailed policy prescription for faster development of Mexico's IT infrastructure, additional employment and gross domestic product (GDP), and increasing productivity.

IT capital is defined in this report to include hardware, commercial software, and services.[1] Telecommunications carriage and equipment, except the equipment used for data switching, are excluded.

The report consists of three sections. Section 1 summarizes our findings and the framework of our policy recommendations. Section 2 presents the analysis on which we base our policy recommendations. Section 3 presents the detailed policy prescription.

Summary of Findings: Following our economic analysis and mathematical calculations of data from the International Data Corporation (IDC), the World Bank, and other sources, we draw the following conclusions. Each of these conclusions is fully calculated, documented, and presented in the text of this report. Based on these conclusions, we make a series of recommendations for policies to improve the findings and grow Mexico's IT sector. Based on our analysis the key statistical and economic findings are:

1. **Countries worldwide fall into two categories: Those that are under invested in IT capital, and all others. The Mexican economy is under invested in IT capital.** The IT capital share of total capital for the group of countries under invested in IT is an average of 2.1 percent. The IT capital share for the group of all other countries is an average of 7.5 percent. In Mexico, the IT capital share is 1.5 percent.

2. **Countries under invested in IT capital differ from other countries in two important ways:**

   - **The IT infrastructures in countries that are under invested in IT capital are less developed than the IT infrastructures in other countries.** Per capita rates of personal computers (PCs), Internet users, and secure Internet servers are all significantly lower in countries that are under invested in IT capital. In addition, software piracy rates, which indicate the strength of protection of intellectual property rights (IPR), are significantly higher in countries under invested in IT capital. This distinction is important, as it will become the standard of measurement we use to compare countries' IT capital impacts.

   - **Economic productivity is lower in countries that are under invested in IT capital.** Real GDP per hour, a measure of productivity, in countries under invested in IT capital is one-fourth of what it is in other countries.

3. **In countries that are under invested in IT capital, the current composition of annual gross investment in IT differs from the composition in other countries, but the differences are narrowing.**

   - **Currently, in countries under invested in IT capital, most of the annual total IT investment is in hardware (62.2 percent) and least is in commercial software (13.3 percent).** In other countries, the hardware share of total IT investment is 36.3 percent; the

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[1] Commercial software is software that is purchased, not obtained free of charge.

commercial software share is 21.5 percent of total IT investment.

- **By 2006, the composition of total annual IT investment in countries under invested in IT will look more similar to the composition found in other countries.** Less of the annual IT investment will be devoted to hardware and more will be devoted to commercial software.

4. **The current composition of annual IT investment in Mexico is similar to the composition found in other countries under invested in IT capital.** Most investment is in hardware (60.8 percent); least is in commercial software (10.3 percent).

5. **However, unlike in other countries—those that are under invested in IT capital as well as all others— the commercial software share of total IT investment is expected to decline in Mexico. There are many potential factors causing this trend. The policy recommendations in chapter three include some analysis of why this may be happening.** More specific to this finding, between 2002 and 2006, the commercial software share of annual IT investment in Mexico will fall from its already low value of 10.3 percent to only 7.9 percent. Even in other countries under invested in IT capital and with less developed IT infrastructures, the commercial software share of total IT investment will be higher in 2006 than it was in 2002. For the group of countries under invested in IT capital, the commercial software share of IT investment will increase from 13.3 percent in 2002 to 15.3 percent in 2006.

6. **Reducing the commercial software share of total IT investment in Mexico will reduce IT industry employment.** With less investment in commercial software, employment in the IT industry in Mexico will be less than what it would be with an unchanged mix of investment. If the composition of Mexico's US$9.6 billion IT investment in 2006 were to be no different from the 2002 composition, 80,419 more people would be employed in the IT industry in Mexico in 2006.

7. **Policies that generate even small improvements in the Mexican IT infrastructure can have significant effects on gross investment in IT capital generally, and commercial software capital specifically, with measurable impacts on GDP.** For example, stronger enforcement of IPR in Mexico would reduce the software piracy rate in Mexico. A moderate 10 percent decline in the piracy rate could increase IT capital 13.4 percent. If IT capital in Mexico in 2001 had been 13.4 percent higher, GDP could have been 0.75 percent higher. A 10 percent reduction in software piracy could have added US$4.6 billion to the economy of Mexico.

Summary of Policy Recommendations

From our analysis we conclude that **faster growth in annual gross investment in commercial software is necessary in Mexico to promote faster development of the country's IT infrastructure, accumulation of and balance in its total IT capital, employment growth, and production and productivity growth.** In addition to stronger enforcement of IPR, there are numerous other steps that can be taken in Mexico to promote investment in IT capital generally and commercial software capital specifically.

The framework of our policy recommendations to achieve these objectives is as follows:

Approach A: Promote investment generally
- Free trade
- Good financial capital access
- Open and competitive government procurement processes

Approach B: Promote investment in commercial software and other IT capital
- Strong protection of IPR
- Strong telecommunications and Internet infrastructure
- High quality human capital development and job promotion
- Vibrant government R&D

Approach C: Promote development of the online infrastructure
- Basic online legal structure
- Strong security
- Consumer confidence

The detailed policy prescription is presented in Section 3.

SECTION 2. INFORMATION TECHNOLOGY IN ECONOMIES WORLDWIDE

The impact of IT is examined here from several perspectives. We begin by looking at a set of 29 countries located throughout the world and find that there are two distinct groups: countries that are under invested in IT capital and all others.[2] We then examine economic productivity and IT infrastructures in countries in these two groups and find that countries under invested in IT capital have lower productivity and less developed IT infrastructures. Next we present a theoretically based model of production that specifies IT capital, other capital, and labor as the factors of production. The model reveals that IT capital contributes significantly to GDP and the contribution is greater when the IT capital share of total capital is greater. In other words, investing in IT capital and developing the IT infrastructure of an economy will lead to higher productivity. We then examine trends in the composition of gross annual IT investment and compare compositions across countries.

From our analysis we find that:

- Mexico's IT infrastructure resembles the less developed infrastructures found in economies that are under invested in IT capital and, as a result, are less productive.

- The current composition of gross investment in IT capital in Mexico differs significantly from the composition found in other countries. In Mexico, the commercial software share of total IT investment is less than in other countries.

- The future composition of gross investment in IT capital in Mexico will diverge further from the composition found in other countries. In Mexico, the commercial software share of annual IT investment is expected to fall. By 2006, the commercial software share of total IT investment will be 48 percent lower than the already low share in the group of countries under invested in IT capital and, hence, with less developed IT infrastructures.

In addition to the impact of IT investment on productivity, we examine the employment impact of IT investment. In Mexico, we find that the expected decline in commercial software investment will reduce IT sector employment.

One way of increasing investment in commercial software and further benefiting from IT capital is to provide stronger protection of IPR. We end this section of our report with an examination of the impact of IPR protection on IT investment and estimate the increases in IT capital and GDP that could occur in Mexico with a reduction in software piracy.
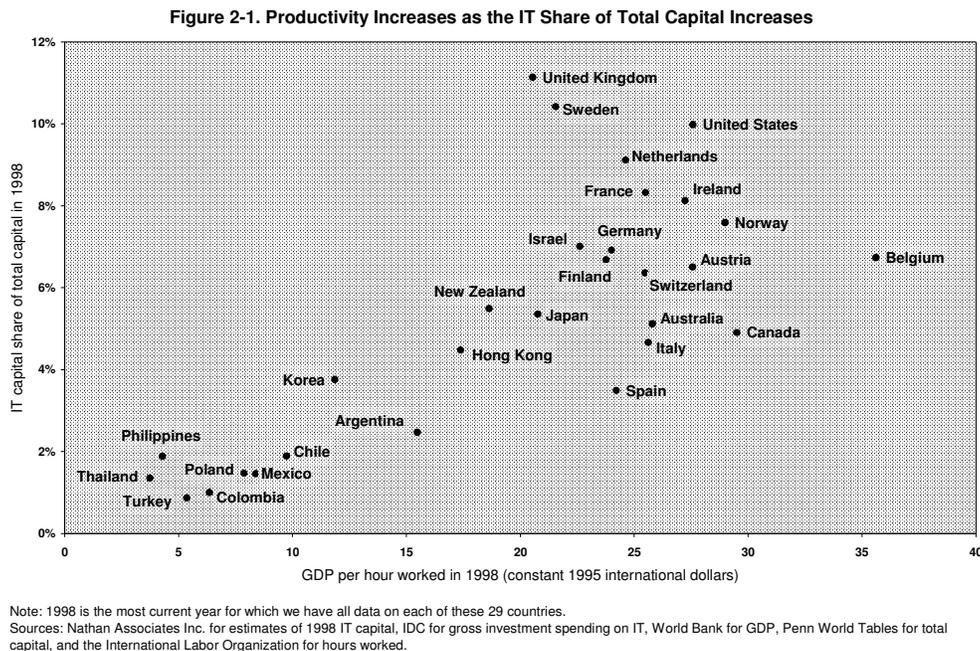
From these findings we conclude that **faster growth in annual gross investment in commercial software is necessary in Mexico to promote faster development of the country's IT infrastructure, accumulation of and balance in its total IT capital, employment growth, and production and productivity growth.**

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[2] Here capital is used in the economic sense, not the financial sense. In economics, capital includes buildings, machines, equipment, materials, and labor force skills (human capital) used in production. Capital is accumulated by gross investment and depleted by use and technological innovation that renders it obsolete. The value of capital can be further eroded by inflation.

IT capital includes hardware, software, and services. Data on annual gross investment in IT capital were provided by the International Data Corporation (IDC). Telecommunications carriage and equipment, except the equipment used for data switching, are not included. Spending is by households, businesses, governments, and educational institutions.

Countries Under Invested in IT Capital Have Lower Productivity. Across the 29 countries for which we have data, we see two distinct groups: those that are under invested in IT capital, and all others. The countries that are under invested in IT capital include Argentina, Chile, Colombia, Korea, Mexico, the Philippines, Poland, Thailand, and Turkey (see Figure 2-1). The average IT capital share of total capital for this group of countries was 2.1 percent in 1998, the most recent year for which we have data on all 29 countries. In contrast, the IT capital share for the group of other countries was 7.5 percent.

Figure 2-1. Productivity Increases as the IT Share of Total Capital Increases

Note: 1998 is the most current year for which we have all data on each of these 29 countries.
Sources: Nathan Associates Inc. for estimates of 1998 IT capital, IDC for gross investment spending on IT, World Bank for GDP, Penn World Tables for total capital, and the International Labor Organization for hours worked.

Mexico is among the group of countries that are under invested in IT capital. The IT capital share of total capital in Mexico was 1.5 percent in 1998.

Countries with economies that are under invested in IT capital have lower economic productivity. For the group of nine under invested countries, 1998 GDP per hour worked was 7.2 in 1995 international dollars.[3] In contrast, 1998 GDP per hour worked for the group of countries not under invested was 24.9 in 1995 international dollars.

Economic productivity in Mexico is higher than in some of the other countries that are under invested in IT capital, but it is significantly lower than productivity in countries that are not under invested in IT capital. In 1998, GDP per hour worked in Mexico was 8.4 in 1995 international dollars.
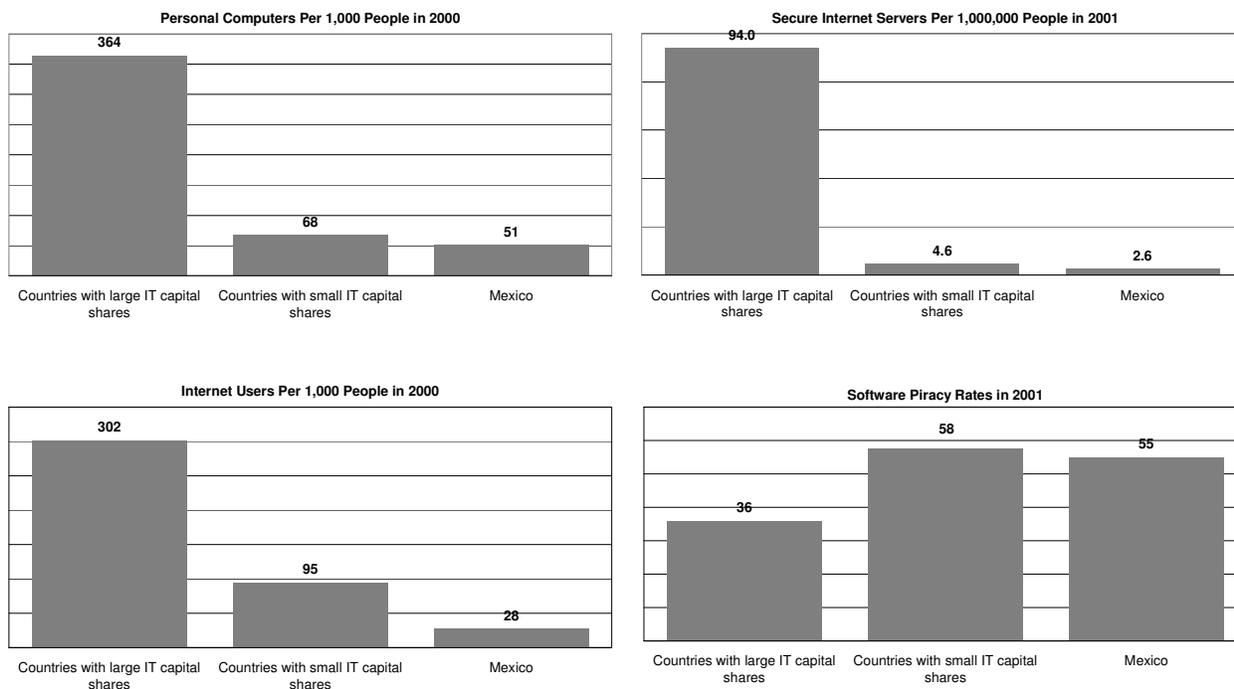
Countries Under Invested in IT Capital Have Less Developed IT Infrastructures. Countries under invested in IT capital have less developed IT infrastructures (see Figure 2-2). On a per capita basis, they have one-fifth as many PCs, one-third as many Internet users, and one-twentieth as many secure

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[3] International dollars are based on purchasing power parities (PPP), which reflect rates at which different currencies can be converted into a common currency that purchases equivalent goods and services. PPP takes into account different prices among countries as well as different currency exchange rates.

Internet servers. Moreover, their software piracy rate is 61 percent higher than the rate in other countries.[4]

Mexico's IT infrastructure resembles the less developed infrastructures found in countries that are under invested in IT capital (again see Figure 2-2). Three of the four indicators—PC penetration, Internet users, and secure Internet servers—reveal greater weakness. However, the software piracy rate in Mexico is slightly lower than the rate for the group of countries under invested in IT capital.

Figure 2-2. Indicators of IT Infrastructure Development

Sources: World Bank's World Development Indicators and, for software piracy, the Business Software Alliance.

Comparing Mexico's IT infrastructure with infrastructures in specific countries reveals similarities across Latin America and differences across less and more developed economies (see Figure 2-3). The Mexican IT infrastructure appears to be somewhat more developed than the IT infrastructures in China and India. Mexico, in comparison with India, a poorer country whose economic strategy includes promotion of investment in IT capital, has 10 times as many PCs per capita, five times as many Internet users per capita, 26 times the number of secure Internet servers per capita, and a software piracy rate that is 21 percent lower than India's. Relative to Ireland, a high-income country that also strongly promotes investment in IT capital, Mexico's IT infrastructure is significantly less developed. Strong IT export sales are a benefit of Ireland's large IT capital investment and strong IT infrastructure. In 2002, Ireland's exports of IT totaled US$12.2 billion, more than five times the amount of its domestic spending on IT products and services.[5]

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[4] Software piracy rates indicate the strength of a country's IPR protection. Countries with more developed IT infrastructures have stronger IPR protection and lower rates of software piracy.
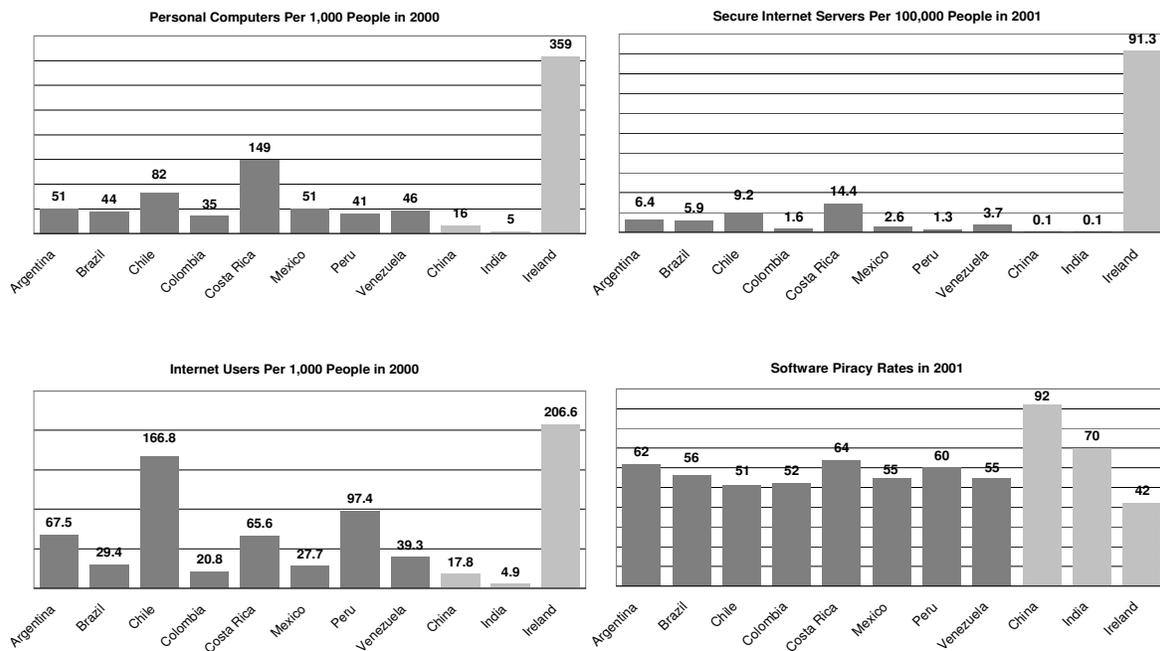
[5] Enterprise Ireland, *Software Industry Statistics for 1991-2000*, n.d., <http://www.nsd.ie/htm/ssii/stat.htm> (February 15, 2003).

Investing in IT and Accumulating IT Capital Increases GDP and Productivity. In all economies, the accumulation of IT capital raises GDP. To quantify the impact, we specified a production function in which IT capital, other capital, and labor hours were the factors of production (the inputs). We estimated the model using data from 1992 through 2000 for all 29 countries. All dollar amounts were measured in constant 1995 international prices. In logarithmic form, the model is as follows:

$$\text{Ln}\,(\text{GDP}_{\text{Country } i,\text{ Year } t}) = \text{Constant} + \beta_1\,\text{Ln}\,(\text{IT Capital}_{\text{Country } i,\text{ Year } t})$$
$$+ \beta_2\,\text{Ln}\,(\text{Other Capital}_{\text{Country } i,\text{ Year } t})$$
$$+ \beta_3\,\text{Ln}\,(\text{Labor Hours}_{\text{Country } i,\text{ Year } t})$$
$$+ \text{Other factors}$$

According to the model, the impact of IT capital on GDP is positive and significant across all countries (see Table 2-1). Every 10 percent increase in IT capital raises GDP 0.955 percent.

Figure 2-3. Indicators of IT Infrastructure Development in Latin American and Other Countries

Sources: World Bank's World Development Indicators and, for software piracy, the Business Software Alliance.

Table 2-1. Estimated Impacts of Capital and Labor on GDP

Factor of production	All countries [a]	Countries with higher IT capital shares [b]	Countries with lower IT capital shares [c]
IT capital	0.955	1.883	0.562
Other capital	2.486	0.636	4.634
Labor	4.621	6.443	2.706

Note: Values indicate the percentage change in GDP for a 10 percent change in one of the factors of production while keeping the other two factors unchanged.

a. All impacts are significant at the 1 percent level.

b. IT capital and labor impacts are significant at the 1 percent level. Non-IT capital impact is not significant at the 10 percent level.

c. IT capital impact is significant at the 5 percent level. Non-IT capital impact is significant at the 1 percent level. Labor impact is significant at the 10 percent level.
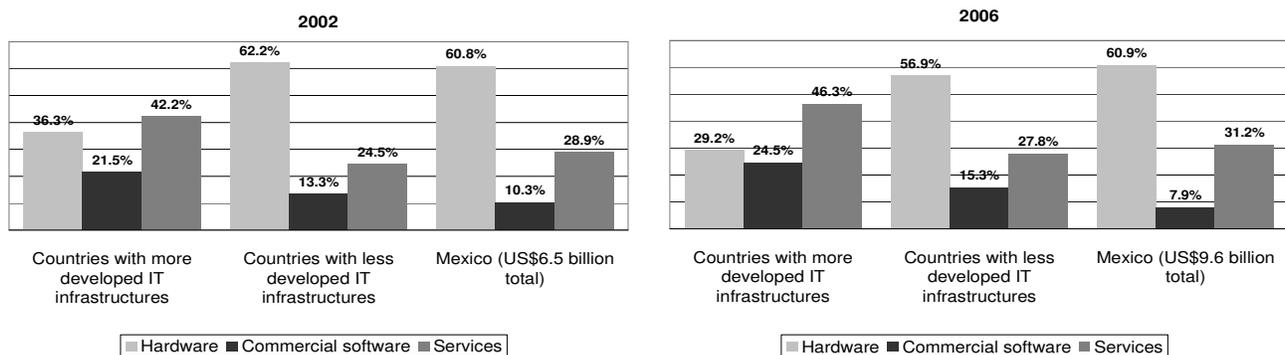
Source: Nathan Associates Inc.

The impact of IT capital on GDP increases as countries accumulate IT capital. In the group of countries under invested IT capital, every 10 percent increase in IT capital raises GDP 0.562 percent. In the other group of countries, every 10 percent increase in IT capital raises GDP 1.883 percent.

Investing in IT capital has a significant impact on economic growth even in countries that are under invested in IT capital and less productive. Between 1992 and 1998, the accumulation of IT capital in the nine under invested and low productivity countries accounted for approximately one-fourth of their 14.8 percent real increase in GDP. Small increases in IT capital can effectively boost GDP.

The Commercial Software Share of Annual Gross Investment in IT Capital is Increasing in Most Countries. The composition of annual IT investment varies across countries.[6] In countries under invested in IT capital, most investment (62.2 percent) is in hardware capital. In the remaining set of countries, the IT investment stream is more balanced among hardware, commercial software, and services (see Figure 2-4).

Figure 2-4. Current and Future Compositions of Annual Gross Investment in IT Capital

Note: This analysis considers gross investment in IT capital in 57 countries, 27 of which are countries with more developed IT infrastructures.
Sources: Nathan Associates Inc. using IDC data.

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[6] Wider availability of IDC data on IT capital investments allowed us to expand this part of our analysis to include 57 countries, 30 of which were categorized as countries with less developed IT infrastructures. In addition to the nine countries already identified, this group now includes Brazil, Bulgaria, China, Costa Rica, Croatia, Czech Republic, Egypt, Hungary, India, Indonesia, Malaysia, Peru, Puerto Rico, Romania, Russia, Slovakia, South Africa, Ukraine, Venezuela, Vietnam, and Yugoslavia.
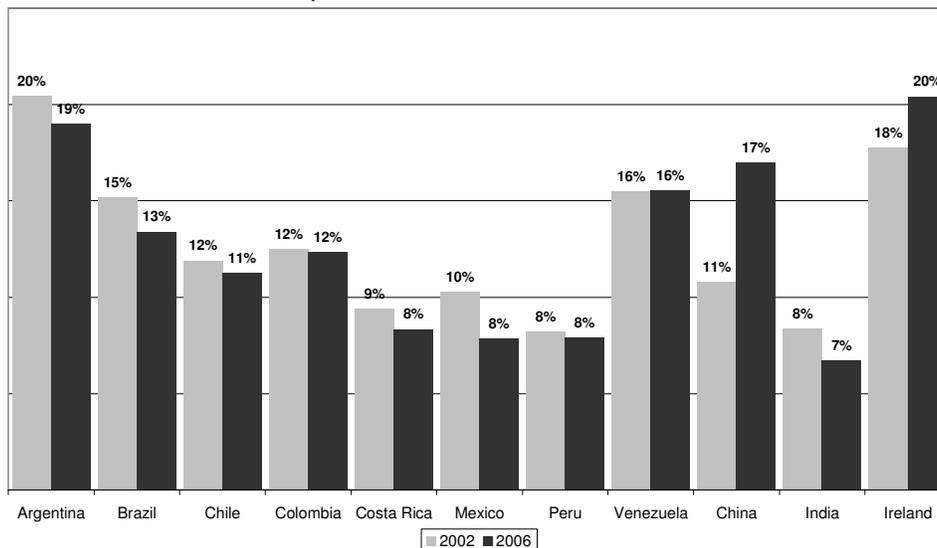
Although the focus in countries under invested in IT capital is on hardware capital accumulation, the IT investment streams in these countries are becoming more balanced. As the installed base of hardware expands, the demand for commercial software increases. And, as the processing speed and storage capacity of the installed base increases, the demand for newer and more powerful software increases. This process drives the shift in IT investment spending from hardware to commercial software.

This is happening already; hardware capital shares of total IT investment are declining and commercial software shares are increasing. In 2006, the hardware share of total IT investment will be 8.5 percent lower than it was in 2002. The commercial software share will be 15 percent higher, increasing from 13.3 percent in 2002 to 15.3 percent in 2006.

Even in countries with more developed IT infrastructures, investment in commercial software is going up. In 2006, the software share of gross investment in total IT capital will be 14 percent higher than it was in 2002, increasing from a 21.5 percent share in 2002 to a 24.5 percent share in 2006.

Contrary to the Global Trend, in Mexico and Other Latin American Countries, Already Small Commercial Software Shares of Annual Gross Investment in IT are Declining. Unlike most other countries, in Mexico and its Latin American neighbors whose economies are under invested in IT capital and software capital specifically, the commercial software share of total IT investment is falling (see Figure 2-5). According to current projections, the largest decline will occur in Mexico. Between 2002 and 2006, the commercial software share of gross investment in IT will decline 20 percent (from a share of 10 percent to a share of 8 percent).

Figure 2-5. Current and Future Commercial Software Shares of Annual Gross Investment in IT Capital in Latin American and Other Countries
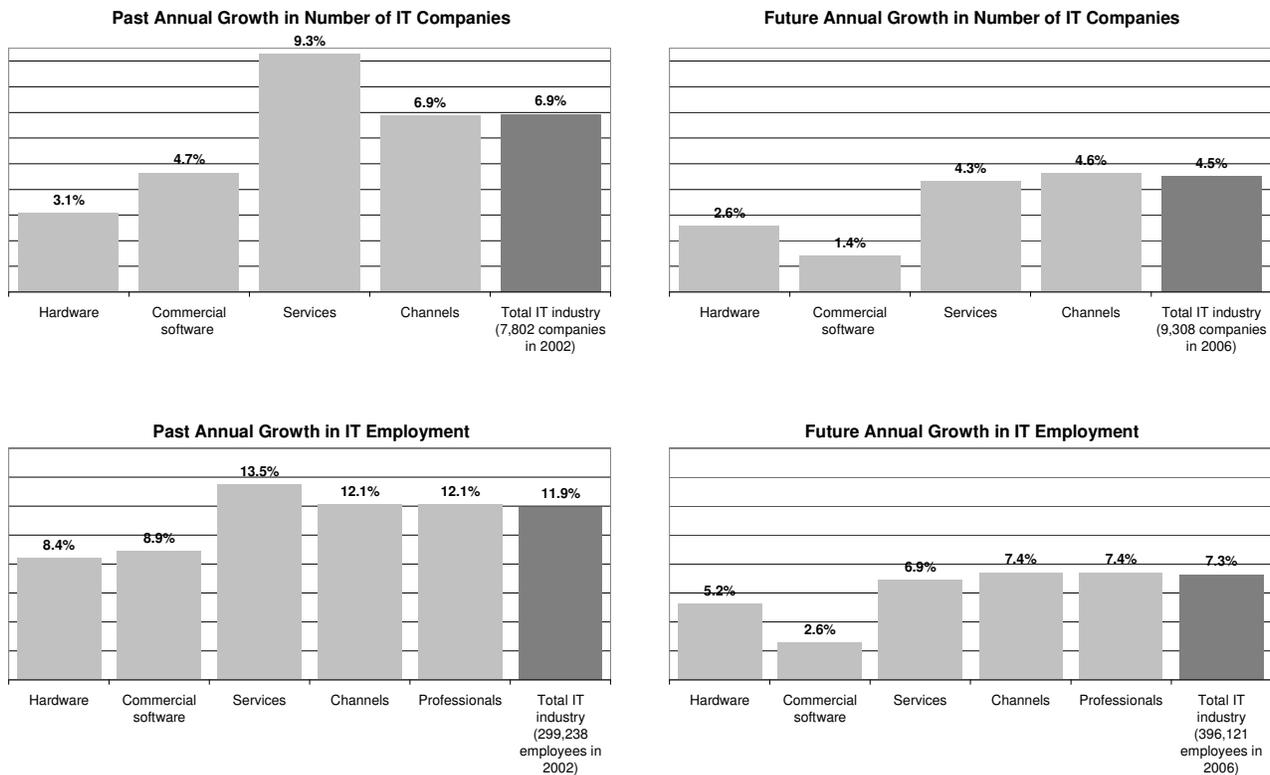

Source: IDC.

In contrast, in China, a poorer country with an IT infrastructure that is less developed than Mexico's, the commercial software share of total IT investment is increasing. It will increase 55 percent between 2002 and 2006 (from an 11 percent share to a 17 percent share).

Reducing Investment in Commercial Software Will Slow Growth in IT Employment in Mexico. IT employment in Mexico is expected to increase, although the rate of increase will be slower than it was historically. Between 1996 and 2002, IT employment grew 11.9 percent per year (see bottom panel of Figure 2-6). Between 2001 and 2006, IT employment will grow 7.3 percent per year.

In 2006, the IT industry in Mexico is expected to employ 396,100 people. Of these, 25,200 will be employed by IT hardware, commercial software, and IT services companies. Another 29,900 will be employed by IT channel companies. The remaining 341,000 will be employed throughout the economy as IT professionals—employees in occupations that require knowledge and skill of designing, developing, implementing, or supporting IT products or services. Examples of IT professional occupations include IT manager, network architect, Web designer, computer programmer, and systems design engineer.
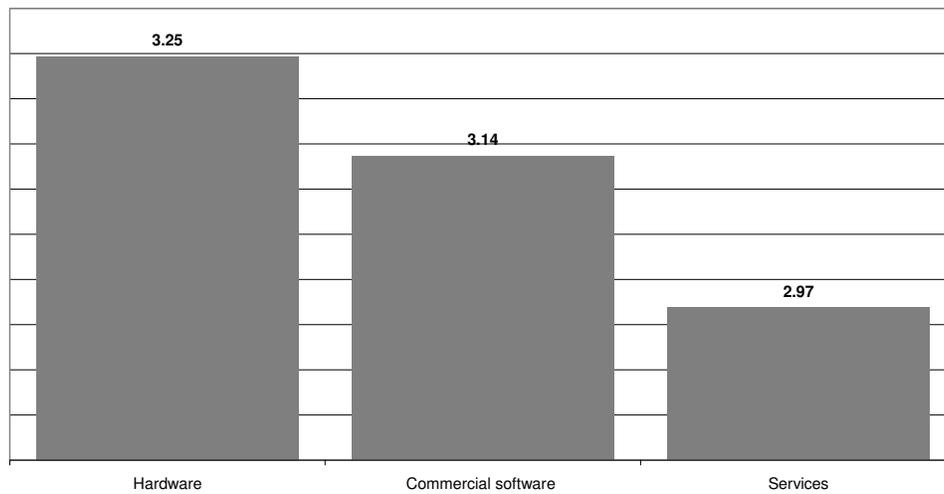
Superficially, the outlook for the IT industry in Mexico appears to be good, but a closer look reveals that the changing composition in IT investment (away from commercial software) will result in fewer total IT jobs. Historically in Mexico, annual investment in hardware and commercial software has generated more jobs than investment in IT services (see Figure 2-7). According to our calculations, based on IDC data, every US$1 million of investment in hardware and commercial software generated 3.25 jobs and 3.14 jobs, respectively. In contrast, every US$1 million of investment in IT services generated only 2.97 jobs. If Mexico's US$9.6 billion IT capital investment in 2006 were to be distributed among hardware, commercial software, and services as it was in 2002, employment in the IT industry in Mexico in 2006 would be 20.3 percent higher; an additional 80,419 people would be employed.

Figure 2-6. IT Industry Growth in Mexico, 1996-2002 and 2002-2006

Note: Past annual growth rates are least squares growth rates.
Sources: Nathan Associates Inc. using IDC data.

Figure 2-7. Employees Per US$1 Million of Investment in IT Capital in Mexico, 2002

Note: Employment in specified IT industry segment only. Multipliers do not include indirect impacts on channel employment and employment of IT professionals outside the hardware, commercial software, and services segments of the industry.
Source: Nathan Associates Inc. using IDC data.

Strengthening IPR Protection Would Boost Gross Investment in Commercial Software and GDP.
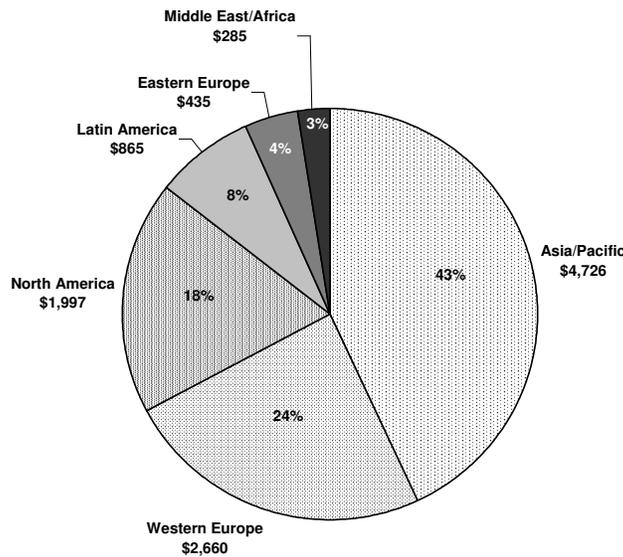Having established the importance of investing in IT capital generally and commercial software capital investment specifically, we now turn to a single aspect of the IT infrastructure—protection of IPR—to analyze and estimate its impact on IT investment. Weak protection of IPR and the resulting high rates of commercial software piracy are found throughout the world (see Table 2-2). According to the Business Software Alliance, nearly US$11 billion of commercial software sales were lost to piracy in 2001 (see Figure 2-8).

Table 2-2. Software Piracy Rates by Region, 1995-2001

	1995	1996	1997	1998	1999	2000	2001
Asia/Pacific	64%	55%	52%	49%	47%	51%	54%
Eastern Europe	83%	80%	77%	76%	70%	63%	67%
Latin America	76%	69%	64%	62%	59%	58%	57%
Middle East/Africa	78%	74%	65%	63%	60%	55%	52%
North America	27%	28%	28%	26%	26%	25%	26%
Western Europe	49%	43%	39%	36%	34%	34%	37%

Source: Business Software Alliance.

Figure 2-8. Software Piracy Losses by Region in 2001
(US$ million in retail value and percentage share)

Middle East/Africa
$285

Eastern Europe
$435

Latin America
$865

North America
$1,997

Western Europe
$2,660

Asia/Pacific
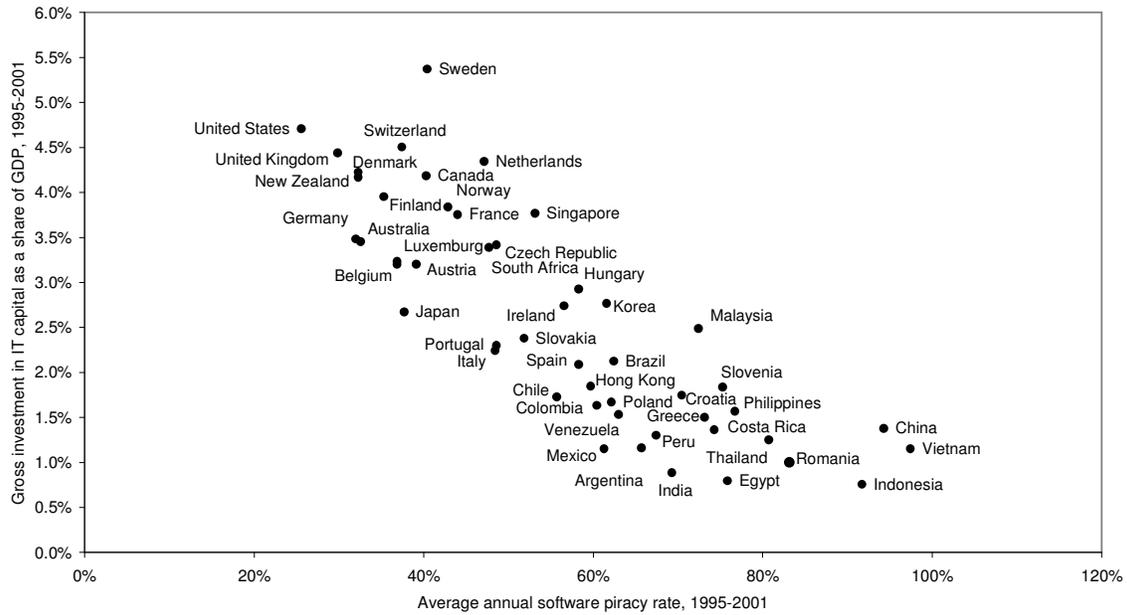$4,726

3%

4%

8%

18%

24%

43%

Source: Business Software Alliance.

Looking across numerous countries, we find that as software piracy rates decline, IT investment increases (see Figure 2-9). Every 10 percent decline in the software piracy rate, *e.g.*, from 70 percent to 63 percent, increases the IT investment share of GDP 13.4 percent, *e.g.*, from 2 percent to 2.26 percent (see Figure 2-10). If Mexico's 2001 software piracy rate had been 10 percent lower (49.5 percent instead of 55 percent) and its investment in IT capital 13.4 percent higher, GDP in Mexico would have been 0.75 percent or US$4.6 billion higher. Even modest success in providing stronger protection of IPR can have a sizable impact on IT investment and GDP.
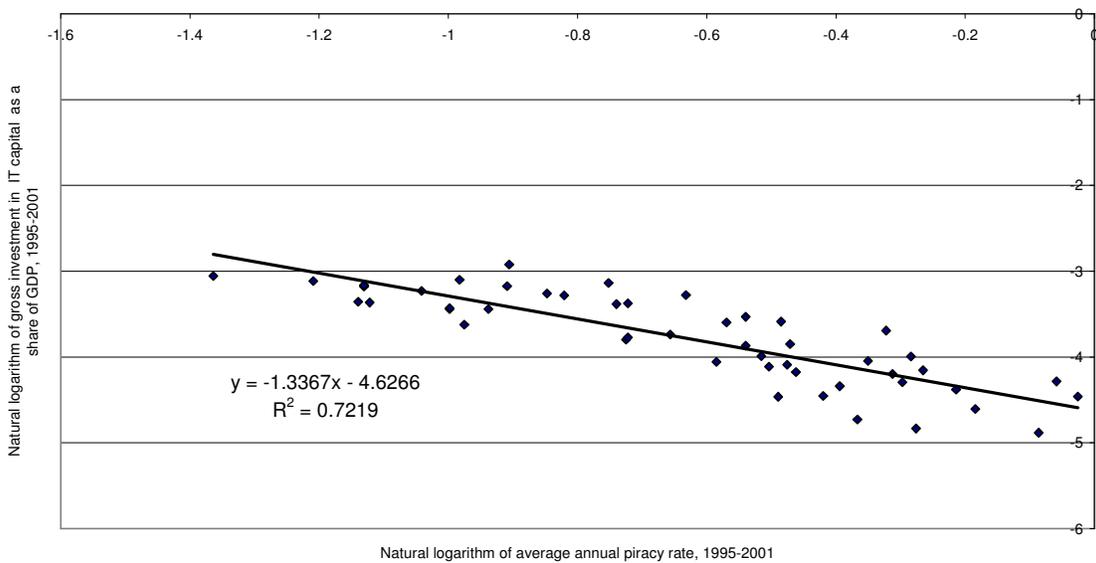
Policies promoting the development and strengthening of the IT infrastructure can have positive impacts on IT capital investment. In the following and final section of our report, we present a program of policies—including ways in which Mexico can strengthen its protection of IPR—that will promote development of Mexico's IT infrastructure through balanced investment in IT capital, and, thereby, raise employment, production, and productivity in the economy.

Figure 2-9. Gross Investment in IT Capital Increases When Software Piracy Rates Decrease

Sources: Nathan Associates Inc. using GDP reported by the World Bank, IT investment spending reported by IDC, and software piracy rates reported by the Business Software Alliance.

Figure 2-10. When the Software Piracy Rate Declines 10 Percent, Annual Gross Investment in IT Capital Increases 13.4 Percent

$y = -1.3367x - 4.6266$
$R^2 = 0.7219$

Natural logarithm of average annual piracy rate, 1995-2001

Sources: Nathan Associates Inc. using GDP reported by the World Bank, IT investment spending reported by IDC, and software piracy rates reported by the Business Software Alliance.

SECTION 3: PUBLIC POLICY IMPLICATIONS

Assuming that a major objective of government is to improve the economic well being of its citizens, then history, global experience, and the results of this paper all suggest that government should seek to stimulate growth of the information technology (IT) sector. More specifically, governments should stimulate the commercial software industry.

Commercial business models benefit the global economy. The commercial business model is a proven economic engine, generating spending of US$2.4 trillion according to a study published by the World Information Technology and Services Alliance (WITSA).[7] The same study shows that the software sector experienced 100 percent growth between 1995 and 2001 – exceeding growth in any other Information Communications Technology (ICT) sector. These facts further support the findings of this report that:

- A robust IT sector speeds economic growth.
- Commercial software and related services are the high-speed engine of IT sector growth and development.
- A commercial IT sector contributes more to an economy when there is stronger intellectual property protection for software publishers.

These data are further enhanced by individual country success stories worldwide highlighted throughout this paper.

Mexico's Specific Situation: The findings of this paper support the general vision of e-Mexico (see discussion below). Further, the Mexican Government's decision to target growth in the software industry specifically is supported by the findings of this paper. This paper shows that the information technology industry, in particular the commercial software industry, can be the economic engine that propels an economy forward. Software is the engine of IT sector growth. Mexico is not currently projected to capitalize on the growth-generating benefits of the commercial software sector. In fact, the commercial software share of total IT investment is expected to decline. For the countries currently under invested in IT capital, the commercial software share of IT investment will increase from 13.3 percent in 2002 to 15.3 percent in 2006. Between 2002 and 2006, the commercial software share of annual IT investment in Mexico will fall from its already low value of 10.3 percent to only 7.9 percent. It appears Mexico may need to target its policy programs more directly to stimulate the IT sector and accelerate implementation of existing programs and plans.

Considering the importance of software to stimulating IT sector growth and the positive potential impact of IT on the economy, it is useful to provide some assessment of Mexico's overall IT industry readiness today. We use a number of different references throughout this paper, including discussions with the Mexican private sector, government data sources, International Data Corporation (IDC) data, Inter-American Development Bank (IADB) data, World Bank data, and Organization for Economic Cooperation and Development (OECD) data, among others. One such indicator that will be used in the final section of this report is from the World Economic Forum's (WEF) Global Technology Reports. The key World Economic Forum Indicator is the Networked Readiness Index (NRI). The indicator is defined in the World Economic Forum's *2002-2003 Global Information Technology Report* as "the degree of preparation of a nation or community to participate in and benefit from ICT development."[8] In the 2001-

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[7] World Information Technology and Services Alliance, *Digital Planet 2002: The Global Information Economy*, February 2002, "Executive Summary", p. 1.

[8] World Economic Forum, *2002-2003 The Global Information Technology Report: Readiness for the Networked World*, Oxford University Press, New York, 2003, p. 10.

2002 report, Mexico ranked 44 of 75 countries surveyed for overall "Networked Readiness."[9] In the 2002-2003 report, Mexico ranked 47 of 82 countries surveyed.[10] It appears that Mexico's overall preparedness ranking worsened slightly. It is important not to over analyze the WEF scoring. The weights given to certain categories of IT preparedness were changed from last year's report to this year's. Also, governments worldwide are movin| g to improve IT growth and development. In this context, Mexico may be improving, just not as quickly as other markets.

With this range of relative differences, it is difficult to determine what a specific change may mean. However, comparison to Latin American neighbors may be useful. In the 2002-2003 report the other ranked Latin American nations are Brazil (29th), Chile (35th), and Argentina (45th). *Mexico was the fourth ranked Latin American nation.*[11] In the 2001-2002 report, Mexico was the fifth ranked nation, but the positions of the other markets were different; Argentina (33rd), Chile (35th), Uruguay (37th), and Brazil (38th) all ranked ahead of Mexico.[12] Again, we believe these are useful numbers for consideration in evaluating certain policy recommendations made here. We by no means view them as conclusive.

Mexico's Information Technology Vision – "E-Mexico": Under the National Development Plan, within the context of its Program on Informatics Development, President Vicente Fox has declared "e-Mexico" a top priority. This is Mexico's vision to leverage the advantages of the digital age. The initiative anticipates the benefits that technology can provide:

> *"El Sistema Nacional e-México como una Política Publica de Estado y no de gobierno,*
> *con una sociedad integrada y totalmente intercomunicada, en donde cada mexicano vive*
> *en un entorno de igualdad de oportunidades entre sí y con el resto del mundo,*
> *respetando y preservando la riqueza pluricultural de México."*[13]
>
> ### -- Secretaria de Comunicaciones y Transportes

The program includes a series of projects focused on building infrastructure and providing better access to technology. Further, the program will target development of access and content in four main areas: e-health, e-economy, e-government and e-education. Specific objectives as outlined in the plan include:

- Accelerate telecommunications and information technology penetration;
- Drive the development of a national software industry;
- Increase the different ways to access and optimize education through technology use;
- Facilitate access generally to health information and e-health initiatives;
- Promote small and medium businesses and create new opportunities for them;
- Integrate all the different cultures and linguistic groups of Mexico;
- Provide access for the disabled;
- Guarantee the legal framework promotes access, as well as the Rights of Mexican citizens and the social and ethical values of the Mexican people;
- Coordinate the different groups that impact growth of technology – public and private; and,
- Promote appropriate funding of necessary activities.

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[9] World Economic Forum, *2001-2002 The Global Information Technology Competitiveness Report: Readiness for the Networked World*, Oxford University Press, New York, 2002, p. 11.

[10] World Economic Forum, *2002-2003*, p. 11.

[11] Ibid.

[12] World Economic Forum, *2001-2002*, p. 11.

[13] Secretaria de Comunicaciones y Transportes, *Sistema Nacional e-México*, septiembre 2002, <www.e-mexico.gob.mx/uploads/media/Resumen2002.PDF> (febrero 24, 2003).
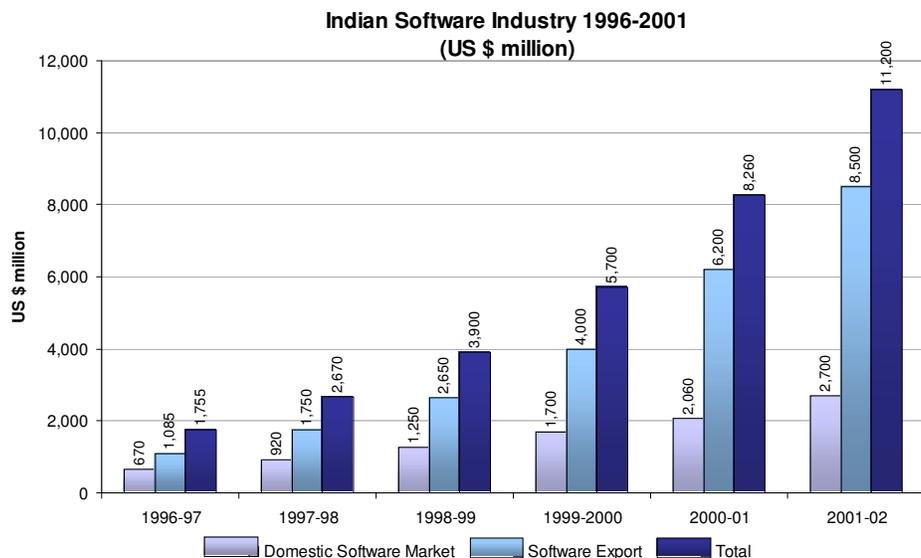
From this group, government officials indicate that priority has been given to 1) creation of the necessary infrastructure to support the system; 2) creation of a large network of Digital Community Centers (target 10,000; at time of writing Mexico had 864 (a new number was expected to have been announced) in place with e-Mexico branding at post-offices, schools, health and community centers in the top municipalities where 80 percent of the population is concentrated; 3) development of a national software industry; and 4) provision of e-services to citizens.[14]

Despite the detailed vision, there has been some criticism of the pace of implementation of the program. It is important to accelerate these programs. Given the findings of this report, we now know that targeting growth in the software sector can help stimulate overall economic growth.

India's Success Story

The growth and prominence of the Indian software industry has been so phenomenal over the last ten years that the country competes with the US as the world's major exporter of software. This success is widely attributed to the growth of a commercial industry. Indeed Oxford Analytica notes that the initial growth of the software industry in India "was entirely driven by private enterprise" and minimal regulation in key areas.

A strong relationship between government and the commercial IT industry in India, particularly the software industry, has helped to develop government policy in directions that promote the growth of the local commercial industry. For example, the National Association of Software and Services Companies (NASSCOM) worked closely with the Indian Government to strengthen copyright laws. In another example, the industry has worked with state governments to facilitate education for development of qualified engineers.

Indian Software Industry 1996-2001
(US $ million)

Year	Domestic Software Market	Software Export	Total
1996-97	670	1,085	1,755
1997-98	920	1,750	2,670
1998-99	1,250	2,650	3,900
1999-2000	1,700	4,000	5,700
2000-01	2,060	6,200	8,260
2001-02	2,700	8,500	11,200

Source: NASSCOM

The Indian experience with a commercial software industry has greatly benefited India's economy:

- "Between 1994-95 and 2000-01, the gross earnings of this commercial software sector grew from 835 million to 8.2 billion dollars and the value of exports from 485 million to 6.2 billion dollars . . . represents annual growth rates of over 50% and nearly 100% respectively."

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[14] Microsoft Corporation, **"**Microsoft and SCT sign a Technology Collaboration Agreement for the creation of Digital Community Centers"; *Microsoft Press Release*, Seattle Washington, 17 April 2002. Note: We are aware that the government has made significant additional progress in opening technology centers in Mexico.

- The driving force of the commercial industry has derived from exports – mainly to North America (two-thirds of software export earnings 2000-01).

(Source: Oxford Analytica "National IT Development: Explaining Success. India")

PRACTICAL POLICY RECOMMENDATIONS TO STIMULATE A COMMERCIAL SOFTWARE INDUSTRY

The data provided in this study, combined with the successful history of the commercial software industry, clearly suggest policies to stimulate the commercial software industry will help local economies. Following on these conclusions, this chapter offers a series of policy approaches for governments to consider in growing a commercial domestic IT industry. These recommendations can be grouped into three major approaches as outlined below. We view no single principle as more important than the other. Rather a combination of each, with a view to the specific situation in Mexico, is the most effective means to stimulate an IT sector.

"For the first time in history, the service economy (including software) has surpassed the size of the industrial economy within the US. According to experts such as Peter Drucker and Michael Porter, this implies that countries in the 21st Century will compete on factors such as workforce quality and national infrastructure. Coordinated and focused government programs can greatly increase Mexico's role as a substantial exporter of software services, exponentially growing the number of highly skilled jobs created within the country."
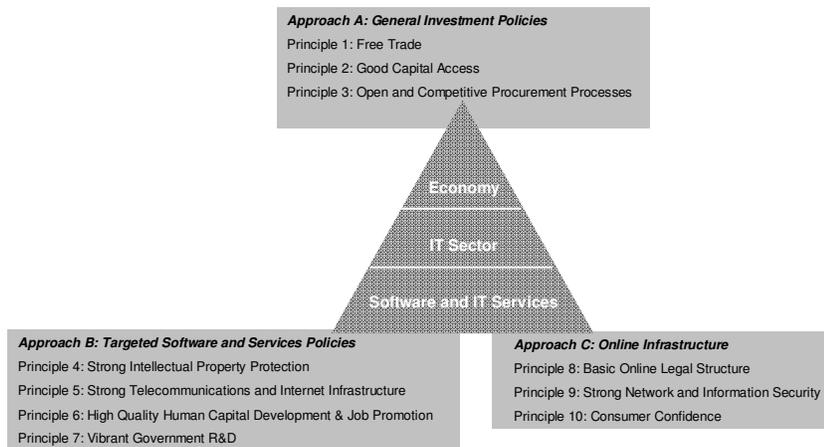
-Alan Colmenares, CEO, Litima, LLC.

Further, nearly all of these principles stimulate both the consumer and producer side of the IT equation. This follows the theory that IT is most successful as an economic driver and equalizer when policy promotes a community of users who can effectively use IT, AND stimulates a community of providers who can respond to consumer needs.

E-SAVVY CONSUMERS
+
IT EDUCATED PRODUCERS
↓
GREATER IT SECTOR GROWTH

Finally, we note that industry leaders, representing successful Mexican-owned and Mexican-based software and IT companies were consulted for this paper. Through that process, several issues were highlighted as potential barriers to growth of a commercial software industry in Mexico. Many of these are reflected in the National Software Development Plan. The most common concerns raised in our interviews were basic doing business issues: inadequate access to capital financing, complicated and lengthy government procurement requirements, high cost of training staff (provide tax breaks to help alleviate costs), labor market laws, lack of marketing support, lack of fiscal incentives, and high communication costs. A major issue raised by nearly every company or organization interviewed was enforcement of intellectual property law. We believe this study provides evidence of the benefits of stimulating the commercial software industry. Certainly the respondents support stimulation of the sector. Many of the concerns cited by interviewees are addressed through the policy recommendations below.

Figure 3-1. A Policy Framework for Promoting Economic Growth

Approach A: General Investment Policies
Principle 1: Free Trade
Principle 2: Good Capital Access
Principle 3: Open and Competitive Procurement Processes

Economy

IT Sector

Software and IT Services

Approach B: Targeted Software and Services Policies
Principle 4: Strong Intellectual Property Protection
Principle 5: Strong Telecommunications and Internet Infrastructure
Principle 6: High Quality Human Capital Development & Job Promotion
Principle 7: Vibrant Government R&D

Approach C: Online Infrastructure
Principle 8: Basic Online Legal Structure
Principle 9: Strong Network and Information Security
Principle 10: Consumer Confidence

APPROACH A: The first approach focuses on traditional investment stimuli principles, gearing them to IT promotion. These principles are important to developing any kind of local industry. In our recommendations, we make some specific suggestions on how to target these items to stimulate a commercial software industry. The general principles we recommend include:

- Eliminate trade barriers.
- Provide access to financial capital.
- Maintain an open government procurement bidding process.

APPROACH B: The second approach focuses on policies directed at stimulating IT services and software industries specifically. These policies stimulate the hard to describe, intangible elements that enhance knowledge, inspire creativity, and drive new thought processes. Examples include:

- Enact and enforce strong intellectual property protection.
- Build a strong telecommunications and Internet infrastructure.
- Invest in human capital and job creation.
- Ensure vibrant and accessible government research and development.

APPROACH C: Given the progressive move of software and services to the online environment, a third approach to an overall government strategy should include creating a legal and regulatory environment to stimulate e-commerce in new products and services. It should also create an environment for software and services to grow.   Some of these policies include:

- Establish basic rules for online commerce.
- Ensure network and information security.
- Build consumer confidence in the electronic world.

The Government of Mexico already has considered many of these policy issues in its e-Mexico initiative. The Government has gone a step further and, as noted above, prioritized the software industry as a key component of that initiative.

Mexico's Focus on the Software Industry: Under the National Development Plan, the software industry is one of the country's top 10 strategic sectors for Mexico's long-term economic growth. The Minister of the Economy presented the 78-page action plan on October 2002. Mexico's "National Software Industry Development Plan" to promote the growth of a local software industry in Mexico provides a detailed analysis of success stories worldwide, the potential of the Mexican market, the establishment of concrete objectives to develop the software industry, and the means to achieving these goals.[15] We will not repeat the full contents of this plan; the readers of this report likely will have seen it already. We will, however, highlight some of the plan's major goals. In addition, throughout the remainder of this paper, as appropriate, we will make note of consistencies or inconsistencies with the guidance in this plan.

The plan incorporates 7 key actions:

- Promote software exports and attract related investments.
- Create the highest quality human resources for software projects.
- Create a legal framework to promote the industry.
- Develop the internal market.
- Develop the current software industry.
- Reach international levels on software development capacity.
- Develop infrastructure on all states supporting the software industry.

Software companies of all sizes, nationalities, and areas of focus have the potential to contribute to Mexico's economic growth and the development of a strong local software industry. For example, during a recent visit of Microsoft CEO, Steve Ballmer to Mexico in August 2001, a three year US$56 million Microsoft donation to the Ministry of the Economy was formalized: $1.5 million for creating Spanish content, and the rest as developer tools related licenses (Visual Studio, Project, Office developer, etc.).[16] Microsoft is launching a second initiative, a software industry development portal. This will help Mexico target its objective of "creating the highest quality human resources for software projects" as outlined in the Software Development Plan.

Keeping this existing initiative in mind, it may be useful to supplement or focus efforts based on the following policy areas.

Closing the Digital Divide

Technology has become the great hope for closing the gap between the world's rich and the world's poor. The hope is well founded, as numerous success stories have demonstrated the power of technology to bring the global market place to the most remote village, the poorest farmer, and the unknown local artist. Technology has the potential to close the gap and that potential is being realized through numerous Information, Communications, and Technology programs worldwide.

ICT products help close the digital gap not only by providing physical access to necessary ICT goods, but also through the power of spending in the overall economy. As demonstrated by this study, spending on ICT products, and software in particular, is a powerful tool to overall economic growth. Developing economies look set to reap some of the greatest benefits of this spending. According to the *Digital Planet 2002*, China's ICT spending is the world's fastest growing, with Eastern Europe following closely.

Although we are on our way to closing the gap, much work remains to be done. One of the world's greatest ICT success stories, India, has fallen short in efforts to close the digital divide. So, while India is

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[15] *Programa para el Desarrollo de la Industria de Software*, La Secretaria de Economía - México, n.d., <http://www.economia-sniim.gob.mx/ofvir/pdis.pdf> (February 24, 2003).

[16] Microsoft Corporation, "Microsoft se compromete ante el gobierno mexicano a formar profesionales para la industria nacional de software," *Microsoft Press Release*, 23 de agosto de 2001.

a major exporter of computer software, a majority of India's citizens are unable to use the products and services developed in their own country. To further illustrate the point, in a World Economic Forum survey India ranks at a low 54 of 75 countries surveyed for network readiness.[17]   It is worth noting that Mexico ranked ahead of India at 44 of 75 countries surveyed. Also of note, these results changed substantially in the new report. For the 2002-2003 report, Mexico ranked 47 and India 37 respectively. In reviewing the details of the 2001-2002 analysis, we find India's low ranking results from a failure to adequately address infrastructure issues and disperse technology education and know-how to basic levels of society.

Promoting access to and production of technology is a critical component of closing the digital divide. It is also an extremely challenging effort. We believe that each of the ten policies discussed in this paper help in some way to close the gap between the world's technology haves and have-nots. Indeed, many of the policies recommended here are supported by the Organization for Economic Cooperation and Development, the United Nations, and the World Economic Forum programs on the issue. Despite their universal applicability, in order to truly close the digital divide, policies will need to be molded to the specific needs and challenges of the Mexican people and the Mexican marketplace. The Mexican Government already has given this some thought through the e-Mexico initiative.

Indeed, President Vicente Fox's e-Mexico initiative's mission is "Ser un agente de cambio en el país, al integrar los esfuerzos que realizan diversos actores públicos y privados en la eliminación de la brecha digital y las diferencias socioeconómicas entre los mexicanos, a través de un sistema con componentes tecnológicos y sociales que ofrezca servicios básicos como aprendizaje, salud, intercambio comercial, y trámites de gobierno, siendo al mismo tiempo punta de lanza del desarrollo tecnológico de México."[18]

In partnership, academia, government, and industry working through these challenges on a daily basis could yield some amazing results for the average Mexican citizen.

APPROACH A: GENERAL INVESTMENT PRINCIPLES TO PROMOTE IT GROWTH

PRINCIPLE 1: Eliminate Trade Barriers. The information technology sector is by its very nature global. Employees sitting in Brazil could be writing software code for a company based in the United States. Barriers to international trade tend to stunt the growth of a local industry, but they particularly do so in the globally integrated IT industry. By limiting access to critical foreign investment and know-how, restrictive trade policies hurt local IT producers. In addition, "trade and FDI remain significant sources of innovative ideas and concepts and may take on greater importance as the complexity of innovation at technological frontiers makes it increasingly difficult for individual firms and countries to engage in innovative activities."[19] More important perhaps, protectionism limits consumer access to less expensive, high-value IT goods and services from abroad. According to the World Economic Forum, trade is a "vital" mechanism to "facilitating technology diffusion."[20] Absent access to technology, an e-savvy population fails to develop and the digital gap widens.

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[17] World Economic Forum, *2001-2002,* p.174.

[18] *Sistema Nacional e-México*, Secretaria de Comunicaciones y Transportes, September 2002, <www.e-mexico.gob.mx> (February 24, 2003).

[19] Organization for Economic Cooperation and Development, *A New Economy? The Changing Role of Innovation and Information Technology in Growth*, 2002, reprint, p. 40.

[20] World Economic Forum, *2001-2002*, p. 114.

There are multiple trade mechanisms to stimulate IT sector growth, including issue focused bilateral agreements, free trade areas (Free Trade Area of the Americas, the North American Free Trade Agreement), and common market approaches (MERCOSUR). All can be useful to stimulating the sector. For illustrative purposes, we focus on the WTO.

Join the Information Technology Agreement (ITA) and eliminate tariffs on IT products. Impose no new tariffs on e-Commerce. We recommend making indefinite the current moratorium on e-commerce tariffs in the WTO. In addition, we recommend joining the Information Technology Agreement (ITA). The ITA is a special agreement within the WTO that focuses on lowering tariff rates to zero on information technology products. Only IT products are covered by the Agreement. Its purpose was to foster trade in the IT area. Neither Mexico nor many other Latin American countries are members of the ITA. Indeed, of the eight countries surveyed for this series of papers, only Costa Rica has signed the ITA. The decision not to join onto the ITA appears to have been taken strategically in an effort to maintain negotiating leverage vis-à-vis IT producing nations in the WTO. Unfortunately, the impact of such a decision denies Latin American nations, including Mexico, access to competitively priced technology products, thus hindering stimulation of the consumer side of the IT policy equation and widening the digital gap.

The Impact of Tariffs and Taxes on Consumer Use of IT Products & Software Parks

Mexico generally has recognized the negative impact that tariffs have on consumer access to computer hardware and software. Through programs such as ITA Plus, Mexican's can access zero tariff rate computer products. Similarly, Mexican goods can have access to foreign markets at zero tariff rates through the North American Free Trade Agreement (NAFTA) and numerous other FTAs Mexico has negotiated.

Given Mexico's low tariff rates, Mexico should consider taking the lead in encouraging neighbors to lower their tariff rates. The high tariff rates on components, finished product, and software around the region disadvantage Mexican producers of these goods.[21] Mexico's IT industry might benefit from Mexican leadership to lower tariff and VAT rates generally in the region – particularly as Mexico moves to be an export leader in the software area.

A final consideration for Mexican policy makers, in our interviews with Mexican companies one of the challenges identified in development of a software industry was access to equipment. Lowering tax rates (and any remaining tariffs on components) may help alleviate these challenges.

One venue for consideration of tax reductions can be through software parks. Software parks offer the opportunity to build targeted infrastructure to support a group of IT industries. Tax incentives associated with the parks help encourage industry participation. And the physical proximity of a vibrant development community generally contributes to knowledge exchange and information sharing. India, Thailand, Malaysia, and a host of other countries have successfully developed Software Parks to promote local software industries.

Liberalize and Provide Full Commitments for Computer and Computer-Related Services and for Value-Added and Basic Telecommunications Under the GATS. The General Agreement on Trade in Services (GATS) is an important tool for promotion of IT services and IT growth by encouraging investment in the software and services sector, exchange of skilled labor, export of local services, and development of e-commerce. While the computer services area appears relatively barrier free in Mexico, it is worth noting that there are no binding multilateral commitments to this situation by Mexico under the WTO GATS Agreement. In the GATS, Mexico has made very modest commitments to computer and computer related services. Indeed, Mexico has made a commitment to only one category of five

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[21] It is important to acknowledge that software tariff rates are typically lower than computer hardware rates. However, VAT rates tend to apply universally and at a high rate. The bottom line is the same – they deny access to technology.

computer related services areas. And, even that limited commitment has restrictions on foreign ownership. International treaty commitments provide investors with the assurance that a country will not "de-liberalize" in a certain field. It adds to investor confidence. Similarly, Mexican investors and providers of computer services benefit when other nations liberalize this field or provide binding international commitments in this area. Mexican computer services providers could benefit from Mexican leadership in this area in the WTO.

Provide Equal Treatment to E-Commerce. WTO members currently are discussing how to cover e-commerce under existing WTO rules.   Any country interested in building its local IT sector should be present and active in these negotiations. We recommend Mexico apply to e-commerce the same principles that apply to traditional forms of trade, including principles of nondiscrimination (national treatment and most favored nation treatment) and transparency. Considering Mexico's interest in software and e-commerce development, we strongly encourage Mexican participation in the WTO's e-commerce discussions.

Promoting Mexican Software for Export

The other side of an open trade regime is negotiating market access for Mexican products abroad. One of the main objectives of Mexico's Program to Develop the Software Industry is to increase the export potential of Mexican software – ultimately to be a worldwide leader in provision of software services.[22] Indeed, one of the areas raised in our interviews with Mexican companies was the need for more basic marketing support to promote exports. While this comment was intended to reflect marketing locally, it may indicate a need for targeted focus in this area as export promotion programs develop. This kind of support is envisaged in the Software Program. The Program offers suggestions for increased activity in this area by a number of Mexican institutions including la Secretaria de Economía, BANCOMEXT, AMITI, and Cadena Productiva de la Electrónica (CADELEC), among others. Over the last year, the Plan instructed these entities to conduct investigations, make assessments, and develop various action plans to support the industry. The National Plan calls for a progress report a year from its announcement. This means in October of the year 2003 we should have a better understanding of how efforts have progressed in this area.

Mexico already has successful commercial software exporters. Sinapsis Technologies México, has been in business for 12 years, employs 180 people, and exports approximately 5 percent of its products. Similarly, companies like GE Dem, Seguridata, and Softtek all are successful software exporters for Mexico. These successful commercial software producers have the potential to be significant contributors to Mexico's trade balance. With programs targeted to stimulate software exports, more companies like Sinapsis could develop.

PRINCIPLE 2: *Provide Access to Financial Capital*. Venture capital (VC) is particularly important to promoting IT-based industries. IT generally does better in markets with greater access to venture capital and favorable stock option compensation rules. Indeed, according to a recent study by the OECD titled *Drivers of Growth: Information Technology, Innovation and Entrepreneurship*, countries should:

Deregulate Capital Markets and Remove Barriers to Venture Capital Financing. "Venture capital plays an important role in bridging the financing gap for innovative projects by new firms and providing managerial advice to start-ups. Governments need to modify legal and fiscal provisions that impede the supply of private capital for risky undertakings and address funding gaps where access to financing is a major business constraint."[23]

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[22] *Programa para el Desarrollo de la Industria de Software*, p. 26.

[23] OECD*, A New Economy*, p. 112.

Capital Stimuli Around the World

Availability of capital, to stimulate a range of technological development without discrimination by type of technology, is important. Like government-sponsored research and development, investment stimuli need to be technology-neutral. In addition to neutrality, fundamental availability of seed capital is important. Some examples of successful seed capital/venture capital programs follow:

Brazil: The Government of Brazil uses, BNDES, the Brazilian Development Bank, and BNDESPar, its interest agency, to help alleviate capital concerns.[24] In interviews with Brazilian IT executives for a similar study, BNDES was cited as among the most useful programs in the Brazilian Government. Industry representatives encouraged great availability of similar programs. The Government is to be commended for its foresight and focus in this area.

Singapore: Since 1999, Singapore has targeted efforts to attract capital for the IT sector. Starting with Technoprenuership 21 (T21), the government's concept plan to spearhead local technology industries, the Singapore Economic Development Board devised various venture capital schemes, attracting both VCs and providing VC funds to start-ups and established entities. In April 2001, the Economic Development Board (EDB), Singapore's lead government agency for the promotion of investments and knowledge-based industries, took over the lead agency role of Technopreneurship 21 championship. EDB now administers a number of Technopreneurship-related schemes. The presence of such funds has transformed Singapore into a venture capital hub where high-tech startups from all over the region come for funding.[25]

Greece: In September 2001, The Greek New Economy Development Fund (TANEO) was developed from article 28 of Law 2843/2000 for the purpose of co-financing the formation of venture capital funds in Greece.[26] The fund is intended to invest in innovative businesses at early development stages. The objective is to encourage the funding of high-tech startups and the growth of venture capital in Greece using the 450 million Euros that it has at its disposal. The fund is still new, so it is too early to determine its success. Nevertheless, the ambitions of the fund are admirable.

> *"Capital is a key resource factor in the development of a networked economy . . . . To foster an environment conducive to the development of innovative, high-growth technology companies, policies must be designed to ensure that capital markets have the requisite breadth and depth to allow for efficient financial intermediation and capital allocation towards activities and projects involving technological creation, diffusion, and innovation."[27]*

Permit Use of Stock Options. Stock options can facilitate entry of firms by providing a way for new enterprises to attract, retain, and motivate employees, particularly in the early stages of development when the viability of such companies is uncertain and lack tangible assets for collateral.

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[24] More information on BNDES can be found at <http://www.bndes.gov.br/english/> (May 25, 2003).

[25] Technopreneurship Singapore, n.d., <http://www.techsingapore.com.sg/content/startup_gov.phtml> (April 8, 2003).

[26] TANEO, n.d., <http://www.taneo.gr/Eng/HomePage_Eng.aspx> (April 1, 2003).

[27] World Economic Forum, *2002-2003*, p. 31.

Capital Access in Mexico: An independent evaluation by the Milken Institute suggests that Mexico is ranked in the middle of other Latin American countries in its ability to attract capital.[28] "The index of 98 countries worldwide (including 18 in Latin America) looks at a combination of factors that can make it easy or difficult to access capital such as the depth, governance and repression of banking in a country; the equity, bonds and advancement level of capital markets; portfolio and foreign direct investment flows; macroeconomic and institutional environments and sovereign debt ratings."[29]

Table 3-1. Capital Access Index

Score and Global Rank April 2002		
Chile	4.53	29
Panama	4.19	34
Argentina	4.02	45
Peru	3.94	50
Nicaragua	3.88	52
El Salvador	3.80	54
Honduras	3.65	64
Mexico	3.65	64
Bolivia	3.61	67
Dominican Republic	3.61	67
Brazil	3.59	69
Guatemala	3.56	70
Uruguay	3.55	72
Costa Rica	3.39	82
Colombia	3.35	84
Venezuela	3.17	87
Ecuador	3.05	88
Paraguay	3.00	89

(Source: Milken Institute)

This mid-tier ranking is confirmed by Mexico's Information Technology Industry Association and several other companies and entities interviewed for this paper. These and other sources cited a lack of adequate access to financial capital as a major impediment to growth of the software industry. Other companies interviewed cited the inability to obtain financing for "intangible" capital such as knowledge or intellectual property. Further, based on a survey by the WEF of executives in Mexico's market when presented with the statement, "Entrepreneurs with innovative, but risky projects can generally find

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[28] Glen Yago, et al., "Capital Access Index 2001: Financial Repression and Capital Access," Milken Institute, March 2001, cited by Latin Business Chronicle, "The Best and Worst Countries for Entrepreneurs," *Capital Access*, n.d., <http://www.latinbusinesschronicle.com/topics/cai2001.htm> (May 30, 2003).

[29] The index of 98 countries worldwide looks at five key components that can make it easier or more difficult for entrepreneurs to access capital. Those components are economic environment, banking development, capital market development, international environment and sovereign ratings.

venture capital in your country", Mexico was given very low scores. [30] Indeed, of 82 countries surveyed on "venture capital availability," Mexico ranked 74.[31] This suggests more work needs to be done in this area.

Table 3-2.

	FDI AS A % OF GROSS CAPITAL FORMATION (2000)
Argentina	25.7
Brazil	26.9
Chile	22.2
China	9.5
Colombia	23.9
Costa Rica	15.1
India	2.1
Ireland	85.4
Mexico	9.9
Peru	6.3
United States	15.8
Venezuela	21.1

(Source: 2002 World Bank Development Indicators.)

One incentive to spur capital investments may be through positive tax incentives. Although not a definitive indicator, it is useful to look to Ireland's example. One of the major factors cited in the growth of Ireland's commercial software industry is tax policy. All manufacturing and internationally traded services industries in Ireland are taxed at a special ten percent rate (which will be raised to 12.5 percent under a new agreement with the EU). Proof of the benefit of the lowered tax rate, may be in gross capital formation. In 2000, foreign direct investment represented 85.4 percent of gross capital formation in Ireland.[32] By comparison, in Mexico, foreign direct investment represented 9.9 percent of gross capital formation in the same year (the most recent year for which World Bank figures are available). Some comparative World Bank figures are provided in Table 3-2.

This information emphasizes the need for work in this area – a need that is already acknowledged by the Program for the Development of the Software Industry. In the report, the issue of capital access is addressed throughout. Recommendations are made for nurturing a local venture capital industry including government-based financing, greater investments in this area from banks, etc. Given what we know about the importance of capital access and the need for it in Mexico, focus on these areas will be important to building software industry capacity in Mexico.

PRINCIPLE 3: Ensure Competitive, Open, Technology-Neutral Government Procurement. A competitive and open procurement environment ensures that limited government funds are being used for efficient purchase of technology products. An open procurement system ensures government

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[30] World Economic Forum, *2002-2003*, p. 284.

[31] Ibid., p. 240.

[32] World Bank, *2002 World Bank Development Indicators*, Washington, DC, 2002, Section 5.2, " Investment Climate,"p. 284.

employees have access to the best, most cost-efficient, state-of-the-art products and services. This makes government more efficient, which in turn facilitates citizen interaction with the government. Further, as a large consumer of IT products, government purchases of IT products stimulate the economy – particularly when those purchases put money back into the commercial software industry.

In a few countries in the Latin American region there has been some consideration given to mandating open source technology or writing open source requirements into procurement guidelines. Doing so could seriously disadvantage Mexican companies that may have developed product along existing commercial models and who might otherwise bid on these procurement contracts. In addition to individual corporate losses, such an approach takes resources away from the economic-generating benefits of the commercial software model to Mexico outlined earlier in this study.

To gain the full benefit of government procurement, we recommend a transparent, non-discriminatory, technology-neutral procurement system. We specifically recommend the following:

Maintain Technology Neutrality in the Procurement Process. Technology neutrality is widely understood as a fundamental principle in any technology policy. Indeed, efforts by governments to predetermine technology outcomes have consistently failed. With this principle in mind, one objective of government computer and software procurement should be to procure on a product's merits, on a value for money basis, and not the model of software development.

Review the Total Cost of Ownership. Procurement is going to be more efficient and cost effective for consumers and citizens when software best meets their needs. As managers develop IT acquisition plans, they must address issues of functionality, performance, security, value, and lifecycle cost of a product. If too much attention is given to acquiring technology with low up-front costs (based on the notion that open source software is free) and too little attention is given to identifying costs of training, maintenance, support, liability issues, etc., procurement decisions could lead to higher, not lower, costs over the life of the technology.[33] Lifecycle cost is especially important to consider for computer software. Software tends to be a small fraction of government's IT budget (typically around 5), but procuring the wrong software could lead to sizeable increases in the long-term cost associated with keeping the software running and useful.

> *"Open source [mandates] will inhibit investment in research and development, slowing down our industry and our country."*
> *Sinapsis Technologies México*

In a study conducted by Alan MacCormack of Harvard Business School entitled *Evaluating Total Cost of Ownership for Software Platforms: Comparing Apples, Oranges and Cucumbers*, the author looks at nearly 90 articles and studies reviewing the issue of total cost of ownership (TCO) with regard to software platforms.[34] Some of MacCormack's conclusions are:

- "acquisition costs for software tend to be dwarfed by other costs, typically comprising less than 10 percent of TCO for a system. This suggests that whether software is free, cheap or relatively expensive has relatively little impact on the total cost of IT investments. By contrast the single largest component cost is staffing . . ."[35]

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[33] Jean Bozman, et al., "Windows 2000 Versus Linux In Enterprise Computing: An Assessment Of Business Value For Selected Works", *An IDC White Paper Sponsored by Microsoft Corporation*, IDC, Framingham, MA, 2002**.**

[34] Alan MacCormack, "Evaluating Total Cost of Ownership for Software Platforms: Comparing Apples, Oranges and Cucumbers," AEI-Brookings Joint Center, April 2003, <http://aei.brookings.org/admin/pdffiles/phpdI.pdf> (May 31, 2003).

[35] Ibid., p. 2.

- ▪ "given that in the more comprehensive studies of TCO, staffing represents over 60 percent of costs, a difference of only 10 percent in staffing costs between platforms will often outweigh any advantage that might come from cheaper software. This result suggests that studies of TCO would be best served by digging into much greater depth on the drivers of differences in staffing cost. Getting this right is *much* more important in the grand scheme of things, than making sure you have adequately captured any discounts that will be received on the software's purchase price."[36]
- ▪ "variations in TCO across different workloads (e.g. web server, file server, print server, etc.) are often much greater than variations in TCO across different vendors for the same workload."[37]

For example, in a study conducted by IDC in 2002, users of both Linux and Windows 2000 were surveyed regarding cost advantages. There were some very interesting results.

- ▪ IDC researchers found that over a five year period of time, the Windows based system offered savings from 11 percent to 22 percent over Linux in network infrastructure, file serving, print serving and security serving. In only one category surveyed, web serving, did Linux have a cost advantage — a mere six percent.[38]
- ▪ According to the study, the lowered costs derive primarily from the much lower staffing needs of Windows.[39]

The Marketplace is the Best Test of Technology

The most competitive industries result from market competition. The failures of governments worldwide to drive the creation of local automobile and aviation industries are well known and stretch from Indonesia to Russia. Similar rules can be applied to the technology sector. Vibrant technology development is driven via the marketplace. When government attempts to specify certain technology outcomes, the result regularly is high cost and failed technology. Some well-known examples follow.

Supersonic Transport: Supersonic transport was considered a vital technology in the US and given more than US$900 million dollars in the 1960s and 1970s. The technology was never developed in the US. Instead, a joint program between France and England developed the technology into what we know now as the Concorde. The program was intended to develop a technology that would leap in front of the US. France and England funded over one billion dollars in development costs. Only 16 were ever manufactured, and only nine were ever sold. State-owned British and French airlines were the only buyers. The planes burned 5,500 gallons of fuel per hour and could carry only 100 passengers. One-way fare from London to NY was over $4,000. On April 10th, 2003 British and French airlines grounded the Concorde permanently. Only 20 passengers rode the last flight.[40] [41]

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[36] Ibid., p. 16.

[37] Ibid., p. 14.

[38] Ibid., p. 11.

[39] Ibid., p. 13.

[40] Jim Thornton, "Farewell Concorde - And Good Riddance," iGreens, April 12, 2002, <http://www.igreens.org.uk/farewell_concorde.htm> (May 30, 2003).

[41] Thayer Watkins, "The Concorde Supersonic Transport," San José State University, Economics Department, n.d., <http://www.sjsu.edu/faculty/watkins/concorde.htm> (May 30, 2003). And Stephen Moore, "The Advanced Technology Program and Other Corporate Subsidies," *Testimony before the Senate Committee on Governmental Affairs*, CATO Congressional Testimony, June 3, 1997, <http://www.cato.org/testimony/ct-sm060397.html> (May 30, 2003).

Korean Broadband Expansion: Korea's broadband penetration is among the highest in the world today. However, a number of Korean officials recently have expressed the view that Korea's approach to broadband – forcing development and adoption of certain technologies - has ended up being particularly harmful to the tech industry. In recent remarks, former Information Minister Yang Seung-taik said, "The Korean government wrongly encouraged companies to adopt ISDN (integrated service digital network) in the early 1980s even though the technology was useless for most domestic solutions developers. The government's promotion of ISDN technology eventually led to overlapping investment with the broadband market."[42]

Evaluate the Security Integrity of Products. Security issues will be discussed again in a subsequent section, but the issue is worth highlighting in the procurement process. Government carries an important responsibility to its citizens not only of providing efficient and cost-effective services, but also of ensuring the vital integrity of the nation's most sensitive infrastructure systems – defense, water, electricity, etc. The government also has access to citizen data, both financial and personal. In each case, the burden is on government to ensure the security of these systems and data. In making procurement decisions, governments should evaluate the security of products being purchased. More specifically, governments should ask themselves:

- Are independent international evaluation criteria being used (such as the Common Criteria for Information Technology – ISO 15408)?[43]
- Is there an identifiable entity (vendor) that is clearly responsible for addressing security gaps?
- Who will be responsible for providing patches to security flaws if they exist?
- Who will ensure the patches are not vulnerable to attack?

Join the WTO Government Procurement Agreement. The WTO's Government Procurement Agreement (GPA) is an important one, containing national treatment provisions, as well as a requirement that technical specifications "shall not be prepared, adopted or applied with a view to, or with the effect of, creating unnecessary obstacles to international trade." The Agreement is a useful set of global rules to implement non-discrimination in procurement processes worldwide. Mexican companies seeking to export software product could potentially benefit if the Mexican Government more actively engaged in these discussions and helped to remove barriers to Mexican products being purchased by foreign governments. Unfortunately, not a single country in Latin America is a signatory to the GPA. Only one Latin American country, Panama, is engaged in negotiations to join. Four countries, Argentina, Chile, Colombia, and Panama, maintain observer status.[44]

Look to International Organization Procurement Standards. Both the World Bank and the Inter-American Development Bank (IADB) maintain strict internal guidelines for procurement purchases. The World Bank has established a rigorous standard for procurement of information technology products. A website addressing the issue provides "specialized standard bidding documents, basic guidance documents, and records the dialogue between the Bank, its Borrowers and the IT Industry."[45] The IADB establishes some general guidelines, intended to provide the public sector with assurances that Bank funding will be used efficiently and economically, and that the process will be transparent:

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[42] Yang Sung-jin, "Former Minister Criticizes IT Policies," *The Korea Herald*, May 29, 2003, <http://www.koreaherald.co.kr/SITE/data/html_dir/2003/05/29/200305290058.asp> (May 31, 2003).

[43] See the section on security in this report for more information on the Common Criteria.

[44] World Trade Organization, "Government Procurement Agreement," n.d., <http://www.wto.org/english/tratop_e/gproc_e/gproc_e.htm> (February 26, 2003).

[45] World Bank, "Information Technology Procurement," n.d., <http://wbln0018.worldbank.org/emt/emtii/ipit.nsf/Main/itprocurement> (April 1, 2003).

- ▪ "COMPETITION: to ensure that the largest possible number of qualified suppliers take part so that borrowers obtain the best market terms.
- ▪ "EQUALITY: to ensure that all participants will be treated equally, avoiding preferences and discrimination of any kind to the detriment of some and the benefit of others, thus making for effective competition.
- ▪ "PUBLICITY: to ensure that all contractors have access to information and clarification during the bidding process and when the bids are opened.
- ▪ "DUE PROCESS: local legislation should provide procedures for the settlement of dispute and should permit bidders to lodge protests and to answer allegations." [46]

APPROACH B: TARGET POLICIES TO PROMOTE SOFTWARE AND IT SERVICES

Approach B encapsulates those intangible, indefinable policy stimuli that inspire creativity - through reward, infrastructure, and vibrant markets.

PRINCIPLE 4: Provide Strong Intellectual Property Protection. One policy stands out as a stimulus to the software sector: intellectual property protection. Strong intellectual property protection is critical to the growth of a local commercial software industry. Absent this incentive, engineers will not invest in the creation of software. Further, our report shows that absent a strong commercial software industry, an economy does not maintain the dynamic growth that drives overall IT spending. Without that commercial software growth, IT spending would have a smaller impact on GDP growth.

Intellectual Property Protection is Important to Mexico's Software Industry

Strong intellectual property protection is important to the growth of local industries. It is particularly important to software developers and technical engineers experimenting with new technologies. Indeed, the only hope that many small- and medium-size technology businesses have for financial success is assurance that they will recover their investment through remittance of licensing royalties on their products. If a new business' product is immediately pirated, a new company will not last long. The Asociación Mexicana de la Industria de Tecnologías de Información (AMITI) representing nearly 150 Mexican and Mexican based companies, cited intellectual property issues as a major problem facing the software industry in Mexico. In addition, intellectual property protection is singled out in the *Programa para el Desarrollo de la Industria de Software* as a major area of improvement for building Mexico's software industry capacity. As that study notes "reforzar la aplicación de las leyes de propiedad intelectual para disminuir los índices de piratería de software" will help grow a commercial software industry.[47]

Implement All Aspects of the TRIPS Agreement. An important first step to promote IT innovation is to implement and enforce the provisions of the WTO's Trade-Related Intellectual Property Agreement (TRIPS), particularly the copyright and enforcement provisions, which include requirements for:

- ▪ Adequate and effective protection of intellectual property.
- ▪ Extension of copyright protection to computer software.
- ▪ Coverage of all aspects of piracy, including unlicensed use by businesses (corporate end-user piracy).
- ▪ Unannounced (*ex parte*) raids in civil and criminal cases.
- ▪ Deterrent-level penalties.

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[46] Inter-American Development Bank, "OP-500 Procurement of Goods and Services," n.d., <http://www.iadb.org/cont/poli/op500e.htm#Objectives502> (April 4, 2003).

[47] *Programa para el Desarrollo de la Industria de Software*, p. 43.

- Meaningful criminal penalties.

Enforce the WIPO (World Intellectual Property Organization) Copyright Treaty. The WIPO Copyright Treaty (WCT) extends copyright protection to the online world. Fully two-thirds of all software is anticipated to be sold online within the next five years.[48] If copyright protection is not properly extended, unscrupulous individuals will have the ability to freely trade and sell software online. Important components of the WIPO Copyright Treaty include:

- Clarifying that copyright protection extends to digital works in temporary or permanent forms.
- Prohibiting the circumvention of anti-piracy technical measures or the alteration of rights management information.
- Specifying the author's exclusive right to "make available" his work (the author controls who sees the work, how it is used, how it is distributed, and how much it costs).
- Providing effective and expeditious enforcement procedures and remedies for online piracy.

International Treaty Implementation Efforts in Mexico

Globally, policy makers attempting to grow domestic information technology industries are recognizing the role that IP plays in the digital age. Recently, Tan Sri Dr. Othman Yeop Abdullah, at the time CEO of Malaysia's well known Multimedia Development Corporation, told the *New Straits Times* (August 2, 2002) that cyber laws and IP laws "play a crucial role in the growth of information and communications technology (ICT) . . . especially so if we are to encourage the development of software . . . without effective protection, our home-grown creative talents would not be able to survive, let alone succeed."

In the global race to promote the IT sector, any policy to stimulate the key IT drivers of software and services should be on the policy agenda. WCT adherence is a good vehicle to do so. To date, thirteen Latin American countries have signed the WCT including Argentina, Chile, Colombia, Costa Rica, Mexico, and Peru. Mexico is to be commended for its forward-looking approach to intellectual property protection in this regard.

Signing onto the Treaty, does not by itself assure adherence to the Treaty. According to the International Intellectual Property Alliance (IIPA), a US-based intellectual property rights group, Mexico's copyright law might not be fully WCT compliant. As reported by IIPA, a recent bill of amendments to the Mexican Federal Law on Copyright includes several significant flaws, including lack of provision for technology protection measures and inadequate provision for author control of its work (the making available right noted above).[49] Another concern, according to IIPA, the draft law fails to provide adequate deterrent penalties as provided for under the TRIPS Agreement. The bill of amendments was passed by the Mexican Congress on April 30, 2003. In general terms, the amendments include provisions to enhance remuneration assurances to authors, longer terms of protection and prerequisites to exploit derivative works.

Enforce IP Laws Once They Are on the Books. Writing laws and ratifying treaties are not enough; the laws must be enforced to have their desired effect. While information technology companies often have their own active anti-piracy programs, their civil actions alone will not prevent piracy. And, considering the potential positive impact that lowering the piracy rate can have on software sector growth, as demonstrated by the data in section one and two, aggressive anti-piracy action would seem to be justified.

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[48] Business Software Alliance, "Opportunities and Growth: A Vision for the Future, 2000- 2005", Washington, DC, June 2000, p. 2.

[49] Eric Smith, "Mexico: Request For Public Comments Concerning Identification Of Countries Under Section 182 Of The Trade Act of 1974, 67 Fed. Reg. 63186 (October 10, 2002)", *IIPA Special 301 Recommendation: Place Mexico on the "Watch List"*, IIPA letter to US Trade Representative - Section 301 Committee, October 30, 2002, p. 6.

Government can improve intellectual property protection by acting as a leader in enforcement of the intellectual property rights of the commercial software industry. In addition, government can advance the interests of Mexico's software industry by exhibiting leadership in the way it acquires, uses, and manages its own software technology. If government demonstrates to the public the importance of using properly licensed software, then the private sector is likely to follow suit. As a major trendsetter and as a major purchaser of software, government's example can help grow the local software industry in many ways.

The WEF, when interviewing on this topic, found that "many observers feel . . . increased protection of intellectual property should be addressed to further stimulate e-commerce and software production in Mexico."[50]

Mexico's Copyright Law

Mexican law already provides many protections for computer software, including specific copyright protection as provided for in the Mexican Federal Law on Copyright, as well as related administrative and criminal provisions primarily set forth in the Mexican Industrial Property Law and the Federal Criminal Code. Del website de la Asociación Mexicana de la Industria de Tecnologías de Información (AMITI),

> "En 1984, los programas de computación eran registrados ante el Registro Público del Derecho de Autor. No es sino hasta 1991, cuando se les incluye como una obra autorial expresamente protegida dentro del artículo 7, inciso "j" de la Ley Federal de Derechos de Autor. Actualmente, de acuerdo al artículo 135 de la Ley Federal de Derechos de Autor, es ilegal realizar o distribuir copias de una obra protegida sin la autorización del titular del Derecho. La única excepción, de acuerdo al artículo 18 (f), es para quien adquiera el uso autorizado de un programa de computación, quien podrá realizar una copia para uso exclusivo como archivo o respaldo."

> "En las modificaciones realizadas a la Ley en 1991, se instituyeron las sanciones penales para la violación de los derechos de autor de los programas de computación. Estas penalidades incluyen: cárcel de hasta seis años, multas de hasta 500 días de salario mínimo, o ambos, por la reproducción o distribución no autorizada de programas de computación."

> "La Ley Federal de Derechos de Autor prohíbe la reproducción de programas de computación que no sea con fines de respaldo y sanciona la realización de copias múltiples para el uso por diversos usuarios, así como también sanciona el dar o regalar una o más copias ilegales. Si se detectan programas de computación ilegales, a usted o a su empresa le podrán ser aplicadas sanciones Penales y/o Civiles."[51]

Support Extension of Patents to Computer Software and Provide Adequate Resources to Staff This Extension. Patent protection spurs broad innovation by requiring inventors, in exchange for legal protection, to publicly disclose how their product works and to promise to release the product to the public when their patent expires. But, patent systems work only when patent offices are properly staffed and funded. As software and other IT industry products increasingly are protected by patent law, the role of the patent office in IT sector growth will become more and more important. Today, no country in the Latin America region explicitly provides for patenting of computer software. Under Mexican law, while IT industry products and/or processes may be susceptible to patent protection (to the extent that they may

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[50] World Economic Forum, *2001-2002*, p.246.

[51] Asociación Mexicana de la Industria de Tecnologías de Información, A.C., *Piratería*, n.d., <www.amiti.org.mx/denuncia.asp#LEGISLACION> (February 23, 2003).

be considered inventions within the scope and definition of the Mexican Industrial Property Law), software is specifically excluded from patent protection. Software protection derives from copyright protection and related provisions.

PRINCIPLE 5: Build a Strong Telecommunications and Internet Infrastructure. Numerous cases demonstrate that a strong telecommunications sector greatly benefits the growth of information technology industries. This occurs as users are provided easier access to information and know-how. If users have never had the ability to interact with the telecommunications infrastructure, or if their experience is one of frustratingly slow downloads, they will not use technology. The telecom sector impact on IT industry growth also affects the producer side. Bandwidth and better infrastructure on which to deliver products encourages industry to build bigger and better.

<div align="center">

The Positive Effects of Telecommunications Deregulation
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Deregulation of telecommunications has proven effective in many markets. For example, when Australia deregulated its international long-distance market, prices for long distance dropped 50 percent. Today, there are over 2 million Internet hosts in Australia.[52]

Chile privatized its telecommunications sector in the 1980s and today is one of the most connected countries in Latin America, with 1.8 million Internet users. At the end of 2000, it had 22.1 telephone lines per 100 inhabitants.[53]

The Republic of Korea negotiated liberalization of its telecommunications market through the GATS Basic Telecommunications Agreement. Korea reports growth in its telecom sector as a result. As of March 2001, 57 percent of Korea's total population used mobile phones and 40 percent were Internet users.[54] [55]

This paper does not evaluate the size of the telecommunications sector relative to the IT sector, nor does it review the impact of the interplay between the two. Rather, we take as our point of departure that telecommunications infrastructure is the critical framework over which e-commerce occurs.

Telecommunications in Mexico: While the telecom situation is rapidly changing, these World Bank figures are useful for comparative purposes.

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[52] International Telecommunication Union, "ICT- Free Statistics," *Working Group Statistics on Communication and Information Services*, n.d., <http://www.itu.int/ITU-D/ict/statistics/at_glance/Eurostat_2001.pdf> (February 26, 2003).

[53] Oxford Analytica, "National IT Development: Explaining Success Stories Chile," from the Information Technology: Growth and Opportunity suite of data; June 2002.

[54] Business Software Alliance, "Elements of a Policy Framework for Vibrant E-Commerce," *A White Paper by the Business Software Alliance*, Washington, DC, 2001, p. 6.

[55] Korean officials recently have criticized their approach of standardization and targeting of certain technologies. They have expressed concern that the approach has limited technology choice and may ultimately put Korea behind its neighbors.

Table 3-3. Telecommunication and Internet Indicators in Select Countries, Various Years

	Telephone mainlines [b]	Mobile phones [a]	Information and commuincation technology [a]	Personal computers [b]	Internet users [b]	Secure internet servers [a]	Average cost of three minute phone call to US [c]	Average cost of three minute local phone call [c]
	(per 1,000)	(per 1,000)	(US$ per capita)	(per 1,000)	(per capita)	(per 100,000)	(US$)	(US$)
Argentina	213	163	310	51	68	6.4	2.80	0.09
Brazil	182	136	287	44	29	5.9	1.80	0.03
Chile	221	222	371	82	167	9.2	2.90	0.09
China	112	66	53	16	18	0.1	na	na
Colombia	169	53	231	35	21	1.6	2.20	0.03
Costa Rica	249	52	na	149	66	14.4	2.00	0.02
India	32	4	19	5	5	0.1	4.20	0.01
Ireland	420	658	1,704	359	207	91.3	na	na
Mexico	125	142	196	51	28	2.6	3.00	0.13
Peru	64	48	na	41	97	1.3	2.40	0.07
Venezuela	108	217	199	46	39	3.7	na	0.08

[a] 2001

[b] 2000

[c] 1999

Source: World Development Indicators Online, World Bank.

Based on this data, Mexico's landline telecom penetration compares unfavorably to many of its neighbors.[56] Reportedly this is particularly the case with respect to rural infrastructure access. Telephone costs are some of the highest in the region.

Still additional statistics, prepared by IDC, show that para el 2007 se estima que el 38 por ciento de la población en México contará con un teléfono celular, y que de ellos, al menos 6 millones de personas estarán utilizándolos con herramientas de Internet. (Source IDC)

Porcentajes obtenidos sobre 103 millones de personas que conforman la población total de México.

Table 3-4.

Mexico Projected Communications Infrastructure Indicators		
	2003	**2007**
Usuarios de Internet	7%	13%
Celulares dados de alta	29%	38%
Usuarios de Internet en celulares	1%	6%
PCs en los hogares	14%	19%
TVs en los hogares	89%	92%
Televisión de paga	20%	23%
Internet en hogares	10%	12%
Narrowband (banda reducida)	9%	10%
Broadband (Banda ancha)	1%	2%

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[56] Pyramid Research indicates that as of June 2002, the number of fixed phone lines was 141 per 1000. More information is available online at <http://pyramidresearch.com/info/pp/021029.asp> (June 9, 2003).

Another indicator of how Mexico is doing is in the World Economic Forum's 2002-2003 report. Some selected indicators from this report that are comparable to the earlier report indicate that Mexico ranks:

- 54 of 82 countries in terms of number of telephone mainlines (124.7 per 1000 people, indicating no improvement from one year to the next);
- 48 of 82 countries in terms of number of Internet users (16.40 per 100 people, indicating a substantial improvement from the previous year's report);
- 44 of 82 countries in terms of number of broadband subscriber lines (0 per 100 people);
- 64 of 82 countries in terms of public access to the Internet.

Internet infrastructure penetration rates are still low, but are progressing. According to the WEF 2001-2002 Technology Indicators Report, Mexico's Internet users increased by more than 200 percent between 1998 and 2000. The 2002-2003 numbers suggest a similar leap forward. The Internet infrastructure access improvements may be attributable to several factors. One may be the e-Mexico agenda itself. Some basic connectivity objectives of that plan include increasing the number of phones to 25 lines per 100 inhabitants by 2006 and creating specialized Centros Comunitarios Digitales (CCDs) to provide general access to the public to the Internet.

Another factor may be liberalization in the telecom area. Mexico opened its market to competition in 1996, but the telecom monopoly Telemex still dominates most market segments. Nevertheless, the increase in competition helps stimulate a decrease in Internet access fees and inspires new pricing strategies – all of which drive growth in the Internet area.

Finally, it is important to note that Mexico's Program to Develop the Software Industry highlights improvements in infrastructure as a key area to be developed in the future. In particular, the Program recommends targeting infrastructure development around ready-made software parks and enhancing infrastructure generally across the country.[57]

Provide Incentives to Companies Investing in Telecommunications Infrastructure. Governments cannot always provide or even marshal resources (nor should they necessarily try) to build a new telecommunications infrastructure or update an existing one. If government provides incentives to telecom companies to build these networks, a public service is achieved, greater capacity for new products and services is provided, and business is stimulated.

On the other hand, laws that tax or propose to add new regulations to Internet development may delay the growth of key IT industries. There is legislation pending before the Mexican Congress now that proposes to tax Internet Service Providers. If it passes, it could create a disincentive to new users to move online.

Invest in Broadband Bandwidth. Expansion of existing infrastructure to promote greater broadband bandwidth will propel access to more consumer goods and services over the Internet. When software and services providers are better able to deliver their products to consumers, demand for these products grows and so does this segment of the economy.

> *"The cost of [the] Internet is high and the lack of adequate international bandwidth makes the Internet really slow and unstable . . . . Subsidization for international bandwidth will definitely help promote IT business and is good for subscribers as well."*
> **- Internet Executive, Mexico.[58]**

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[57] *Programa para el Desarrollo de la Industria de Software*, p. 68.

[58] World Economic Forum, *2001-2002*, p. 246.

As noted above, Mexico's broadband access ranks poorly by comparison to its neighbors. Mexico ranks 44 of 82 countries surveyed.[59] The WEF measures the actual number and transmits a ranking according to that number. In this case, the data suggests that there are 0 broadband lines available per 100 people in Mexico. Further, because so few countries have broadband access worldwide, 44 is the lowest ranking available. A number of countries share this spot with Mexico.

From a more positive perspective, a report by eMarketer says that Mexico ranked third in Latin America in terms of broadband access in 2001. At that time, penetration rates in Mexico were estimated at .6 percent. According to the e-Marketer reporter, this translates into 7.2 percent of Mexican households that were on line at the end of 2001 using broadband.[60]   No doubt this has improved over the last couple of years.[61] By 2004, this figure is projected to increase to 4.4 percent.[62] As you can see, the various data sources provide slightly different pictures of infrastructure readiness.

Ensure Technology Neutrality. Mandating certain technologies while restricting others limits competition and may unintentionally hurt development of better technologies or newcomers to the market. An unrestricted technology environment is critical for the development of software- and services-based industries.

Building Infrastructure: Cooperative Efforts among Industry, Government & the Private Sector
Part of Mexico's success in expanding access to Internet facilities is through the cooperative efforts of academia, government, the private sector, and non-governmental organizations. The goal of all is to provide infrastructure access in order to grow the IT industry in Mexico. For example, through the *Internet en mi biblioteca,* a Project sponsored by el Consejo Nacional de Ciencia y Tecnología (CONACYT), a number of entities have come together to provide Internet access in libraries.[63] A number of entities, including private organizations, contribute to the project. For example, since 1998 Microsoft has invested more than 400 thousand dollars to equip 50 libraries.

Ensure IT Infrastructure Access for Consumers. Ensuring that consumers have access to technology in order to become familiar with and use the Internet is important. This will be discussed in human capital development as well. Internet infrastructure access can be stimulated in many ways: through government sponsored kiosks, tax breaks for Internet cafes, and lowered tax rates for Internet telecom use versus voice use, etc. Multiple avenues exist. The key is to get them in place and move access forward.

PRINCIPLE 6: Invest in Human Capital and Job Creation. The global information technology phenomenon is driven by human intellect and ingenuity. This is doubly true for software- and services-based industries—both intangible asset-based industries. People and their knowledge are going to be the drivers of software growth. As with many of the recommendations made here, human resource development is critical to the producer and the user sides of the IT industry equation. Human resource development is a key component in closing the digital divide as well. IT literacy among a user base is critical for companies to be able to sell product domestically. The statistical data above shows that one of the world's major producers of software, India, has lagged in creation of a domestic user group for its

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[59] World Economic Forum, *2002-2003*, p. 317.

[60] Ibid., p. 316.

[61] Ben Macklin, "Broadband & Dial-Up Access," eMarketer, New York, August 2002, p. 315.

[62] Ibid., p. 319.

[63] Dr. Alfredo Sánchez, "Primer Taller NSF - CONACYT Sobre Bibliotecas Digitales," Universidad de las Américas - Puebla, n.d., <http://ict2.udlap.mx/dl/workshop99/reporte.html> (June 8, 2003).

products. On the producer side of the equation, governments can grow local industries by nurturing local talent pools.

Finally, an ultimate benefit in software industry growth, and particularly human capital stimulation, is overall job generation. The software sector is powered by people. This creates endless opportunities for employment in an economy that is prepared to capitalize on those possibilities. We believe that job creation via the commercial software sector is most effectively stimulated by addressing each of the ten points outlined in these policy recommendations. However, human capital investment is the policy most clearly linked to job generation in an industry that depends on people as its primary asset.

Human Capital Development in Mexico: The WEF compliments Mexico's efforts to use education to spur information technology development, calling Mexico an "innovator" in this area.[64] Even before e-Mexico, the Government launched its Telesecundaria program that provided education through satellite broadcasts and videotapes. Mexican Universities are reportedly using information technology extensively, offering a wide range of relevant degree courses, and increasing the number of distance learning education courses. A more recent initiative, e-Educación focuses on technology as a means to help provide primary and secondary education to individuals who did not have an opportunity to complete their education.

Education and building human capacity was one of the fundamentals outlined in the Software Program. Point number two states, "Educación y formación de personal competente en el desarrollo de software, en cantidad y calidad convenientes." Continuing efforts in this area will help stimulate the fundamental human component of the software industry. Such activities also contribute to job generation for Mexico by enhancing the number of technically qualified software engineers and by creating an e-savvy and more highly skilled workforce.

Invest in Basic Literacy. Investment in basic literacy ensures a community of able IT users/consumers.

Invest in Math and Science at Basic Levels. Focusing on basic math and science skills at early stages of learning sets an important foundation for future IT innovators. Establishing the foundation for engineering and services talent at early ages is critical to closing information technology gaps and to establishing the intellectual base to develop local software and services industries. Company programs, such as Intel's Science and Engineering Fair for grades 9-12 encourages creativity and focus on the sciences.[65]

Commercial Software Industry, Job Generation & Human Capital Development

One of the benefits of the commercial software model is that it is in industry's interest to educate and train consumers and producers of software and IT products locally. While government involvement in human capital development is critical, commercial software vendors and vendor neutral organizations are promoting IT utilization, education, and training to stimulate the growth of indigenous industries. For example, Hewlett-Packard's (HP) e-Inclusion program promotes partnership between HP and the developing world, specifically to serve low-income populations. E-Inclusion programs have been launched in Brazil and Costa Rica. Similarly, Adobe works with the United Nations and the Food and Agriculture Organization (FAO) to help farmers in remote areas access information ranging from weather to crop prices. Dell, Gateway, Intel and Microsoft, all contribute to "Teach to the Future", a worldwide effort to help teachers integrate technology into classroom instruction. CompTIA has certified the IT skills of roughly half a million entry- and mid-level workers in the IT sector in nearly 80 countries. IT certifications are an effective means for employers to identify IT skill levels and a proven predictor of performance across the industry

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[64] World Economic Forum, _2002-2003_, p. 317.

[65] Intel Website at www.intel.com/education .

In Mexico specifically, we have seen corporate investment in human development.

- Centros de Vinculación Empresarial: To date, 32 classrooms have been set up around the country, hosted by Chambers and Associations equipped with PCs, software, and satellite links specifically to increase productivity of human capital in small and medium enterprises. This is a joint project in association with HP, Interdirect (a satellite transmission/distance learning company) and Tralcom (a company providing Learning Management Systems). The Office of the Secretary of Economy is paying for a percentage of the cost of the courses and for the facilities. The industry partners provide the technological infrastructure for free to Enciclomedia. Proyecto financiado por Microsoft en el que CONACYT y la Universidad Pedagógica Nacional digitalizaron contenido de los libros de texto gratuitos para relacionarlo con contenidos de Encarta y otras fuentes del Sector Educativo, como TV UNAM, entre otras.[66]
- La Unión de Empresarios por la Educación A.C. o "UNETE" es un organismo que pretende complementar el trabajo de Red Escolar recaudando fondos de la iniciativa privada para equipar escuelas primarias y secundarias públicas con laboratorios de cómputo. Donations from Compaq (hoy Nueva HP), Ford y sus distribuidores, Fundación del Empresariado Chihuahuense, Fundación Televisa, Microsoft de México, Lotería Nacional para la Asistencia Pública y Don Max Shein (q.e.p.d.) han equipado más de 500 escuelas y este año se sumará otras 700. The organization also works with a number of large media companies, including "Televisa, Multivisión, Grupo Imagen, Cinemex, Radio Fórmula, Eumex, Publi XIII, Época, Newsweek, Teve de mente, Yahoo!, Proceso.com, El Universal Online, entre otros."*[67]*
- Intel Teach to the Future: Under this program, Intel works with the Ministry of Education to train teachers grades 1-9 in how they can incorporate PC technology into the classroom. Since its inception in 2000, the program has trained 50 thousand teachers. The goal is train 300 thousand by 2004.[68]

Invest in Information Technology Training. Targeted investment in information technology training and certification will provide an essential base of human capital in a global market that is short on IT workers. Countries should provide support for IT training and certification at all levels, including retraining programs as technology changes. In particular, government working in conjunction with IT corporate training and certification programs could help promote growth in the software and IT services sector.

Admit Foreign Talent to the Local Economy. Governments should encourage and permit foreign IT talent to enter the country. These individuals share important knowledge with local workers and contribute directly to overall market growth—particularly in short-term efforts to grow local software and services industries. Similarly, the Mexican Government should encourage foreign governments to admit Mexican talent for training, education, and sale of services.

The World Economic Forum and the World Bank have gathered some statistics that show how countries are doing with human capital development. Table 3-5 shows how Mexico compares to some of its neighbors. The first three categories of this chart were developed by the World Economic Forum in its 2001-2002 report.[69] The WEF surveyed corporate executives in each of these markets and asked them

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[66] Sánchez, <http://ict2.udlap.mx/dl/workshop99/reporte.html>. Also, Microsoft Corporation, "Firma SEP Convenios Con CONACYT y Microsoft México para la Ejecución Del Proyecto Enciclomedia", *Microsoft Comunicado de prensa*.

[67] UNETE, "La Unión de Empresarios para la Tecnología en la Educación, UNETE A.C., presentó su informe anual," 13 marzo 2003 <http://www.uneteya.org/seccion.asp?it_id=250&sec_id=42&com_id=0> (June 8, 2003).

[68] www.intel.com/education

[69] The indicators from the 2001-2002 report are used, as we believe these are more useful categories to consider for human capital development than those provided in the 2002-2003 report.

to provide a value performance ranking for their respective country. Those value rankings are then compared to other countries to arrive at a Mexican position of all 75 countries surveyed. The results for Mexico are adequate relative to other neighbors. World Bank figures showing basic literacy ranks are good or compete with other Latin neighbors, but by comparison to India, they are high. It should be emphasized that this table is provided simply for illustrative and comparative purposes. We do not view this information as absolute; rather it offers a point of departure for discussion regarding possible areas of policy focus for Mexico.

Human Capital Development in Mexico: The World Economic Forum and the World Bank have gathered some statistics that show how countries are doing with human capital development. The chart below shows how Mexico compares to some of its neighbors. It should be noted, however, that there are numerous government, university, and industry initiatives underway to promote human capital development in Mexico. As a result, some of these figures may be outdated.

Table 3-5. Human Capital Indicators

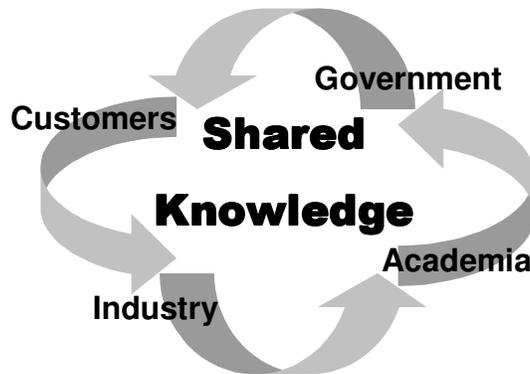		Argentina		Brazil		Chile		Costa Rica		Colombia		Mexico		Peru		Venezuela		India		PRC	
	Rank (of 75)		Rank (of 75)		Rank (of 75)		Rank (of 75)		Rank (of 75)		Rank (of 75)		Rank (of 75)		Rank (of 75)		Rank (of 75)		Rank (of 75)	
*Net Access in Schools	36		37		25		35		42		40		46		61		46		39	
*Investment in Employees' Development of IT Skills	34		27		34		40		61		40		61		46		34		61	
*Quality of IT Training & Education Programs	49		40		29		26		60		55		55		52		9		63	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
**Adult Literacy (2000) Percent ages 15 and over	97	97	85	85	96	96	96	96	92	92	93	90	95	85	93	92	68	45		
**Personal Computer installed in Educations (2000)	122,881		690,196		108,907		NA		108,209		395,813		NA		92,655		161,014			

* Source: World Economic Forum, The Global Information Tecnology Report 2001-2002
** Source: World Bank Development Indicators 2002

In the 2002-2003 report, Mexico ranked 64 of 82 countries surveyed in quality of local IT training programs. This may be considered a fall compared to the previous year's report (recognizing the changes in methodology between the two reports). A new indicator developed by the WEF puts Mexico's "quality of math and science education" at 77 of 82 countries surveyed.

PRINCIPLE 7: Ensure Vibrant and Accessible Government-Funded Research and Development.
Some of the greatest technological advances of all time have occurred through the creative "ecosystem" of government, university, and private sector research and development. This is no less true for the IT sector. Indeed, the Internet itself was a product of government funding, university research, and private sector application and development. This "ecosystem" is vital for growth of the software industry. In the software ecosystem:

- Governments and universities advance the knowledge base through basic research and put this in the public domain.
- Governments create incentives for commercial companies to build on this knowledge through a legal system of IP.
- Commercial companies undertake applied research and develop products that use this knowledge to move technology forward.
- The resulting economic growth, tax revenue, job generation, and commercial contributions help support further basic research.

Figure 3-2. The Software Ecosystem

The architects of Mexico's e-México initiative envisaged a similar ecosystem. Indeed, in President Vicente Fox's announcement of the e-México initiative he said,

> "*Doy instrucciones al Secretario de Comunicaciones, a Pedro Cerisola, de iniciar a la brevedad el proyecto e-México, a fin de que la revolución de la información y las comunicaciones tenga un carácter verdaderamente nacional y se reduzca la brecha digital entre los gobiernos, las empresas, los hogares y los individuos, con un alcance hasta el último rincón de nuestro país.*"[70]

In order to keep this vital ecosystem going, we encourage government's continued engagement in basic IT research. Such investments not only improve general technology proliferation, but also contribute positively to the growth-generating power of the software industry - leading to overall economic growth, increased tax revenue, and job generation. Specifically,

Continued and Increased Public Funding for Basic Research. Government-sponsored research is particularly vital in the areas of basic research. New scientific breakthroughs can lead to innovative and novel thinking and research by universities and practical application development by the private sector. Although basic research often yields long-term benefits to society in the form of new technologies and products, in the short-term such research is often too general to justify to shareholders and too expensive to sustain financially. While private firms are taking on increasing research and development burdens, there are some fundamental areas of scientific development that only government (and universities) can sustain.

"In our discussions with Mexican businesses, one of the concerns raised by the local software industry was the lack of access to basic equipment and facilities as a hindrance to R&D development in universities. The recommendation was to find ways to make it easier for universities to acquire equipment, communications and support IT careers."

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[70] Vicente Fox Quesada, Presidente Constitucional de los Estados Unidos Mexicanos, 1 de Diciembre de 2000, <http://www.e-mexico.gob.mx/index.php?id=23> (February 23, 2003).

Disseminate Knowledge Generated by Public Research. The value of Government-funded research rests in large part on the system in place to ensure that basic research innovations are transferred to the private sector for eventual use in commercial products. A successful transfer system will help incubate the research ecosystem. This system should include policies and procedures designed to 1) communicate advances in publicly-funded basic research to the commercial sector, 2) license the results of basic research to allow for its transfer to the commercial sector, and 3) communicate with industry on a regular basis to understand which areas of basic research offer the greatest commercial opportunity for the country.

Create Incentives for Private Sector Based Research. While some research must remain in the government sector, government can prompt research and development in areas of particular national interest by providing grants, providing tax breaks, and promoting strong intellectual property protection so that creators can reap the benefits of their labors.

Some World Bank indicators are provided in the table below. While not a complete picture, they give some indication of research and development activity in Mexico compared to neighboring countries and similarly positioned countries.

Table 3-6. Research and Development Indicators

	Scientists & Engineers In R&D (in millions)1991-2000	Science & Engineering Students (% tertiary level students)1987-1997	Science & Technology Journal Articles (1997)	Expenditures for R&D (% Gross National Income 1989-2000)
Argentina	711	28	2119	.48
Brazil	168	27	3908	.77
Chile	370	42	850	.56
Colombia	NA	36	208	NA
Costa Rica	533	20	73	.06
Mexico	213	32	1915	.36
Peru	229	34	63	.00
Venezuela	194	26	429	.34
PRC	459	43	9081	.06
India	158	25	8439	.62
Ireland	2132	31	1118	1.54
Source: World Bank Development Indicators 2002				

In addition, it is worth noting that the WEF specifically cited Mexico as having an exemplary research and development program through the National Council of Science and Technology. "Mexico's initiatives to promote R&D are particularly noteworthy." The Council,

> "serves as the vehicle for the promotion and sponsoring of specific projects concerning research and the dissemination of scientific and technological information. Mexico also has the Integrated System for Information on Scientific and Technological Research, an information and registration system of activities and institutions involved in science and

technology that also serves as a mechanism for R&D institutions to obtain support from the federal government."[71]

Furthermore, the software ecosystem seems to be working in Mexico. One example is with the Fundación Mexico Digital. The Ministry of Economy is inviting private institutions to invest in the development of projects to set up digital value chains. The Government will match private investments, but the entity is intended to remain an autonomous, private institution. To date, Cisco, HP, IBM, Intel, Microsoft, market research firms, chambers and associations, and many other players (expected to reach 20 providing money for the establishment of the institute) have agreed to participate.

APPROACH C: BUILD THE LEGAL INFRASTRUCTURE FOR THE ONLINE MARKETPLACE

The future of software and services is online. Services that are accessible any time, any place, and on any device are the new reality. This new reality will grow only if the infrastructure exists for safe and secure online transactions. Policies to promote IT growth in software and IT services industries must include long-term policies to ensure a vibrant and growth-driven marketplace for those products and services in an online world. They must also address the needs and concerns of users operating in an online world.

PRINCIPLE 8: Establish Basic Rules for Online Commerce. A business will not provide online service if the legal foundations for that business are uncertain. Businesses involved in electronic transactions must know that the transactions are authentic and will be respected in a court of law.

In the Case of Mexico
In 2000, the Mexican Congress passed a bill of amendments to the Civil Code for the Federal District on Common Matters and for all the Mexican Republic on Federal Matters,[72] the Federal Code on Civil Procedures, the Commerce Code and the Federal Law on Consumers Protection to strengthen recognition of online contracts and e-commerce transactions.

In the civil/commercial fields, these amendments provided: 1) the acknowledgment of the acceptance/consent by means of electronic media; 2) the allowance for the people engaged in commerce to keep their commercial records by electronic means; 3) the definition of the legal scope and evidentiary value of data messages and electronic means; 4) the regulation of online contracts and e-commerce transactions, and the use of automated systems, and 5) the introduction and definition of the paramount concept of data message.

On the administrative side, the amendments to the Federal Law on Consumers Protection introduced international principles on consumers' protection in e-transactions. The amendments included protective provisions on the type of contents, advertising and means to assert the relevant rights. Also in the administrative field, the Federal Law on Administrative Proceedings was later amended to give credit and faith to proceedings conducted by electronic means.

Other 2000 amendments took place on the criminal side. The Federal Criminal Law was amended to specifically provide for penalties assessed on unauthorized access and data corruption, including

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[71] World Economic Forum, *2002-2003*, p. 33.

[72] Currently, the Legislative Assembly of the Federal District enacts its own Civil Code for the Federal District and the Mexican Congress enacts the Federal Civil Code on federal matters. Since the Civil Code for the Federal District was previously applicable to both common and federal matters, the Federal Civil Code resembles identical provisions to those provided in the Civil Code for the Federal District.

governmental and financial systems. Child pornography broadcasted or transmitted by electronic means was also specifically criminalized..

The Mexican Congress recently passed a bill of amendments to the Mexican Commerce Code on electronic signatures, primarily based on the UNCITRAL Model Law on Electronic Commerce. The amendments include new definitions to determine precisely the legal validity of electronic messages, regulate the use of electronic signatures and provide for the establishment of certification providers, as well as recognition of foreign electronic signatures.[73]

"Mexico is to be commended for its vision in the area of e-commerce. The e-Mexico initiative and targeting the software industry will help our industry and ultimately grow the economy in Mexico."

- Sr. Javier Allard,
Director General
La Asociación Mexicana de la Industria de Tecnologías de Información.

Do No Harm. In the rush to embrace the information age, caution in promulgation of legislation is warranted. Since information technology is such a new area, we are still grappling not only with how to legislate, but also with what might need to be legislated. In government efforts to create the best potential environment for e-commerce, it is important to avoid predetermining technological outcomes. While keeping this basic principle in mind, several areas of electronic law deserve high priority:

Electronic Contracts: As transactions and product delivery increasingly move online, businesses are facing challenges in doing business in markets that provide no legal recognition of electronic contracts. Business in the online world should be just as simple as business in the physical world. The Uniform Inter-American Rules for Electronic Documents and Signatures (UIAREDS) has adopted an approach that is changeable with various technologies and business models. It also gives parties full autonomy to vary contract rules that govern their specific transaction. This kind of flexibility generates industry confidence to do business online and encourages investment in online services that might not be available in the physical world.

E-Signatures: Electronic signatures help assure businesses that a party with whom they are transacting business is who the party claims to be. This assurance is an important step in establishing customer confidence in online commerce. E-signature rules should strive to ensure maximum technological development. Laws requiring use of a specific technology may stunt development of this area of e-commerce and limit user choice of e-signature provider.

Jurisdiction: E-commerce creates a number of questions and potential conflicts concerning jurisdiction of a transaction. Businesses must understand the legal ramifications of selling their product or service outside of their country. It becomes even more complex in federal systems of government, where businesses may have to deal with national and local rules. This is particularly true for small companies that cannot afford the cost of going to court in a faraway country. To protect and promote the local IT market, companies should be allowed to write the presiding jurisdiction into their contracts. If a question of jurisdiction arises, a seller should be given the benefit of the doubt and the law of the seller's home jurisdiction should apply. Such rules would give confidence to foreign e-commerce investors and would help Mexican businesses sell abroad as well.

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[73] "Decreto por el que se reforman y adicionan diversas disposiciones del Código de Comercio en materia de firma electrónica", enacted in 2003 (publication pending), <http://www.sat.gob.mx/AGJI/acac97/inf_2002/dr_ladua.html> (June 9, 2003).

PRINCIPLE 9: Ensure Network and Information Security. Without consumer confidence in the security, privacy, and integrity of information in cyberspace, there will be no e-commerce. Protecting information on the Internet is a prerequisite to seeing growth on the Internet. The escalating problem of viruses, hacking, malicious attacks, and other security breaches is apparent in everyday news stories. Economies just beginning electronic commerce promotion may not be as focused on security issues. But given the global nature of the IT industry it is important to focus attention on security.

Security Considerations for Government's Selecting Software

One of the major factors in government acquisition of software for vital government systems is likely to be security. While evaluating and assessing the security of a system is a complex task that should be undertaken by security experts, some simple questions can help in the evaluation process:

- Does the software meet the standards of the Common Criteria for Information Technology (ISO 15408)? (It should be noted that Mexico's software action plan generally supports the use of ISO standards, although not specifically with respect to security. [74])
- Has the software been audited by an independent third party?
- What party is responsible for addressing any breach in the security of software after its acquisition?
- Does the procurement contract include security patches?
- Will these patches be rigorously tested to ensure they do not introduce new vulnerabilities to the government's computer systems?

Some general principles to promoting online security include:

- **Develop rules that allow security levels to meet user needs.** Security needs of business, government, and consumers will vary depending on the data being protected and the culture of the individual or country in question. Flexibility is necessary to meet individual needs.
- **Encourage consumers to use strong security tools and educate consumers on the tools.** Frequently, security breaches could have been prevented through simple changes in passwords or better use of anti-virus products. Raising consumer awareness and ability to use products can do a great deal to control basic security challenges.
- **Ensure technology neutrality in laws related to online security.** Governments do not want to unintentionally create dependency on an inferior technology.[75]
- **Strive for international consistency in laws.** Stronger security efforts should not create barriers to trade.
- **Adopt the Common Criteria.** The Common Criteria are an international set of standards for defining IT product security requirements and evaluating whether a product meets those requirements. This helps consumers better match their security needs to a product.
- **Enact and enforce tough laws for online security breaches.** Well-publicized enforcement may deter future computer criminals.

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[74] *Programa para el Desarrollo de la Industria de Software*, p. 64.

[75] One advantage of non-commercial software, advanced by proponents of open source software, is the fact that anyone can potentially examine source code, identify security flaws and propose new security fixes. However, this "many eyes" benefit does not ensure security. In fact, open source and commercial software both face security challenges. CERT, a leading organization that tracks security vulnerabilities, reported that in 2002 there were five security vulnerabilities found for Microsoft Windows, 12 for Red Hat Linux and 12 for Sun Solaris. (www.cert.org)

More About the Common Criteria

Individual countries can adopt the Common Criteria by joining the Common Criteria Recognition Arrangement (CCRA).[76] Since the CCRA's inception in 1998, IT security agencies in 14 countries have joined. Members include Australia, Canada, France, Germany, Spain, and the United States. The CCRA expresses the signatories' common commitment:

- ”to ensure that evaluations of Information Technology (IT) products and protection profiles are performed to high and consistent standards, and are seen to contribute significantly to confidence in the security of those products and profiles;
- “to improve the availability of evaluated, security-enhanced IT products and protection profiles;
- “to eliminate the burden of duplicating evaluations of IT products and protection profiles; and
- “to continuously improve the efficiency and cost-effectiveness of the evaluation and certification/validation process for IT products and protection profiles.”

Computer Security in Mexico and the Region. In its Development Indicators Report, the World Bank now counts the number of secure computer servers in a country. Secure servers are defined as servers using some form of encryption technology. While the definition is not a useful practical definition of security, the statistics do provide an interesting comparison. The World Bank provided the following 2001 statistics:
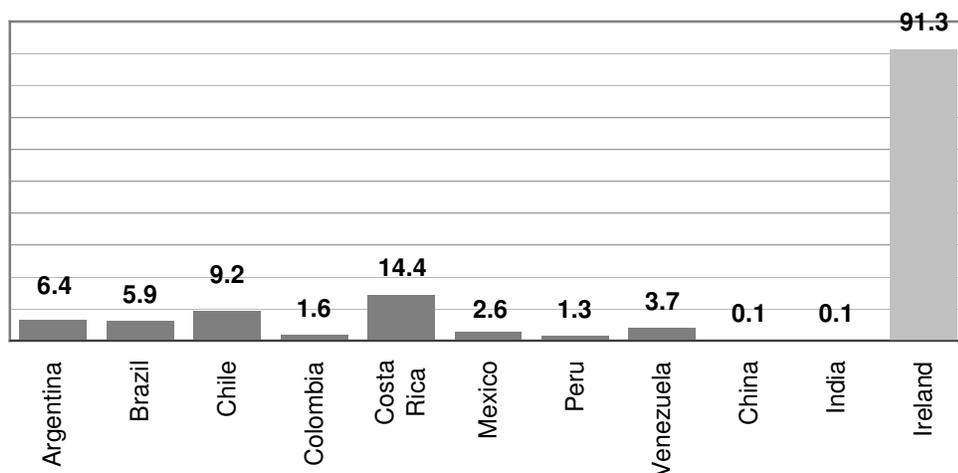
Table 3-7.

Computer Security in the Region (Secure server=server using encryption technology)	
Argentina	238
Brazil	1028
Chile	141
Colombia	71
Costa Rica	56
Mexico	259
Peru	35
Venezuela	92

On a per capita basis, Mexico's servers, as defined by the World Bank's "security" definition, are quite low – 2.6 per capita.

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[76] The CCRA is available on the Internet at <http://www.commoncriteria.org/registry/mr.html>.

Figure 3-3. Secure Internet Servers Per 1,000,000 People in 2001

Similarly, the WEF looked at security issues for the first time in its 2002-2003 report. Mexico ranked 50 of 82 countries surveyed in that report.[77]

PRINCIPLE 10: Build Consumer Confidence by Protecting Individual Privacy Online. Sensitivity regarding personal information is related to cultural needs and current levels of access to data by business and government. Online transactions present new challenges and therefore new fears for consumers. The reality is that online transactions will never grow if consumers are too afraid to transact online. Because the level of consumer sensitivity to use of data is often culturally based, yet the online world is global, development of a consensus in this area has been somewhat challenging.

One way to support these programs is through industry self-regulatory certification bodies. One example of such a body is TRUSTe. TRUSTe is an independent, nonprofit, global initiative that exists to help consumers feel confident about using the Internet for communication, shopping, and research. It aims to build consumer confidence by promoting the principles of disclosure and fair information practices among the websites that participate in the program.[78] TRUSTe licensees in 25 countries worldwide display a widely recognized TRUSTe "seal of approval." The seal tells consumers that the website protects their privacy by giving them full control over the uses of their personal information. TRUSTe is just one of several such privacy seal or "trustmark" programs in place around the world. For example, the Korean Association of Information and Telecommunications awards an "ePrivacy Mark" to qualified Internet sites that satisfy stringent data protection criteria.

Despite the complexities of the global privacy issue, there are some widely recognized best practices for vendors. Comptia recommends:

- Posting a clear and conspicuous notice of the website operator's privacy practices for consumers, including identification of the types of personally identifiable information (PII) collected from users in the ordinary course of business and the planned uses of that information;

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[77] World Economic Forum, *2002-2003*, p. 240.

[78] More information can be found at <http://www.truste.org>.

- Having straightforward "opt-out" procedures that give consumers the ability to decide not to have their PII used or disclosed for purposes outside of the scope of the purpose(s) for which the PII was collected;
- Developing procedures to provide reasonable assurance that the site is managed in conformity to stated privacy policy; and,
- Taking reasonable steps to help protect the security of PII collected from consumers.[79]

Whether rules are through self-regulation, government mandate, or some combination of these things, it is important that no policy discriminate against online commerce as compared to other forms of commerce.

Data Protection in Mexico: At present, personal data protection is primarily regulated by generic civil law provisions, and specifically by the Federal Law on Transparency and Access to the Public Governmental Information (regarding information provided to governmental bodies) and the Law on Credit Information Companies (regarding information on the personal credit/financial situation).

Moreover, there is a pending initiative in the Mexican Congress on protection of personal data (regarding information provided to private parties). Such data privacy legislation has passed Mexico's Senate and is pending in the House of Deputies.[80] The legislation is broad and as currently drafted will negatively impact a number of businesses. The provisions may be particularly harmful to the growth of electronic commerce. For example, the draft law would effectively forbid a company from sending data on its employees in Mexico across borders to its headquarters in another market. Further, the legislation would forbid exchange of information with any country that did not have exactly the same data protection standards as Mexico.

Industry generally opposes the legislation. In a February 2003 presentation, the Alianza por el Respeto a la Privacidad y Libertad de Información, an ad hoc coalition of mostly businesses, indicated "En caso de aprobarse la iniciativa de Ley en las condiciones planteadas pondría en desventaja a México en el TLCAN, beneficiaría a empresas de Centro y Sudamérica y ahuyentaría la inversión en México."[81]

While the intention of legislators certainly is well meaning, it is important to balance consumer privacy with the practical concerns of global business. This balance is even more necessary in the borderless world of the Internet. Finally, considering Mexico's ambitions to become a net exporter of software and software-related services, cutting off cross border data flows could have a direct negative impact on these goals.

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[79] The Computing Technology Industry Association (CompTIA), "CompTIA and Internet Privacy," n.d., <http://www.comptia.org/sections/publicpolicy/initiatives/internet_privacy.asp> (June 4, 2003).

[80] "El Proyecto de Ley Federal de Protección de Datos Personales," proposed language is available at <http://www.cddhcu.gob.mx/servicios/datorele/cmprtvs/1po2/set/2.htm> (June 9. 2003). Original bill submitted on February 14, 2001 by Senator Antonio Garcia Torres. It has been reviewed by the Commissions on Constitutional and Legislative Affairs. Approved by Senate on April 30, 2002.

[81] Christiane Dayan, "Postura Respecto a la Iniciativa de Ley Federal de Protección de Datos Personales," presentation to the Trade and Industry Committee of the House of Deputies, February 2003.

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