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**DIRECTORATE FOR SCIENCE, TECHNOLOGY AND INDUSTRY
COMMITTEE FOR INFORMATION, COMPUTER AND COMMUNICATIONS POLICY**

Working Party on the Information Economy

**ICT DIFFUSION TO BUSINESS: PEER REVIEW
COUNTRY REPORT MEXICO**

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FOREWORD

In June 2006 this report was presented to the Working Party on the Information Economy as part of the peer review of ICT diffusion to business in Mexico. It was recommended to be made public by the Committee for Information, Computer and Communications Policy in October 2006.

The report was prepared by Myriam Forstel (consultant) and Graham Vickery of the OECD Secretariat. The series of peer reviews of ICT diffusion to business is directed and co-ordinated by Graham Vickery. It is published under the responsibility of the Secretary-General of the OECD.

SUMMARY

Mexico has made good progress in modernising its economy and has started to successfully address structural problems including poverty and low levels of human capital. The 3-4% annual GDP growth is very encouraging, coupled with low inflation and federal deficits and strong export performance. Social security benefits have been extended to the very poor, primary school coverage is almost universal, and promising reforms have been undertaken especially in citizen services and improving government transparency. The challenge for Mexico is to take advantage of the very favourable macroeconomic environment to improve productivity performance to raise living standards across the board and tackle the large informal job market. ICTs can play an important part in achieving goals by improving economic performance and increasing competitiveness. Programmes such as e-Mexico which combine infrastructure development with citizen services are very popular and are a further step in the right direction. Other programmes, including skills development and support for indigenous firms (PROSOFT, Fondo PyME), should be strengthened and further focused to improve efficiency and extend reach to businesses. Better overall planning and priority-setting is needed to provide continuity in programmes beyond a particular administration and to prioritise initiatives where they can give the greatest impacts.

Policy domain	Current policy priority	This priority should be	Recommendations
Co-ordination of initiatives	Medium to High	Increased	Although there is a well-articulated overall strategy, implementation is spread over many ministries increasing co-ordination costs, and a dedicated ICT policy ministry or similar institution should be considered
Infrastructure	Low to Medium	Increased	There is a need to increase competition in network infrastructure to reduce costs to business, and to continue and expand initiatives (including in the private sector) to equip the population with ICTs, increase connectivity and expand use. The CCDs are a good start, as is the Enciclomedia project for schools, but follow-on planning to these initiatives is necessary.
R&D and innovation	Medium	Increased	R&D is lagging and recent efforts by CONACYT and others to increase innovation and commercialisation need to be strengthened and broadened.
Venture capital	Low	Increased	Venture capital needs very substantial boosting.
ICT skills	Low to Medium	Increased	ICT skills should be improved and multiplied by continuing public-private sector initiatives, and flexible course development and training strategies further strengthened to ensure skills are constantly updated.
Content creation	Low	Increased	There is large potential to increase digital content production of all kinds to take advantage of the global Spanish language.
Small and medium sized firms	Medium	Increased	SME initiatives are still scattered and need a more central focus on raising productivity and improving competitiveness.
Standards, trust-security	Low to Medium	Increased	Standards and security initiatives are dispersed (different e-signatures for different government departments) and need a more coherent strategy.
Evaluation	Low	Increased	Evaluations are not adequate and need to be deepened (including impact studies); basic economic data and programme data urgently need improvement to support better evaluations.

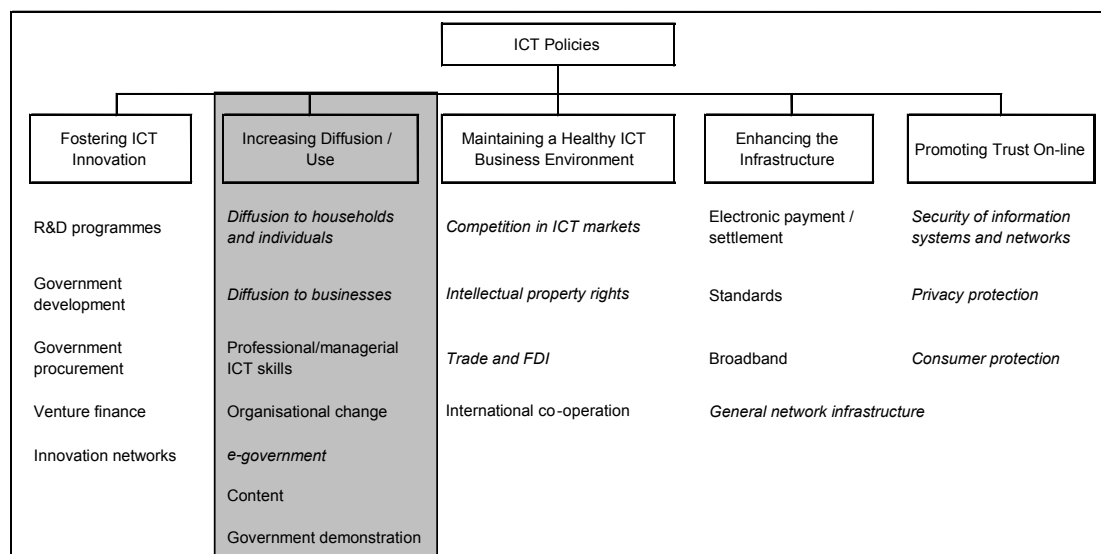
INTRODUCTION

Information and communication technology (ICT) is an important driver of productivity, growth and employment (OECD Growth Study, OECD, 2001, 2003). Mexico faces major challenges to improve its performance on all of these fronts to increase GDP per head of the rapidly growing population and to tackle related issues including the very large share of informal employment and low levels of education. ICTs can contribute to improvements in all of these, by improving business efficiency, raising the level of growth, increasing the effectiveness of government and helping to improve the quality of human capital. The peer review of Mexico is designed to contribute to improved economic performance by identifying strengths and weaknesses in the Mexican economy where better and broader use of ICTs could improve overall economic performance and contribute to social development.

The review of Mexico is one of the peer reviews of ICT diffusion to business, designed to respond to needs of countries to improve economic performance and to review policies that can contribute to improving performance. This review is part of the wider OECD policy review process. In 2001, the OECD Ministerial Council urged the OECD to strengthen its peer reviews of structural reforms. The 2002 Ministerial Council requested “the OECD to increase its monitoring of member countries’ implementation of the recommendations of the OECD Growth Study”. OECD peer reviews are used as a method to bring together peers from member countries to discuss policy experience and challenges in an individual country.

This report is background for the fifth review meeting in June 2006 conducted in the Working Party on the Information Economy (WPIE). It follows a first round of reviews in December 2003 (Finland, Korea, Switzerland), a second round in June 2004 (Norway, Italy), a third round in December 2004 (Denmark, the Netherlands) and a fourth round in December 2005 (Austria), by which time nine countries will have been reviewed. A cross-country comparative synthesis was prepared on the basis of earlier reviews to identify good policy practices covering Denmark, Finland, Italy, Korea, the Netherlands, Norway and Switzerland (OECD, 2005a).

The review covers diffusion of ICT to business in Mexico. It describes current and previous policies aimed at improving the scale and effectiveness of ICT uptake in firms to improve economic performance. The report presents recommendations for possible policy actions based on analysis of the strengths and weaknesses in Mexican ICT-related policy. The review takes a broad view of ICT policies, as outlined in Table 1 below, as many policies directly and indirectly influence the uptake and impacts of ICT in business.

Table 1. ICT Policy Framework

Source: OECD (2006d), *Information Technology Outlook 2006*.

ICT diffusion to business

ICT investment and use can be a strong driver for labour productivity and multifactor productivity at firm level. The regulatory environment, the availability of appropriate skills, the capability for organisational change, as well as the strength of accompanying innovations in ICT applications all have major effects on the ability of enterprises to seize the benefits of private and public investments in ICT (OECD, 2003, 2004).

The role of ICT as an enabler of change across traditional segments of society and its institutions introduces new challenges in developing and implementing appropriate policies and implementation mechanisms. The broader understanding of success factors calls for a wider range of policies and better statistics to monitor policies and their impacts. It also calls for more consistent and comparable evaluations across OECD countries, so that policy lessons can be drawn and policy efficiency improved within the context of national economic development and policy goals.

GENERAL ECONOMIC SETTING AND INDUSTRY STRUCTURE

Mexico's general economic performance and outlook has been positive over the last few years. Macroeconomic indicators are satisfactory with a GDP growth rate of 4.2% in 2004, 3% in 2005 and projected to be close to 4% in 2006-07, and inflation is under control with the GDP deflator around 5.5%. Government financial deficits are relatively low and the current account deficits was -0.8% of GDP in 2005. The volume of goods and services exports has grown strongly from 2004 although imports are growing more strongly and trade remains in deficit (OECD, 2005b, 2006a). Anti-poverty programmes are showing encouraging results and recent regulatory and administrative reforms are improving transparency and increasing efficiency of the Mexican government. This trend is expected to continue in the medium term.

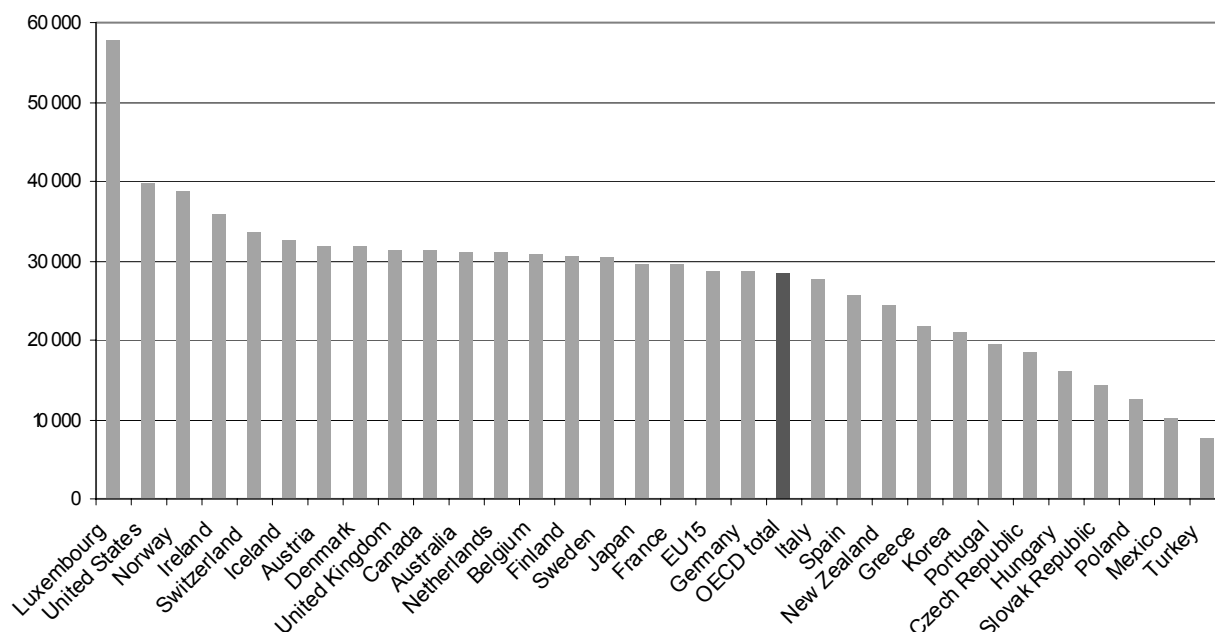
However there are persistent structural problems in the Mexican economy which need addressing urgently, particularly during a period when the general macroeconomic climate is favourable for economic reform. These structural problems include low levels of human capital, a very large informal labour market (the official unemployment rate was 3.5% in 2005), low productivity levels and productivity growth and large income inequalities. These are coupled with rigid regulations in many areas which overall slow the transition to a more modern and productive economy.

Despite Mexico's good recent and projected GDP growth, Mexico's GDP per capita was USD 10 100 in 2004 (in purchasing power parities), just over 30% of the OECD average, and at the bottom end of income levels between Turkey and Poland (Figure 1), and living standards lag far behind the OECD average. GDP per capita has also grown more slowly than in many countries and in its NAFTA neighbours (53% from 1991 to 2004 in current USD and PPPs, compared with 63% in Canada and 69% in the United States) (OECD, 2006c). This can be partly attributed to production inefficiencies and low labour productivity. Combined with a large population (109 million in 2006, the 13th most populous country) and the high rate of population growth, improved performance is essential to raise living standards.

Productivity growth: Mexico's productivity growth (GDP per hour worked) is low although it has improved considerably from the dramatic declines in the period through 1997 (OECD, 2006c). Since 1991 Mexico (along with Italy and Switzerland) has recorded the lowest productivity growth rates. Over the period 2002-04 labour productivity grew at only 0.13% per year compared with the OECD average of 1.8%, the third lowest in OECD countries. Although 2005 was considerably better, the 2006-07 outlook is for continued subdued labour productivity growth (OECD, 2006a).

More importantly, labour productivity growth has been far lower than in other large OECD economies undergoing economic catch-up – Poland had a labour productivity growth rate of 4.4% over the 2002-04 period, Turkey's was even higher although it has fluctuated widely, and Korea has had consistently high productivity growth rates (4.5%). And business unit labour costs are also growing faster than in these countries, although not as fast as in Mexico's NAFTA partners. To raise living standards, productivity performance will have to improve markedly over the medium-term and be sustained over the long-term, and ICT investments can potentially help improve performance. Growth in private non-residential fixed capital formation has been above the OECD average from 2004 and is expected to remain high (similar to its NAFTA partners). This should help to make up some of the shortfall in electricity, transport and communication infrastructure, and provide opportunities for increased productivity-enhancing ICT investment.

Figure 1. GDP per capita, 2004
US dollars, current prices and PPPs



Source: OECD, 2006c.

Income distribution: Poverty remains widespread in Mexico, affecting 50% of the population, and 1 in 6 Mexicans lives in extreme poverty (OECD, 2005b). Income inequality, as measured by the Gini coefficient, was very high at 48 in 2000, compared to the OECD average of 31 and this has risen somewhat since the mid-1980s (the higher the number the more unequal the income distribution). According to Telcel, Mexico's major cellular provider, only 36% of the population have a yearly income over USD 6 000. A large part of the population is not benefiting from the country's growth, posing an obstacle to domestic market expansion and long-term growth in general. Improving living conditions for all citizens is high on the priority list for the Mexican government for both equity and economic reasons.

Human capital: Mexico's human capital in terms of educational attainment and skill levels is the lowest in the OECD (OECD, 2005b), despite the efforts that have been undertaken to increase coverage and participation in primary and secondary education. In 2005, according to a survey by the Institute for Statistics, Geography and Informatics (INEGI), the average schooling among the working population was 8.2 years. Efforts so far have mostly concentrated on improving the scope and quality of primary education which has now become universal. Major challenges remain as the size of the school age population (second after the US in OECD countries) increases and those completing primary education move to the secondary level. The major share of education expenditures go to teachers' salaries and very little has been spent on school equipment. There is no linkage between teachers' salaries and performance, and the quality of education has tended to be poor due to this.

In an effort to improve this situation, the Mexican government has recently directed efforts towards students' and teachers' performance evaluation and it has used the OECD PISA student educational attainment results extensively as a tool for reform and to improve performance. PISA results for Mexican 15-year-old students showed low levels of performance in the different tests, and although frequent computer usage in schools was above the OECD average, home use was very low, making overall use very low compared with the average. Furthermore, a high proportion had been using computers for less than one

year and a very small share for more than 5 years. To overcome some of this gap, investment in equipment and installations and introduction to ICT in schools has been increased considerably (see Enciclomedia initiative in the section on ‘Specific initiatives’ below).

Formal and informal employment: Employment rates are somewhat below the OECD average; they are relatively high for men, considerably above the OECD average, and considerably below the OECD average for women (OECD, 2006c). Mexico’s informal employment is very large, making up 41.5% of the working population age 16 and over in March 2006 (INEGI). Official unemployment is relatively low at 3.4% of a total of the 38 million formally employed (Observatorio Laboral). The distribution of the formally employed is given in Table 2.

Table 2. Distribution of employment among formally employed, March 2006

Sector	Employment share (%)
Agriculture and fisheries	13.8
Construction	8.3
Manufacturing	16.6
Distribution	19.8
Services	40.0
Other	0.8

Source: INEGI (2006), Survey on occupations and employment. Not specified 0.75%.

Workers in the informal labour market tend to be low-skilled, lack social benefits and training opportunities, and do not pay taxes, raising the tax burden for the formally employed. Labour laws are restrictive and tax and social security requirements inflexible, lowering incentives to move to the formal labour market. However, even for the formally employed, work conditions are less than ideal. Unemployment benefits are nonexistent, the pension system is weak and on the job training is rare. Social security benefits for the formally employed are channelled through two institutions, the Mexican Social Security Institute (IMSS) which in 2004 covered 43 million private sector workers and their families, and the Institute for Security and Social Services for State Workers (ISSSTE) which covered 10.5 million public workers and their families (INEGI, 2006).

Size distribution of firms: Around 92% of Mexico’s companies are small and medium enterprises (PyME) with less than 50 employees. PyMEs are commonly defined as having less than 50 employees, and during survey interviews 50 employees was the usual maximum size mentioned. The ‘Diario Oficial de la Federacion’ (DOF) however maintains three distinctions: micro, small and medium enterprises. Numbers of employees vary according to the sector of activity: for example in services and commerce medium companies have less than 100 employees, in industry less than 250. By this definition, PyMEs make up 99.7% of all Mexican enterprises.

Regional disparities in Mexico are very high, with a few states far ahead economically and relatively advanced as far as ICT uptake is concerned. The metropolitan area around Mexico City, Guadalajara in the State of Jalisco and Monterrey in the State of Nuevo Leon are the most advanced cities in almost every respect. However there has been a rapid increase in State government funds specifically to develop the IT industry more broadly across the country (out of the 31 states plus the Federal District around Mexico City, 19 State governments invested in IT projects in 2005, and in 2006 26 were involved in PROSOFT). This suggests a substantial increase in state-level interest in IT as a driver of growth and employment.

Monterrey is the home of many successful and internationally known companies which started as family-owned businesses (see Cemex in the 'Special initiatives' section below). It is also home to the *Instituto Tecnológico y de Estudios Superiores de Monterrey* (ITESM), one of Mexico's top universities, particularly for business and engineering studies; it has one of Mexico's major technology parks; and is the home for Softek, Mexico's and Latin America's largest software company which supplies around 80% of Mexico's software offshoring services going to other countries. Technology parks are also located in Guadalajara, Mexico's 'Silicon Valley', and in Querétaro (home of SigmaTao a rapidly-growing software outsourcing services firm with participation of Telmex), or are under construction (Federal District, Durango, Baja California, Puebla and Sonora). In contrast, most of the southern states, such as Chiapas, are underdeveloped and still largely agriculture-based. Education levels in these areas are very low and poverty levels are very high.

R&D expenditure is 0.39% of GDP, far below the OECD's average of 2.26%, and is largely financed by government. In 2001, business enterprises financed only 30% of R&D, the lowest amount for OECD countries, while the government financed 59%, the third highest of OECD countries (after Poland and Portugal), with the education sector around 9%. However there has been a shift to greater business sector funding and in 2003, government contributed around 54%, the private sector around 35% and higher education around 8% (CONACYT-INEGI R&D survey, 2004). Major efforts have been made to increase R&D, particularly in the business sector, and new tax incentives and business-orientated R&D funds have been set up. Tax incentives for companies that invest in R&D are very generous compared to almost all other OECD countries, and Mexico ranks second highest after Spain, with a 0.388 rate of tax subsidy (OECD, 2005c). The National Council for Science and Technology (CONACYT) estimates that these new funds will raise expenditure on R&D towards 0.7% of GDP (source: CONACYT interview).

Venture capital has been very slow to develop in Mexico and there is no internationally comparable data on its volume or impacts on business in Mexico. The *Financial Times* (8 July 2005) estimated that the total volume of venture capital in Mexico amounted to around USD 2 billion. Mexico received only 0.1% of global venture capital flows in 2002 and 80% of Mexico's venture capital comes from abroad. High taxes, too many regulations and a cultural hesitancy to take financial risk were all cited as reasons for the low availability of venture capital. Efforts are being made to change this situation, e.g. pension funds have been authorised to invest up to 15% in equity, following the US model. Institutions such as the National Development Bank (NAFIN) have started providing venture capital and linking technology firms to outside investors (the Angel investors, see 'Specific initiatives' section).

GENERAL ICT DIFFUSION

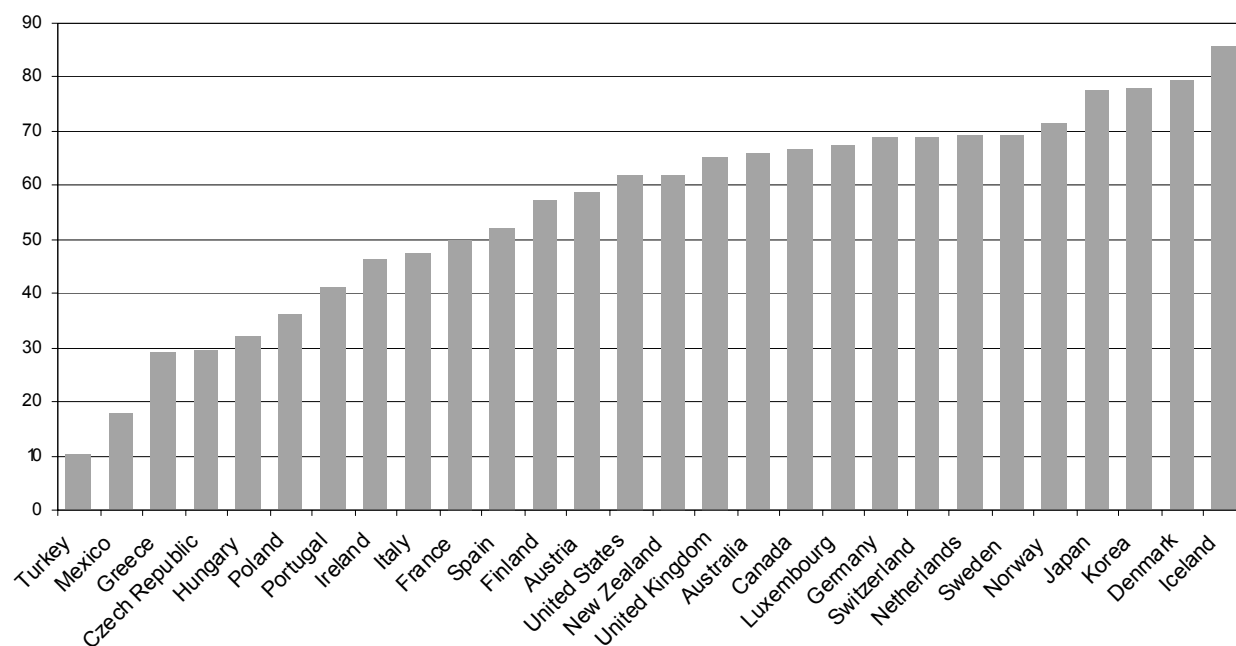
ICT diffusion to households

ICT diffusion among the general population is still low in Mexico compared to most other OECD countries. As elsewhere, ICT uptake is highest in urban areas, although government initiatives such as the Digital Community Centres (part of the e-Mexico system described below) are improving coverage in rural areas by providing connectivity and computer access free of charge to users.

Computer penetration

Household computer penetration is low, with 18% of Mexican households having access to a home computer in 2004, the second lowest share among OECD countries after Turkey.

Figure 2. Households with access to a home computer
Percentage of all households, 2004 or latest available year



Source: OECD, 2006b.

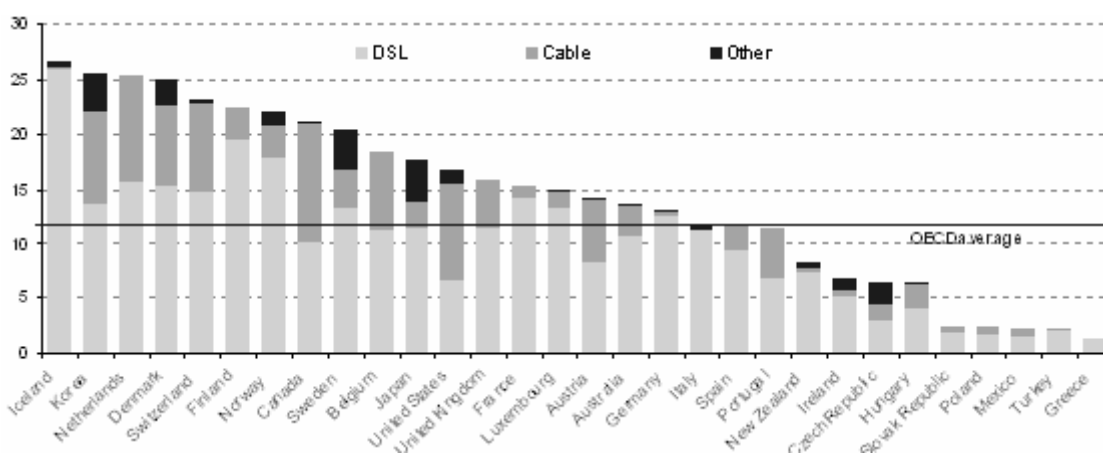
There were an estimated 10.8 million PCs in Mexico in 2005, a net increase of 10% from 2004 and this was expected to increase by another 10% in 2006 (Select as quoted in AMIPCI's White Paper 2005). This increase can be credited to some extent to initiatives such as those by Telmex and Grupo Elektra, which have introduced the low end market to computers by offering low priced packages with user-friendly financing plans. Telmex for example offers 24-36 monthly payments through the phone bill while Grupo Elektra targets an even lower income group by offering computer equipment with free Internet minutes through weekly cash payments over a period of up to two years.

Internet penetration

In terms of other general ICT indicators, Mexico is close to the bottom of OECD countries. Only 8.7% of Mexican households had Internet access in 2004, the second lowest after Turkey and this relative position has not changed very much even if Internet penetration has grown rapidly.

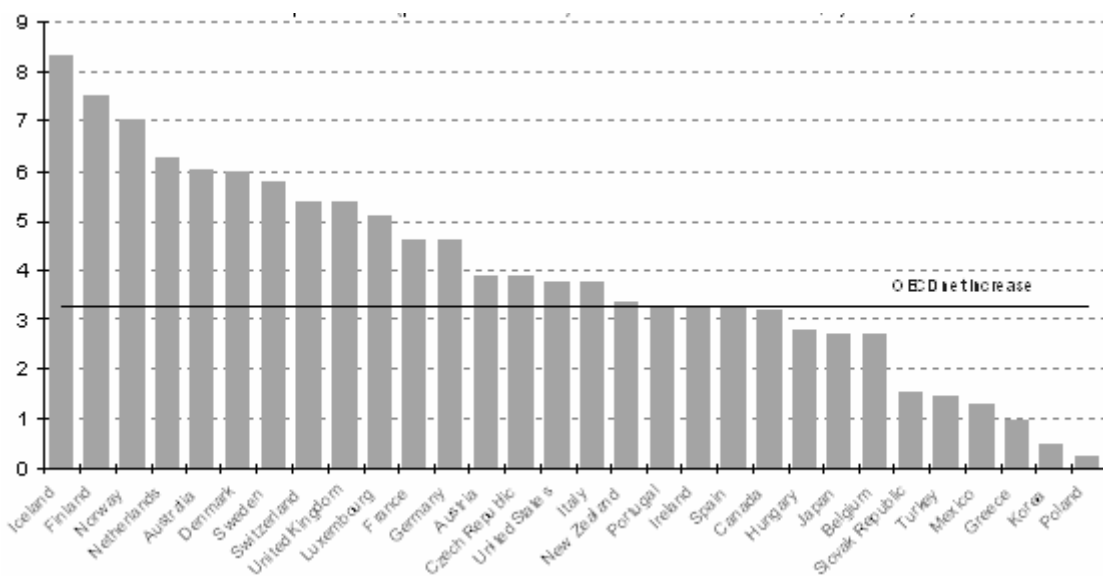
Mexico is third lowest in broadband subscribers among OECD countries. In December 2005, there were a total of 2.3 million broadband subscribers in Mexico, and per 100 inhabitants, 1.5 subscribed to DSL, and 0.6 to cable broadband. Between the last quarter of 2004 and 2005, Mexico's broadband penetration rate increased by 1.28 per 100 inhabitants, far under the OECD net increase average of 3.26/100 (see Figures 3 and 4).

Figure 3. OECD Broadband subscribers per 100 inhabitants, by technology, December 2005



Source: OECD, 2006b.

Figure 4. OECD Broadband penetration (per 100 inhabitants) net increase Q4 2004-2005, by country

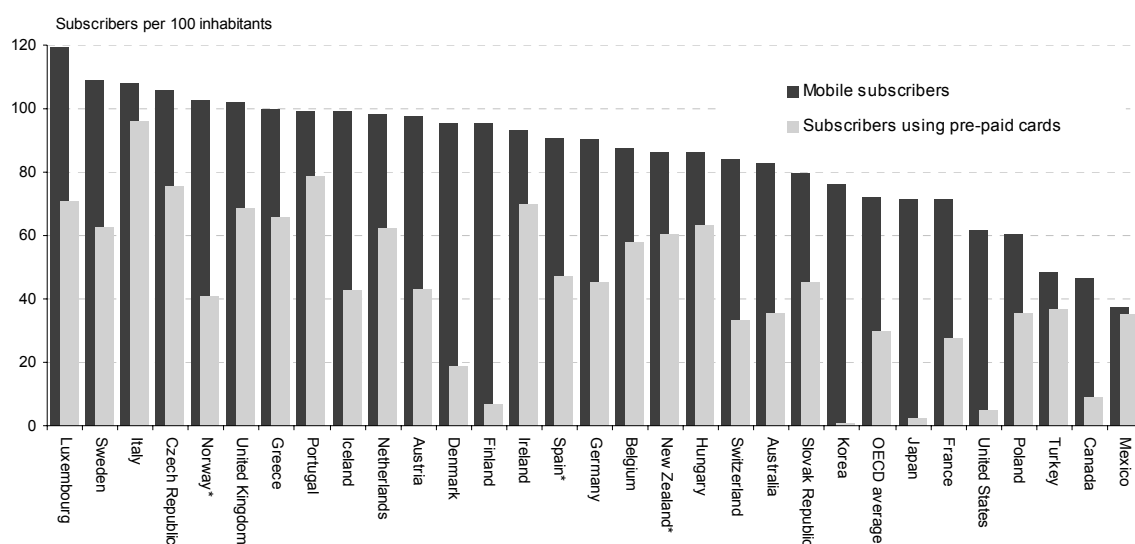


Source: OECD, 2006b.

Telephony

Mexico ranks the lowest in OECD countries, for both fixed and mobile channels per 100 inhabitants. In 2003, there were 19.2 fixed and 29.3 cellular mobile channels per 100 inhabitants, as compared to the OECD average of 58.8 fixed channels and 64.2 for cellular mobile channels. The compound annual growth rate of both channels over 1998-2003 was 28.4%, the highest among OECD countries and more than double the OECD average rate, but Mexico still has a very considerable way to go to catch up. Mexico also has the lowest number of mobile subscribers, with 37 subscribers per 100 inhabitants in 2004. Of these subscribers, 35 use prepaid cards, which is the highest share in total subscribers in OECD countries (Figure 5). The availability of these low-cost cards has been one major factor responsible for the increase of mobile uptake among Mexico's two lowest socio-economic categories, from 9% in 2003 to 27% in 2005 (Centre for Research and Economic Studies, CIDE).

Figure 5. Mobile subscribers and subscribers using pre-paid cards per 100 inhabitants, OECD countries, 2004



Source: OECD, 2006b.

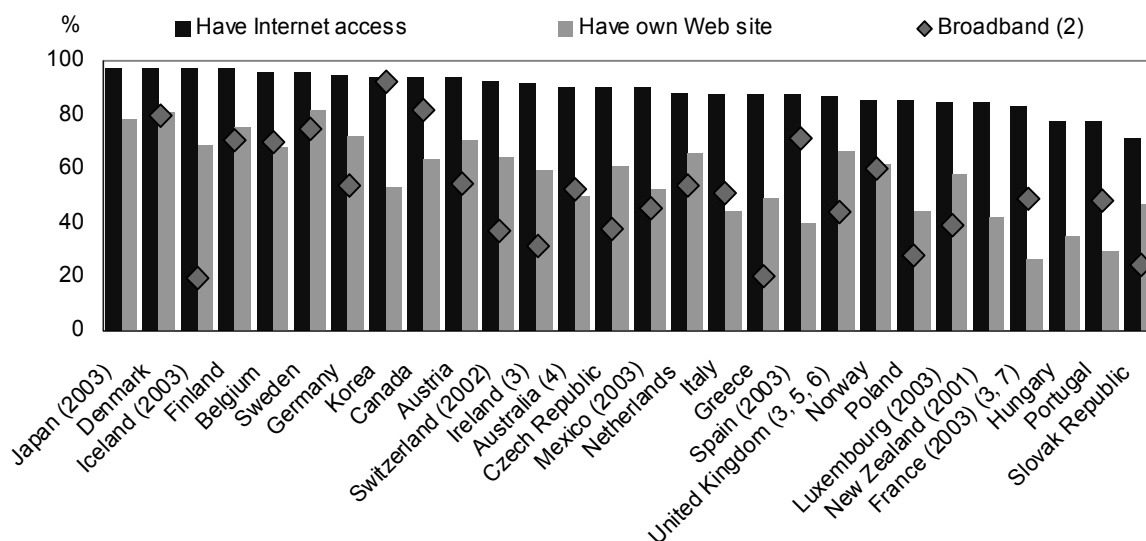
ICT DIFFUSION TO BUSINESS

Large companies are relatively well connected

ICT diffusion in large companies in Mexico is high compared to general ICT diffusion. However, general ICT diffusion is still low and concentrated in urban areas and companies depend on well-connected customers in order to sell products on-line and provide services. For these reasons e-commerce and on-line banking are not well developed. Companies are making efforts to increase customers' use of the Internet and are teaming up with the government to encourage increased ICT use (see 'Navega protegido' in 'Specific Initiatives' below).

Business Internet penetration in Mexico is relatively high: 90% of businesses had Internet access in 2003, 46% broadband access and 52% their own website, placing Mexican business in the middle ranks of OECD countries (Figure 6). However, these data cover businesses with 50 or more employees, which in Mexico make up only around 8% of the total, compared with the cut-off of 10 or more employees for other countries.

Figure 6. Business use of the Internet and websites, 2004
Percentage of businesses with 10 or more employees (1)



1. For Mexico, data refer to enterprises with 50 or more employees and include manufacturing, services and construction.

2. Most countries define Broadband in terms of technology (e.g. ADSL, cable etc) rather than speed.

3. Includes all of NACE 92.

4. Website includes a presence on another entity's website.

5. Broadband includes wireless connections.

6. Includes all of NACE 55.

7. Also includes mining and quarrying, and electricity/gas/water.

Source: OECD, 2006b.

E-commerce is likewise not well-developed. For Internet selling and purchasing, Mexico ranks lowest in OECD countries, with an average of 2.2% of businesses engaged in both selling and purchasing, compared to an OECD average of 25% selling and 12.5% purchasing. The notable exception in Mexico is retail, where 16% of businesses engaged in selling over the Internet (OECD, ICT Database 2005). The *Economist's* 2005 "e-readiness rankings" placed Mexico 36th out of 65 countries in the e-business environment, second in Latin America after Chile but before Brazil (*The Economist*, 2005).

Internet banking

On-line financial transactions and e-banking can be an important introduction to ICT use for businesses as well as increasing the efficiency of the banking sector. However Internet banking is taking off slowly. Given the large size of the informal economy in Mexico, there are only around 30 million offline bank users in Mexico. Efforts are being made to increase bank use by creating anonymous accounts with a limited transaction amount per month to avoid money laundering. Another initiative ('Boletazo') is promoting debit and credit card use by entering card users and businesses using Selling Point Machines automatically in separate raffles which offer attractive prizes *a)* to customers when paying with debit or credit cards and *b)* to businesses when they start using Selling Point Machines. Given the relatively low use of off-line banking, on-line banking is still in its inception, although it has grown rapidly. For on-line bank users, the most common banking procedure is checking balances, which makes up around 90% of all activity according to the Mexican Internet Association (AMIPCI). 'Advanced' services, such as payments to merchants still rely on an authentication procedure which in most cases requires physical presence at the bank and issuance of a security card with a number combination, in order to avoid on-line fraud. On-line transactions are also being encouraged by new initiatives of the taxation agency (SAT) including on-line tax returns and encouraging use of e-invoices, and social security initiatives (by IMSS) such as company social security payments now having to be filed on-line.

E-government

E-government initiatives and applications can provide an impetus to business use of ICTs as well as potentially improving the efficiency of government administration by encouraging on-line interactions with government agencies. Most governments start with simple information availability and then incrementally move to more advanced transactional and interactive services. E-government in Mexico was directly promoted by President Fox as part of a strategy for improving the business environment through administrative reform and lowering restrictive regulations and procedures that businesses have to undergo. Services for companies are available on-line under the 'e-Economy' section of the e-Mexico portal (<http://www.emexico.gob.mx>) and under the 'business' section of the citizen portal [gob.mx](http://www.gob.mx) (<http://www.gob.mx>). The services are usually informative, such as information and advice on investment, company start-up etc, but the number of transactional services is rising. According to AMIPCI, 60% of all Internet users have used on-line government services but no breakdown for businesses is available.

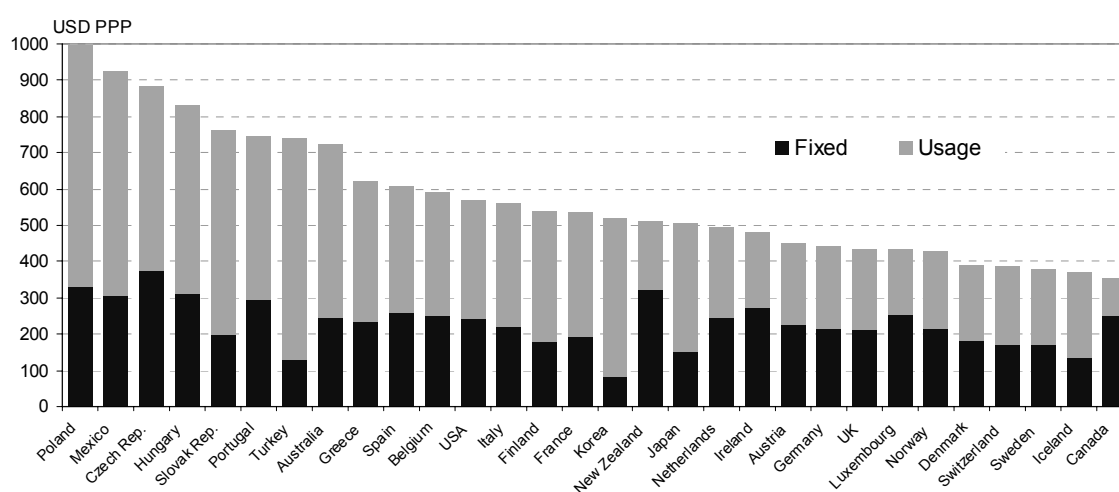
Telecommunications market

Mexico's telecom market was closed to competition until 1990, when Teléfonos de México (Telmex) was privatised and concessions for cellular telephone operations were allocated. The long-distance market was opened in 1996. Telmex however continues to dominate the market, controlling 95% of local telephony, 80% of long-distance calls, 75% of the mobile telephone market and 68% of Internet services (Economist Intelligence Unit and Telmex interview). Telcel, the mobile subsidiary of Telmex also controls 55% of the broadband market, the remainder is largely cable. In mobiles, given Mexico's unequal income structure, Telcel is mainly targeting the low-end market through prepaid cards and heavily subsidised handsets. Other mobile telephony operators include Telefonica (Spain) and Unefon, a Grupo Elektra subsidiary.

Since 2002 operators are switching to GSM (Global System for Mobile communications) from TDMA (time division multiple access) networks. A pilot project for 3G technology was started in 2006, but operations are not expected to start by 2007 after handset prices decline. According to Telmex, voice applications will remain more popular than mobile TV and other advanced applications in Mexico and Latin America in general.

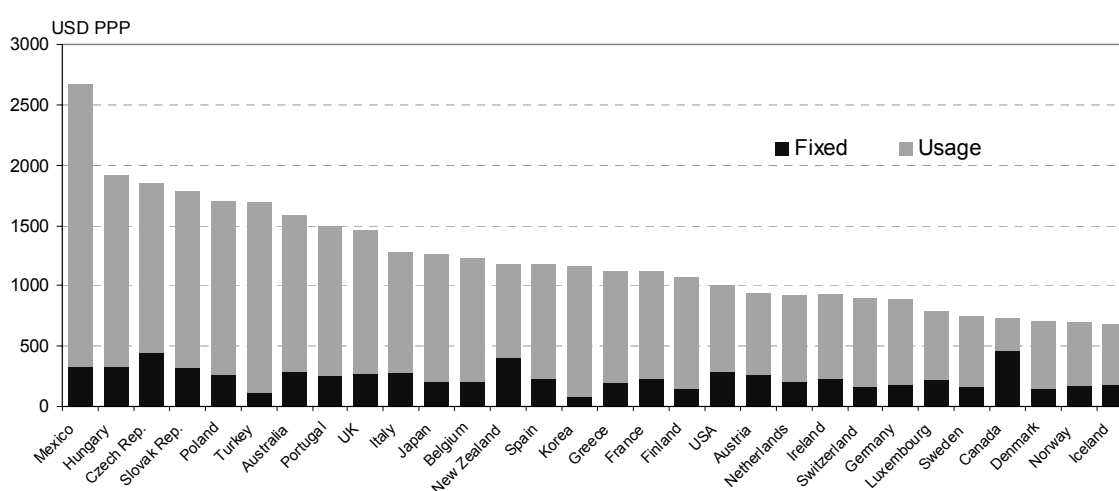
Due to the continuing low levels of competition in the domestic market, prices to users are high. According to OECD data (in USD and PPPs), Mexico is the 2nd most expensive country as far as residential charges are concerned, and the most expensive for business charges, and is in a similar situation to Eastern European countries (Figures 7 and 8).

Figure 7. OECD composite basket of residential telephone charges, November 2005
Annual charge, USD PPP, including VAT



Source: OECD and Teligen, 2006. Calls to mobile networks and international calls are included.

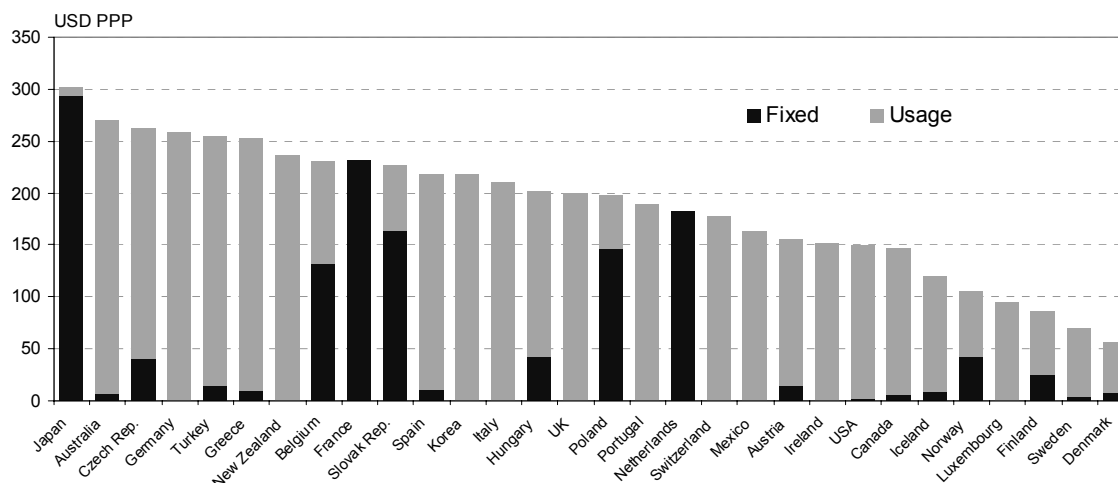
Figure 8. OECD composite basket of business telephone charges, November 2005
Annual charge, USD PPP, excluding VAT



Source: OECD and Teligen, 2006. Calls to mobile networks and international calls included.

On the other hand, Mexico's low-user mobile telephone charges are considerably below the OECD average. They are around 11th from the bottom and similar to those in the US (in USD PPPs). Prepaid mobile phone cards are the major reason for lower prices, they are priced competitively and there is no fixed charge.

Figure 9. OECD basket of low-user mobile telephone charges, November 2005
Annual charge, USD PPP, including VAT



Source: OECD and Teligen, 2006. Includes packages using prepaid cards.

ICT-related business R&D

There are no separate data available for R&D in the ICT sector. However, business R&D increased from around USD 502 million in 2000 to around USD 1.21 billion in 2004, aided by fiscal incentives (CONACYT data). Overall, there is a marked shift to business R&D expenditures, although there is a considerable way to go before the R&D expenditure distribution is similar to that of most other OECD countries. A considerable share of both business and government expenditures is no doubt going to ICT R&D, including software and ICT services.

ICT-related education

ICT education in Mexico is delivered through technical high schools, technical schools and universities. The National College for Professional Technical Education (CONALEP) is the country's largest technical education system. However there is no comparative data on the number of ICT graduates from the various institutions, and the data that exist are contradictory. According to estimates by the National Association of Universities and Higher Education Institutions (ANUIES), of a total of 1 940 000 students enrolled at the Bachelor's level in 2004, 14.5 % were enrolled in ICT-related studies – around 281 000 ICT-related Bachelor level enrolments. The share of technical level students was 31.7%, with a total of over 23 000 enrolled, but the share enrolled in master's courses was lower (5.8%) and in doctorate studies lower still (3.5%). In a Metropolitan Autonomous University (UAM) review of the quantity and quality of human resources necessary for software development commissioned by the Ministry of Economy, estimates are given of the IT educated in IT employment. It is estimated that out of 480 000 IT and software professionals employed in 2005, 52% had received a technical education (including basic, intermediate and upper levels), 41% had completed Bachelor or higher studies while 7% had no (IT) education (see Annex B. Table B.1). While the number of IT employed was estimated to grow on average by 7% each year until 2010, the structure of the education background of the employees was estimated to remain basically the same.

ICT-related FDI

Foreign direct investment inflows into Mexico declined markedly from 2000 to 2003. *Maquiladora*¹ investment dropped dramatically, and between 2001 and 2003 around one-quarter of the *maquiladoras* left (one out of three were subsequently relocated in China according to AT Kearney). FDI revived in 2004 and 2005, rising from USD 12.8 billion in 2003 to USD 17.9 billion in 2004 (largely associated with flows into the financial sector and foreign M&As in this sector) and remained high at USD 17.2 billion in 2005 (UNCTAD, 2006). A considerable share of this investment is in ICT-related areas.

According to the AT Kearney Foreign Direct Investment Confidence Index, Mexico fell from position 3 to 22 between 2003 and 2004 and rose again to position 16 at the end of 2005 and for the electronics sector it was the 4th most attractive FDI location. Mexican business and policymakers are aware that they cannot compete on price with countries such as China. Instead they need to play the ‘complementary offer’ card, focusing on quality and making the most of their geographic and cultural proximity to the United States and its Hispanic market which will keep growing and become wealthier. There has also been a strategy to sign bilateral trade agreements with Asian countries and Europe. However, even the advantage of being part of NAFTA needs to be buttressed with efforts to move up the scale to higher value activities. Other Latin American competitors such as Chile have emerged and have moved faster on reforms such as lowering business costs and improving education (OECD, 2005b).

ICT supply sector

Mexico has a relatively high share of manufacturing employment in ICT manufacturing (essentially *maquila* assembly) and an average share of value added in ICT manufacturing, suggesting the labour-intensity of *maquila* manufacturing operations (see Annex A). Both ICT employment and value added increased in relative importance over the 1995-2003 period, as ICT manufacturing grew relatively rapidly. ICT manufacturing largely consists of importing electronic components and exporting communication equipment, computer and related equipment, and audio and video equipment. Labour-intensive ICT assembly is the basis for the trade surplus in ICT goods trade, and the high and increasing revealed comparative advantage index (RCA) in ICT goods exports demonstrates its relative specialisation in the manufacture of these goods. Only Korea, Hungary, Ireland and Japan had higher RCA indices in 2004 (OECD, *Information Technology Outlook* 2006).

On the other hand Mexico has a very low share of services value added and employment in ICT services. Mexican ICT services value added is largely in telecommunications, whereas a larger share of employment is in IT services. The relatively low share in ICT services, particularly IT services suggests that the new policy focus on software and related IT services is a necessary one if Mexico is to change its services mix to develop and provide more software and IT services to the rest of the economy (OECD, 2006d).

Summary

Mexico is improving its ICT diffusion but is still facing challenges, including: the business size structure and the predominance of small firms, the low level of R&D and indigenous technological development and structural weaknesses in the labour market and education sector which will need to be addressed before further substantial progress can be made. The regulatory climate leads to high communication costs for business. E-readiness indicators are low, in part due to previous governments’

1. A *maquiladora* (or *maquila*) is a factory that imports materials and equipment on a duty-free and tariff-free basis for assembly or manufacturing and then re-exports the assembled product usually back to the originating country.

policies, e-banking is low and largely limited to basic services, due both to low use of bank accounts and to the fact that back office procedures are not yet automated.

However, efforts are being made to address these issues, R&D is being increased through the CONACYT, some of the weaknesses in the education sector are being addressed and there have been efforts to build a more business-friendly environment. E-government initiatives are also helping to improve the business climate and offering more services on-line as a start to reducing regulations associated with business creation, and more targeted business development policies have been introduced.

CO-ORDINATION OF ICT POLICY

To improve economic performance and raise productivity growth Mexico is faced with the challenge of having to advance on a number of fronts simultaneously. It faces competition from new low-cost competitive economies such as China and India and has to overcome structural weaknesses including infrastructure and education shortcomings, inequalities in income and living standards, and public sector administrative inefficiencies which are obstacles to business and investment. It has to move towards an economy which is more diversified internationally while still taking advantage of its geographical location and the trade advantages within the NAFTA.

A coherent ICT strategy is a necessary part of the overall aim of improving economic performance. Part of this strategy is to improve co-ordination and co-operation across the many government and industry actors involved in ICT policy and programme delivery. Table 3 lists the main actors in the ICT policy area. ICT responsibilities are distributed to many different ministries, depending on their competencies. Other institutions, such as the National Council for Science and Technology (CONACYT), the national development bank (NAFIN), the 32 State governments and executing agencies such as the Taxation Agency (SAT) and the Social Security Institute (IMSS, the largest ICT spender in the government), also play a role in ICT policy definition and delivery and how ICTs diffuse to, and are used by, business.

The Presidential Office for Governmental Innovation is in charge of the overall development strategy. The Ministry of the Economy is in charge of co-ordinating the funding of programmes designed to develop ICT capabilities (software and the IT industry with the PROSOFT programme) and improve small business performance (the Fondo PyME programme), the Ministry of Communications and Transport is in charge of the e-Mexico system (the major component of which is the Digital Community Centres programme), and the Ministry of Education (SEP) in charge of the e-learning segment particularly the “Enciclomedia” project (see below). The government CIO is located in the Ministry of Public Administration and co-ordinates overall public sector ICT policy and e-government services provision.

Table 3. Main policy makers in the ICT field

Co-ordinating and supporting institutions	
Presidential Office for Governmental Innovation (OPIG)	Overall strategy: National Development Plan (PND), 10 year industry development vision Sector strategies: National Plan for Enterprises (PNE) and Special Science and Technology Program (PECyT) 2001-2006 Benchmarks for Presidential goals
Ministries	
Ministry of Economy (SE)	'e-Economy' segment of e-Mexico strategy Policy for development of the IT Industry (PROSOFT) and its fund E-commerce strategy group SME Fund (Fondo PyME) National system of incubators Assistance to increase competitiveness through ICT. Centres for Production Integration (CAPs) Export facilitation (PITEX, SICEX)
Ministry of Communications and Transport (SCT)	Co-ordinates e-Mexico strategy, including the Digital Community Centres (CCD)
Ministry of Public Administration (SFP)	Government CIO, implements e-government, public sector IT policy
Ministry of Labour and Social Welfare (STPS)	ICT in National Employment Service. 'Chambanet'. Labor observatory
Ministry of Education (SEP)	Education policy, curriculum modifications. 'E-learning' segment of e-Mexico, 'Enciclopedia' project for multimedia classrooms
Ministry of Finance (SHCP)	Includes tax agency (SAT) below
Institute for Statistics, Geography and Informatics (INEGI)	Economic and geographical data Employment statistics (monthly and quarterly surveys: ENOE) Population census
Institutions	
National Council for Science and Technology (CONACYT)	Implements 'State Plan for Science and Technology' (PECyT) Funding research, development of research results
Latin American Institute for Educational Communication (ILCE)	Digitises textbook content for Enciclopedia Distance education and education planning
National Development Bank (NAFIN)	Development bank, provides guarantees, consulting and start-up capital
National Bank for Public Works and Services (BANOBRA)	Infrastructure funding, technical assistance for state and municipal governments
BANCOMEXT	Export Bank
Taxation agency (SAT)	eSAT - on-line filing of common tax returns. e-signature, e-invoices
Mexican Social Security Institute (IMSS)	Agency for non-government workers. On-line filing system for companies (IDSE). Smart cards for health services
Federal Telecom Commission (COFETEL)	Telecommunication regulator
COFEMER	Federal Regulation Commission
Federal Attorney for Consumer Protection Office (PROFECO)	Consumer protection agency e-commerce and spam initiatives
Associations	
National Chamber for the Electronic, Telecom, and Computer Sciences Industry (CANIETI)	Important actor in setting up 'PROSOFT' Funding mechanisms for IT industry (PROSOFT, Fondo PyME) Advice on how to set up company networks (operating as CAPs) Links policy to local implementation Promotes Mexico as an IT sourcing country (Mexico IT, www.mexico-it.com)
Mexican IT Industry Association (AMITI)	Important actor in setting up 'PROSOFT' Funding mechanisms for IT industry (PROSOFT, Fondo PyME) Runs software.net.mx portal for software industry. Applications for PROSOFT funding are processed to the SE
Mexican Internet Association (AMIPCI)	Represents Internet industry, undertakes research
Mexican Quality and Software Engineering Association (AMCIS)	With UNAM developed MoProSoft (quality certification for software suppliers) targeted at SMEs and certified by NYCE
Mexican Electronic Commerce Standards Association (AMECE)	Standardised product information. Traceability projects. Standards (bar codes, RFID) for distribution
National Association for Computer Education Institutions (ANIEI)	Develops curricula for IT teaching, including for graduates Defines professional profiles Adapts IT education to industry requirements
NYCE	Official standards body for the IT and electronics industry (MoProSoft, ISO standards, etc.). Certifying agency for MoProSoft standard
Fundación México Digital (FMD)	Private organisation works with SE to promote IT in business processes

The new ICT policy, e-Mexico and e-government are initiatives of the Fox administration. *Overall ICT policy* is driven by the realisation that Mexico's competitiveness is decreasing and that foreign investment is being redirected to countries with lower labour costs. The 2001-2006 National Development Plan (*Plan Nacional de Desarrollo*, PND) addresses the need for Mexico to raise its competitiveness by promoting development and use of ICT. This overall strategy was subdivided into:

- Raising awareness about technology in the population.
- Fostering local technology, adjusting foreign technology; ICT diffusion to business.
- Fostering the development of the IT industry.
- Promoting digital process restructuring in companies, especially in small companies.
- Promoting digital supplier chains.
- Strengthening the software industry.

The strategy has a top-down approach to foster the local IT industry and a bottom-up approach to enhance the domestic ICT market and applications. For implementation, the PND ICT strategy was further divided into seven action lines and institutions assigned to them (Table 4 gives PROSOFT strategies, but some participants, programmes and projects go beyond PROSOFT).

Table 4. IT strategies, main goals and implementing actors

Strategy	Main goals	Implementing actors
1. Promote exports and attract investment	Promotion campaign ("Mexico IT: Always near your business") Identify international market opportunities Strategies to attract international investment	BANCOMEXT, SE, CANIETI, AMITI, State governments, private sector
2. Develop human resources for the ICT sector	Improve core and elective subject programmes Systematic development of teacher training Strengthen links between universities and IT firms Update study programmes for private sector requirements Link to private sector to speed school to work transition Quality monitoring of students and teachers Fund additional on-the-job training	SEP, ANIEI, ANUIES, CONACYT, ILCE, SE, universities, private sector
3. Legal framework for IT industry and e-commerce	Resolve legal issues concerning ICT use Adopt a fiscal framework that favours development of the internal ICT market	Congress, private sector, CONACYT, SE, SHCP, AMITI, AMIPCI
5. Develop the domestic IT market	Develop a general 'digital' culture Conversion to digital processes, value chain integration Strengthen digitisation of Federal government and of government services for business sector	President's office, NAFIN, SE, FMD
4. Strengthen local IT industry	Reform public bidding law, foster local ICT procurement Subcontract public ICT services to the private sector Finance start-ups (venture capital, guarantees), incubators Finance operating companies (working capital, equipment, process capabilities) Finance training	SE, NAFIN, State governments, private sector, President's office, congress
6. Reach international process capability levels	Funding for training and certification in quality standards (CMM, ISO, MoProSoft) Establish Mexican standard for software development and maintenance for SMEs (MoProSoft) Establish standards and certification agency (NYCE)	SE, AMCIS, universities, CONACYT, private sector, NYCE
7. Promote regional IT clusters	Develop synergies and economies of scale Use common infrastructure (broadband etc) Support state initiatives to develop IT industry Support development of national IT clusters	SE, private sector, universities, State governments

There are three principal Federal funds for programmes described in Table 4: the Fondo PROSOFT (Fund to implement Federal policy for IT industry development) and Fondo PyME (Fund for SMEs) in the Ministry of Economy; and CONACYT funding for business R&D (*e.g.* Fondos Sectoriales). To set up new business funding mechanisms with commercial banks the national development bank (NAFIN) is financed from the special Funds. State governments, business associations and companies contribute financially and participate in developing and applying programmes. Funding proposals are usually made through a ‘promoting organisation’ (PROSOFT) or ‘intermediary organisation’ (Fondo PyME) which can be State governments, business associations or educational institutions, but not banks. These organisations often pre-evaluate projects before submitting to PROSOFT or Fondo PyME.

The *e-Mexico* system was launched in July 2002, and is financed by a public Trust Fund headed by the e-Mexico Council. The Council is headed by the Ministry of Communications and Transport, with the Ministries of Finance, Public Administration (e-government), Education (e-learning), Health (e-health) and Economy (e-economy) and the National Bank for Public Works and Services (BANOBRRAS). It aims to integrate citizens into the information society, improve connectivity and reduce the digital divide. A network of digital community centres (CCD) is a major activity of e-Mexico. A portal (<http://www.emexico.gob.mx>) was created around four ‘knowledge’ poles: e-learning, e-health, e-economy, and e-government. The e-economy segment is run by the Ministry of Economy. The e-government segment of the portal provides information and relevant citizen services.

The *e-government* strategy is part of the overall ‘Good Government Agenda’ instituted by the Fox administration in 2001. It is designed to improve government efficiency and increase business use. The strategy defines the six main goals for government reform; e-government is number four. Each ministry has to comply with a set of ‘presidential goals’ which are reviewed on a monthly basis. Prior to the Fox administration, the Federal government’s IT policy was under the authority of the Institute for Statistics, Geography, and Informatics (INEGI). In 1995 the Telecommunications Law was passed and in 1996 the e-procurement tool, Compranet, was set up. The Electronic Declarations Legislation Package was passed in 1998. In 2000 e-government authority was transferred from INEGI to the President’s office and in April 2003 it went to the Ministry of Public Administration where it is currently.

The regulatory framework for e-government was set by Congress through a series of legal reforms. These include digital transaction (to facilitate e-commerce) and data message archiving standards and requirements. The Transparency Law was passed in 2002 and the Institute for Access to Public Information (IFAI) set up. Citizens can request government information through IFAI by using an on-line request form. The commerce code was amended to include the electronic signature which took effect in November 2003. Planned reforms (*e.g.* tax reform) are still pending or were rejected by Congress.

Overall co-ordination: A large number of actors participate in Mexico’s overall ICT policy co-ordination, and it is not always clear how responsibilities and hierarchies are defined. Some of this stems from the fact that reforms since 2001 have added new programmes without eliminating the old ones. This leads to opaque structures, duplication and overlapping programmes which appear fragmented and under-funded. Although there is an overarching national development plan which encompasses ICT and comprehensive e-Mexico and e-government initiatives, many government institutions still compete with one another when it comes to implementation. An example is the electronic signature where different solutions are proposed by different implementing agencies (*e.g.* SAT hoping that its model will ‘win’ over other proposals) leading to duplication and dispersed efforts. Furthermore shifting of programmes across ministries can lead to dilution of ownership, since some authority is retained by the former ministry (*e.g.* the Ministry of Public Administration is still responsible for e-Mexico’s content, although the system moved to the Ministry of Communications and Transport). This can lead to a dilution of decision making as a large number of actors need to be consulted for each project, and dilution of accountability in evaluations.

HORIZONTAL INSTITUTIONS AND INITIATIVES FOR ICT DIFFUSION TO BUSINESS

R&D support: CONACYT ICT-related programmes

The National Council for Science and Technology (CONACYT) has responsibility for implementing the PECyT goals, notably raising R&D expenditure in Mexico to about 1% of GDP (for 2005 S&T expenditures see Annex B, Table B.2). Before 2001, CONACYT used to provide funds for basic research only. Now it is active in technological development and business innovation, provides start-up capital and guarantees funds for technology companies through its AVANCE programme and R&D tax credits up to 30%. The tax incentive is the largest single government technology initiative in terms of effective expenditures (tax revenues forgone were equivalent to around 40% of CONACYT's R&D expenditures in all other programmes in 2004, Table B.2). The amounts are authorised by Congress each year. They doubled in 2004 when they reached around USD 93 million. SMEs accounted for around 60% of the number of recipients over 2001-2004, but a considerably larger share of the tax incentive goes to (probably larger) firms which receive several credits. A relatively large number of companies and projects participate in the incentive scheme and this has implications for the design of other programmes such as Fondo PROSOFT and Fondo PyME (Table 5).

Table 5. CONACYT tax incentives

	2001	2002	2003	2004
SMEs (%)	60	62	59	63
Large companies (%)	40	38	41	37
Companies (number)	150	201	245	357
Projects (number)	548	787	918	1 308
Tax expenditures (million USD)	38.4	45.9	46.3	92.6

Source: CONACYT.

The 30% R&D volume tax credit is generous compared with most other OECD countries. It follows a trend towards simple volume-based tax credits which are easier to implement than incremental incentives, although they have other disadvantages. Mexico is only second among OECD countries behind Spain in the generosity of this kind of R&D incentive when it is calculated in conjunction with tax rates etc. This suggests that, to the extent that R&D in ICT manufacturing, software, IT services and digital content is eligible for the tax incentive, Mexico is a relatively attractive place to undertake this kind of R&D, provided the human resources and other infrastructures are available. Overall Mexico has generous R&D incentives which should have positive effects on ICT R&D. On the other hand there are small disincentives to software investment when this is part of plant, which may hinder software investment to a certain extent (OECD, 2005c).

CONACYT's direct funds are divided into three categories:

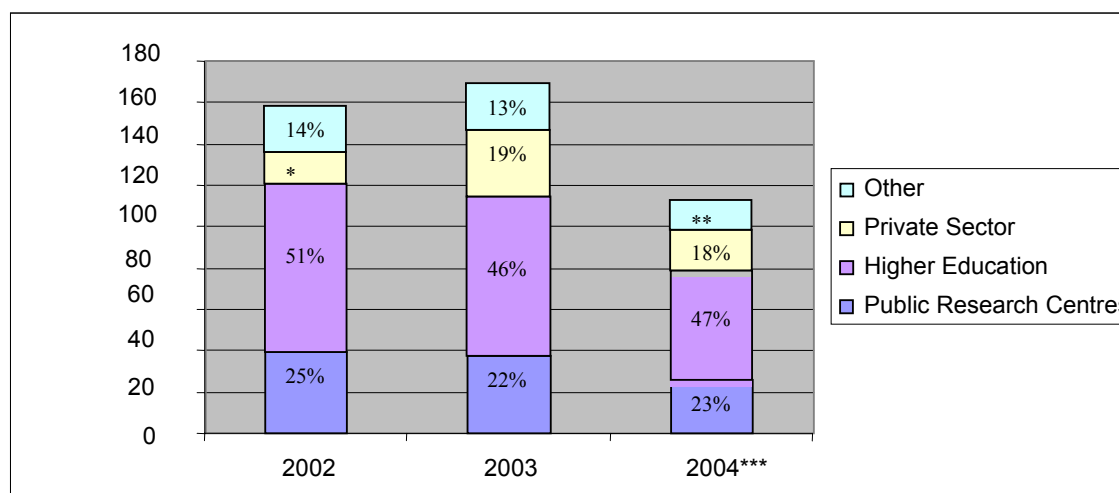
- *Sectoral funds*: for sector-specific research (water, energy, etc) funds are provided by the relevant ministry (including the Ministry of Economy) and CONACYT and administered as trust funds.

- *Mixed funds*: for S&T development at the state and municipal level, these funds are provided by the relevant state/municipal governments and CONACYT.
- *Institutional funds* (CONACYT): for R&D and scholarships.

Around 50% of mixed and sectoral funds went to Higher Education in 2004 (Figure 10).

Figure 10. CONACYT mixed and sectoral funds, 2002-2004

Funds disbursed in million USD and as % of total



* 10% **12% ***preliminary figures

Source: CONACYT 2004.

Firms applying for CONACYT funding register with the RENIECYT, a database of actors involved in S&T projects.

Building software and IT capabilities: PROSOFT

Mexico's software promotion programme, PROSOFT, was created in October 2002 in the Ministry of Economy to raise competitiveness by strengthening the Mexican IT sector. Initially it focused on the software industry (PND strategy area 6 above) but since 2004 it covers the whole IT sector (strategy area 3, but also other areas). PROSOFT is part of the general policy to move away from labour-intensive assembly towards high value-added services. According to an unpublished PROSOFT evaluation (2005), 90% of the Mexican packaged software market is serviced by imports and most packaged software firms only market it and do not produce it; on the other hand around 90% of custom and IT services is supplied domestically. To increase domestic capabilities and tackle import-dependence (see Table 4 above for overall PROSOFT strategies) policy focuses on:

- Strengthening the domestic market, including modernising ICT education by updating curricula to reflect private sector requirements and speed up the transition between university and employment.
- Strengthening the software export industry including assistance to technology parks through the provision of low-cost connectivity, facilities etc.
- Strengthening the legal framework for electronic commerce and electronic business.

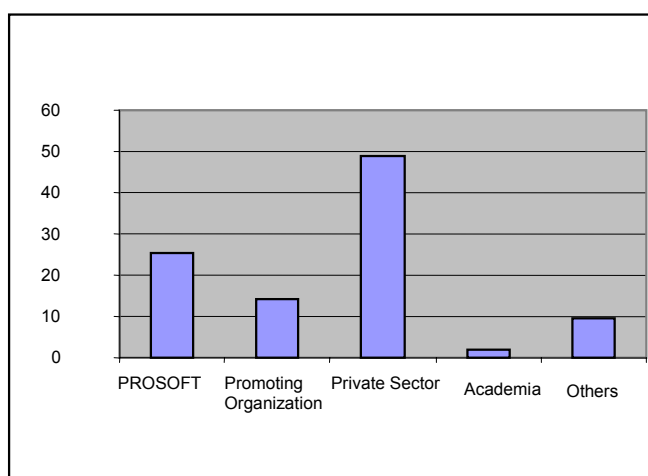
The programme interacts with software and IT companies through its website (run in conjunction with AMITI) <http://www.software.net.mx>, which provides information on software and IT solutions and related news and events, and enables business networking.

The PROSOFT Fund (Fondo PROSOFT) became operational in 2004 with government (Ministry of Economy) funding of USD 12.8 million; this increased in 2005 to USD 17.7 million and the Federal budget allocation increased to USD 42 million in 2006. Funding applications can be made on-line; however they have to go through a ‘promoting organisation’, which can be industry associations (AMITI, CANIETI and AMCIS) and State governments. In 2005 the number of projects was relatively low (181) but involved 1 060 firms through industry associations and State participation (see Annex B, Table B.3 for funding details), the reach of the Fund’s activities is multiplied through industry association and State participation as ‘promoting organisations’. The Fund financed the following activities in 2005:

- Technological development and innovation (29% of total funding).
- Human capital development (23%).
- Promotion and commercialisation (16%).
- Quality and process capacity (12%).
- Entrepreneurial and strategy strengthening (10%).
- Productive projects (6%).
- Regional and entrepreneurial strengthening (3%).
- Development of critical mass (0.9%).

PROSOFT funds should be co-financed 50-50 by the private sector, but promoting organisations, universities and states can also participate. In 2005, PROSOFT contributed 26% of total project funding, the private sector 49% and promoting organisations including States 14% (Figure 11). From the outset, the programme has worked with State governments to accelerate the development of their local ICT clusters. Unsurprisingly, the State of Nuevo Leon (Monterrey) had the largest number of projects and requested the most funds; the State of Jalisco (Guadalajara) received a larger percentage share of total funds (27% of total) and Nuevo Leon received 13% (unpublished internal PROSOFT audit and evaluation, 2005, see Annex B, Table B.3).

Figure 11. PROSOFT project financing, contribution by organisation, % of total



Source: Prosoft 2005, see Annex B, Table B.3.

Investment and support for business financing: NAFIN

NAFIN is the publicly owned development bank present in all 32 states which in part provides transaction funding for production chains, *i.e.* bridge financing to reduce cash-flow problems of suppliers to larger firms. It provides training, consulting services and guarantees financial intermediaries. 30% of its clients are in the public sector including PEMEX, the Federal Electricity Commission and IMSS. Of the 70% in the private sector, 50% are in retail distribution. NAFIN also provides guarantee funds in conjunction with both PROSOFT and Fondo PyME after receiving initial funding from them. Access to financing makes up over one-third of Fondo PyME expenditures, notably in guarantee funds and seed capital (Annex Table B.4).

Supporting SMEs: Fondo PyME

SME related policies are co-ordinated from a ‘subministry’ (SPyME) in the Ministry of Economy to provide assistance for creation and development of SMEs, improve their productivity performance and contribute to employment generation and economic development. The 2001-2006 Programme for Enterprise Development (*Programa de Desarrollo Empresarial*, PDE) describes overall goals and activities. The Fondo PyME was established in 2004, integrating smaller funds which existed previously. The budget for Fondo PyME in 2004 was USD 105.8 million, and in 2005 USD 167 million. The number of projects (and firms) appears to be relatively low (757 projects in 2005, see Annex B, Table B.4) but the reach of the Fund’s activities is multiplied through participating industry associations and state involvement as ‘intermediary organisations’ and many projects are aimed at improving the supporting infrastructure for small firms. Nevertheless the Fund should consider both streamlining activities to provide greater focus and pruning non-productive activities which can be better delivered by the private sector, while extending reach in awareness and infrastructure projects to more small firms. This would have a greater impact on overall competitiveness and productivity.

CAPs. These are non-profit associations (*Centros de Articulacion Productiva*, CAP) funded by the Fondo PyME. They provide business assistance to SMEs to raise productivity and increase competitiveness through the use of ICT and development of partnerships and networks with other enterprises, universities or the public sector. CAPs function at the regional level and provide a variety of services, from market studies to assistance with training needs and funding. Their goal is to develop good practice models which can be replicated nationally. In the ICT area industry associations such as CANIETI often function as ‘CAPs’.

The Fund financed the following activities in 2005:

- Access to financing includes seed capital and guarantee funds (with the participation of NAFIN and 25 banks) (38% of total funding).
- Sectoral and regional productive programmes (33%).
- Company start-up and strengthening, technological development and innovation, including incubators and training (23%).
- Access to markets (6%).
- Events and promotion (0.8%).

Fondo PyME is co-financed 50-50, similarly to the Fondo PROSOFT, with other funds from State governments or ‘intermediary organisations’. There are no data on how much each organisation funds, and although funds are usually matched there are large differences across different programmes. ‘Sectoral and regional production’ projects have received the highest outside funding. In 2005 they had a

“complementary funding index” from non-Fondo PyME sources of around 16 compared with around 1 for most other activities, *i.e.* non-PyME sources were the major providers of project funds (see Annex B, Table B.4 for details).

ICTs in value chains: *Fundación Mexico Digital*

The *Fundación Mexico Digital* (FMD), launched in 2003, is co-ordinated by the Ministry of Economy through PROSOFT. It is a public-private partnership (civil non-profit association) with nine major participants: the Mexican subsidiaries of IBM, HP, Cisco, Intel and Microsoft and Telmex; and CANIETI, AMITI and NYCE, the standards and certifying agency. FMD focuses on business processes and the integration of value chains to demonstrate the benefits of IT adoption and develop the domestic IT market. The first four projects focus on food retailing, processed foods, the *maquiladora* industry and hotel industry. These will serve as references for future projects and lessons learned will be disseminated in the industry. In 2005 the budget was USD 368 000, of which 50% was from the Ministry of Economy and the remaining 50% from Foundation members.

Business regulation and institutional initiatives: Streamlining and taxing

In May 2003, a joint agreement between the Commission for Federal Regulations (COFEMER) and the President’s office established a moratorium on new administrative procedures issued by government agencies. Only procedures and transactions listed in the Federal Registry for Transaction and Services (RFTS) can be applied and no new ones created. This is meant to reduce ‘illegal’ procedures while cutting down on red tape. Although this is not an ICT-specific initiative it is intended to cut down on administrative procedures and raise efficiency.

The on-line fast-track company registration and set-up system (SARE) is designed to reduce administrative procedures for company creation from 52 days to 2 days. SARE is geared towards small companies; there are additional procedures according to the size of the company. It is operational only in municipalities with high business activity. Aguascalientes is the first state to be entirely covered.

Major institutions such as the Mexican Social Security Institute (IMSS) and the Tax agency (SAT) have introduced business services on-line. Examples are IDSE (IMSS business services) and eSAT, the on-line tax filing system, which is now mandatory for companies that earn over USD 30 000 per year (see ‘Specific Initiatives’).

Diffusing ICTs more widely across the population: e-Mexico

The e-Mexico Fund has spent USD 100 million since its inception, with the single biggest expenditure item community connectivity – 30% of funds (see ‘Specific Initiatives’). Other activities include: data centre (hosting all application for e-Mexico and some other agencies), monitoring systems (for performance), help desk, and platforms (for developing portals and search engines). The citizen web portal ‘gob.mx’ (<http://www.gob.mx>) links citizens to government electronic services and provides general resources according to social profiles, such as ‘migrants’, ‘families’, ‘special need’, ‘tourists’ etc. Links are provided to the relevant ministries and other institutions. The network of digital community centres (CDD) which are located mainly in rural and disadvantaged areas provides free access to these services.

SPECIFIC INITIATIVES TO ENHANCE ICT DIFFUSION

This section analyses the main initiatives which directly and indirectly affect ICT diffusion and impacts on business performance. The initiatives are summarised in Table 6 at the end of this section.

Infrastructure: The e-Mexico system (Digital Community Centres, CCD)

The infrastructure component of the e-Mexico system is the network of Digital Community Centers (7 200 so far), where citizens have free access to e-Mexico services and content and general access to the Internet. The purpose of the Centres is both social (inclusion of all citizens in the Information Society) as well as a push for technological development. Bidding was underway in April 2006 to achieve 10 000 CCDs in 2006. The centres are connected through three satellite networks at speeds between 168 and 185 kbps for the first network and 240 and 333 kbps for the second and third networks at a cost of around USD 3 000 per connection point. As ADSL becomes available (provided by Telmex at average speeds of 256 kbps) the satellite connections are 'moved'. Telmex provides 4 000 Internet access connections to CCDs in 3 270 localities with a monthly connectivity cost around USD 27 per connection.

Co-ownership and co-financing are key to the CCD concept. Centres are located in public schools, libraries, health centres and post offices, especially in rural and disadvantaged areas. The first CCD is located in the current headquarters of the Ministry of Communications and Transport (SCT) which is in charge of the overall initiative. Municipal and State governments provide the facilities, furniture, part of the equipment and the operational costs of the centre, including attendants' salaries. The federal government provides connectivity, part of the equipment, training, training material, monitoring and maintains a help desk. According to the SCT, the failure rate of the centres is around 1.8%, mainly due to poor positioning of the satellite dishes and poor connectivity. Besides the increase in connected people, the general demand for Internet access has increased, leading to the opening of private 'cybercafes' often next to the centres. Some of the use in CCD is by small and very small businesses, increasing their ICT skills and *e.g.* setting up websites for their business.

Support for commercialisation of R&D projects: CONACYT programmes

The CONACYT AVANCE programme is designed to offer researchers and companies assistance for with 'the last mile', *i.e.* funds for the final development and commercialisation of projects that have already undergone initial development. The follow up to this programme is the 'Entrepreneur/Angel Investor Program' involving CONACYT and NAFIN to provide venture capital and facilitate access to commercial credit. CONACYT evaluates projects from the technological and legal side, while NAFIN evaluates their business plans. Once a project is accepted, CONACYT/NAFIN will invest in it and look for complementary investors ("Angels") who will buy stock. Finally, the Guarantee Fund for Technological Development is provided by CONACYT, NAFIN and commercial banks to companies ready to commercialise new products nationally or internationally. It provides working capital for expansion and access to credit at preferential rates.

Skills and diffusion: Diffusion of ICT in education

Enciclomedia is designed to bring the benefits of ICT to the classroom. It is a joint project between the Ministry of Education (SEP) and the Latin American Institute for Educational Communication (ILCE), co-financed by the Inter-American Development Bank. It provides a digitised version of mandatory school manuals, with additional digital educational material and integrating features such as interactive games, animation and virtual tours. 200 people are working in the 'biblioteca virtual' at ILCE digitising texts and adding additional content, some from Microsoft's Encarta with whom ILCE has a contract. So far only the last two years of primary school have been targeted, but a version for the first two secondary school years is planned. The system works without Internet, although there are plans to integrate it in the future. So far 50 000 classrooms have been equipped with a PC, an interactive blackboard, projector and loudspeakers. Teachers are given training on how to use the equipment, but there have been concerns regarding delays in training and irregularity of equipment shipments. The equipment is expensive, the cost per classroom is around USD 5 500, and there have been concerns regarding the high overall cost and cost over-runs and how the bidding process for the equipment was conducted.

ICT-oriented education and training

IT professional numbers were projected to more than double in the period 2004-2014 (Annex Table B.1). They are currently equivalent to around 1.4% of the formally employed, compared with 3-4% in most OECD countries (OECD, 2006d), and the composition of occupations is expected to change considerably over this period. The National Association for Computer Education Institutions (ANIEI) with Ministry of Economy support is updating curricula for ICT-related programs to reflect industry's requirements and to develop better-trained employees. Curricula updating covers technical high schools, technical schools and tertiary institutions where ICT-related undergraduate programmes make up 60% or more of all programmes. Updating focuses on 'competencies', *i.e.* skills and profiles (project manager, software architect, developer, etc.). The intention is to make curricula more practical and easier to evaluate. It has been implemented in around 50% of specialised ICT schools. Since implementation of the new curricula can take time and resources and has often been opposed by teachers' unions, a 'para-curricular' model was created to provide courses outside of full-time education. Teachers are currently being trained for this model. Finally, a government-academia-private sector centre has been created to accelerate integration of graduates into the workforce. Ministry of Economy funding has also been extended to on-the-job training.

Business organisation

Supply chain management is seen to need further improvement in Mexico. A number of initiatives are designed to improve supply chain efficiency through improved use of ICTs. FMD studies are intended to shed light on these issues and develop business process models in specific sectors. One-half of NAFIN's funding to the private sector goes to supply-chain financing.

The Mexican Social Security (IMSS) is the highest user of ICT in the federal government, and provides an on-line supply chain management tool for its institutional inventory system (*Sistema de Abasto Institucional*, SAI). SAI is an inventory monitoring system for medical products which issues supply orders when stocks are diminishing. Suppliers are notified on a customised webpage with secure access. Another IMSS business organisation tool is an on-line social security fee calculation tool for companies (SUA) which assists in calculating the total employer social security contributions. Use is mandatory for companies with over 5 employees, and 80% of payments are made through this system. Once the cost is calculated, a disc is issued which needs to be taken to a bank for payment. In the future, payments will be on-line, but banks will always be used as intermediaries, with no direct payments to IMSS.

Box 1. Best practice example: “The Cemex Way”

Cemex of Monterrey is the third largest cement producer in the world, with annual sales of USD 15.8 billion, operations in 50 countries and over 50 000 employees. Its strategy is to focus solely on cement production and globalise through international acquisition. In order to reap the benefits of this geographic diversity, it has invested heavily in ICT and Business Process Reengineering with the goal of standardising business processes and having only one global ICT platform to support them. This has led to increased efficiency, economies of scale and time and resource saving for post-merger integration.

Standards

International standards for software are important tools to improve quality and facilitate international recognition of software suppliers. Mexico has developed its own software process standards accreditation MoProSoft, launched in August 2005, and the standards and certification agency (NYCE) has responsibility for mandatory and voluntary standards for IT and electronics. According to AMCIS, 150 companies are using MoProSoft, and 30 of them are being evaluated but the results are not yet available. The advantage for Mexican SMEs adopting the MoProSoft model is that it costs far less than the North American quality standard accreditation and process improvement Capability Maturity Model Integration (CMMI) operated by the Carnegie Mellon Software Engineering Institute (USD 3 000 compared to USD 70 000). Also, it is a stepping stone towards international standards focused on small companies, given that established standards models such as CMMI tend to be geared towards large companies. A potential weakness is the lack of international recognition which is an important drawback. If Mexico is to develop software exports and improve services competitiveness it is essential that standards and certification used by Mexican firms are widely accepted internationally. International recognition is being addressed by presenting MoProSoft to the International Organization for Standardization (ISO) (with representatives from Ireland, Canada, Finland, India, Korea, the United States and other countries) which will use it as a base document for developing new standards for very small enterprises.

Electronic signatures

Different electronic signatures are being implemented across a variety of government bodies (SFP, IMSS, SAT, and the Mexican Export Bank, Bancomext). This has a positive effect on ICT usage, since it pushes businesses and citizens to go on-line to complete transactions in less time at lower cost. There is a common acknowledgement that a single electronic signature would help simplify procedures and increase efficiency, however each institution has adopted its own approach as no consensus has been reached on issues such as security and authentication. For example, SAT uses eight fingerprints for its authentication process, whereas the IMSS uses all ten, suggesting that some authentications are more complex than required. In other cases, not all parts of the back office have been sufficiently simplified before going on-line resulting in “digitisation of inefficiencies”.

e-SAT is the on-line initiative of the Taxation Agency. It wields great influence, as it is mandatory for businesses and private citizens who earn over USD 30 000 per year to file their tax returns on-line. These are filed through an on-line system called ‘Declaranet’ with the option of *i*) using the ‘advanced electronic signature’ and having the entire process on-line, or *ii*) printing the declaration and using regular signature and filing process. The first option was used by 99.8% of all companies in 2005, but only by 56.1% of private citizens. The digital signature is composed of a certificate which verifies the contributor’s identity by using his tax registration ID and relating it to biometric data (fingerprints and photograph). It is necessary for the contributor to come to the tax offices and have picture and fingerprints taken in order to be issued the certificate. The signature is encrypted using PKI. As of April 2006, 650 000 certificates had been issued, up from 325 000 end-August 2005. The distribution was 51% to private citizens, 30% to companies and 19% to legal representatives.

E-invoices will eventually be important for business process restructuring. They have been issued by SAT since 2005 but have not yet been widely accepted; major companies such as Coca-Cola only started using them very recently (May 2006). Many procedures, such as taxation related to company creation, are still paper based or need paper back up, leading to an 'Internet-based system that produces paper'.

"IMSS from your company" (*IMSS desde su empresa*, IDSE) is an on-line employee social security payment and administrative registration system for companies. It began in October 2004 and also uses an advanced electronic signature with PKI. It replaced a magnetic disc system. At the end of 2005, 67% of a total of 80 million registrations was made through IDSE. The system can be accessed through 850 kiosks equipped with an e-card reader, 80 in chambers of commerce, the rest in social security offices.

e-card

The Mexican Social Security Institute (IMSS) is introducing an e-card for health services, which includes social security, health care, disability and retirement benefits and prescriptions. These cards will eventually be distributed to all IMSS beneficiaries once their identities are verified through photograph and digital fingerprints. Doctors will use the card to better identify patients. Most doctors already use electronic medical records which are stored in the IMSS main database. There is an overall plan to introduce a citizen e-card which would integrate all services (health, identity etc.), however these plans have not yet been finally formulated or implemented.

Awareness raising/information

A wide variety of mechanisms exist to raise information about ICT in both the business and the general population. The purpose of the e-Mexico system is to integrate all these mechanisms, by providing a one-stop access point, its portal (<http://www.emexico.gob.mx>) and citizen portal (<http://www.gob.mx>) which provide information and useful links according to sector (health, business, government, education).

To extend the use of electronic government services such as SAT and IMSS beyond the population required to do so by law, a widespread information campaign is being undertaken in print and broadcast media. SAT is including advertisements for the improvement of 'tax culture' in Enciclopedia to reach the younger population. Each government agency has its own website providing information about its services. Leaflets are also distributed with easy to use instructions for services such as SAT. These include contact information for further information and complaints.

The consumer protection agency (PROFECO) is directing attention to new challenges such as how to protect consumers in a globalised on-line economy with increased electronic transactions. On-line purchases and fraud prevention are the two fields that currently receive the most attention as well as spam and privacy concerns. PROFECO organises and participates in public awareness campaigns such as the 'February is anti-Fraud month' by providing information on its website (<http://www.profeco.gob.mx>), its monthly 'Consumer' brochure and other specific brochures as well as radio and TV programmes. It also provides training to government officials, especially on e-commerce issues.

'Safe Internet surfing' (*Navega protegido en Internet*) is an initiative by large companies, business associations and PROSOFT, intended to provide consumer education on how to use the Internet safely. Its major goal is to change the perception among the general population that on-line transactions are unsafe and increase trust in e-banking and e-commerce activities. This is done through on-line tools and information, such as virus protection software and videos (<http://www.navegaprotegido.com.mx>) as well as offline activities, such as computer training and one-day 'equipment protection' seminars.

Awareness programmes specifically for the business sector are provided by the major funds (CONACYT, PROSOFT and Fondo PyME), either on their websites or in outreach programmes. Business associations and chambers of commerce such as CANIETI also provide information in the local context.

Table 6. ICT-related initiatives by field of intervention

Programme / initiative	Infrastructure and equipment	R&D	Business start-up	Software & services	Skills	Organisation, process management	Awareness and information	Technology transfer	Content	Trust & security
e-Mexico	x				x		x	x	x	x
e-SAT				x		x				x
e-signature				x		x				x
e-invoices				x		x				
IDSE and SUA (IMSS from your company and on-line calculation)				x	x	x				
SAI (IMSS institutional inventory system)				x		x				
AVANCE programme (CONACYT)		x	x							
Entrepreneur/Investor Programme (NAFIN)			x	x						
SARE (on-line company registration, start-up)			x							
PROSOFT				x	x	x	x		x	x
Supply chain management (FMD)					x	x				
Fondo PyME (CAPs)			x	x	x	x	x	x		
ICT curricula update (ANIEI)					x		x		x	
Enciclomedia	x			x	x		x		x	
Navega protegido en Internet							x		x	x
Boletazo programme							x			x
Consumer campaigns (PROFECO)					x		x			x

Evaluation

Economic impact studies of policies and programmes have been uncommon in Mexico. Most government agencies monitor programmes according to funds spent, and do not evaluate the economic effects of the spending. Most programmes that have been or are being evaluated are recent (*e.g.* PROSOFT) and *ex post* economic impact evaluations are not yet available. Standard monitoring of government programmes is usually made annually in the form of audits. Outside evaluations are undertaken on a regular basis but these often use data from the programme agency and results are rarely conclusive.

More recent programmes evaluated in detail include PROSOFT, Fondo PyME, some CONACYT programmes and Enciclomedia, which are relatively advanced in their use of evaluation and have more transparent accountability procedures:

- PROSOFT was audited internally in an unpublished evaluation report, and has had two outside implementation reviews. According to the UNAM evaluation report, 93% of the beneficiaries rated the performance of the fund as good or excellent, and 2.4% rated performance as bad. The evaluation report suggests concerns among PROSOFT beneficiaries as to the usefulness of the categories of funding and the amount, which was perceived as too limited (PROSOFT and state contributions combined). Also, there is a need for clarification of the scope of the programme and whether it applies to software projects no matter what sector they originate from, rather than only software firms. Finally, beneficiaries wanted more rapid disbursement of project funds and better contacts with the programme administration.
- Fondo PyME was evaluated in 2006 (UAM, 2006). The results are similar to PROSOFT, except that delays for fund disbursement were seen as being more severe, leading to low ratings for 'response time' (1.9 out of a 5 point scale, with 2 being 'poor'). Some enterprises reported that they abandoned projects because of funding delays. Also, concerns were voiced on the use of a standard application form for all funding categories, although these are often very different.
- CONACYT programmes and funds are evaluated each year and results posted on their website. For 2005, evaluations were available on mixed funds and four sectoral funds (health and social security, S&T for economic development, airports and aviation, and the environment). However, the evaluation report for mixed funds (UAM) only describes management and funds requested, authorised and disbursed by fund category, state and organisation, with no impact analysis.
- A preliminary evaluation of CONACYT's R&D tax incentive for 2003 showed that recipient firms performed well, and had increased production, sales from new products, and total sales, exports and profits, although not all can be unequivocally attributed to the incentives (eSmart, 2005) (see Table 7). AVANCE ("last mile" funding) and the fiscal incentives are well administered, but overall it was thought that: *i*) funding categories are too general, *ii*) programmes are devised centrally and not always adapted to beneficiaries' needs, *iii*) there should be a stronger link to other programmes, and that *iv*) these programmes should be considered as economic investment, instead of 'public expenditure' which has led to criticism because of their private sector focus.

Table 7. Performance of firms receiving CONACYT R&D tax incentives in 2003
Million USD

Impact	Accumulated value
Increase in production	2 362
Development of new products	1 457
Cost reduction	81.9
Increase in sales	5 376
Exports	1 856
Substitution of imports	83.28
Increase in profit	418.5
Number of patent requests	108

Source: CONACYT and eSmart, 2005. Incentive USD 46.3 million, 245 recipient companies.

- A CONACYT survey of 6 000 households rated their services on average as satisfactory (7.7/10), and of 40 client government agencies interviewed, 50% were very satisfied, 30% somewhat satisfied, and the remainder little or not satisfied.

- Enciclomedia has not been evaluated by an external body. ILCE's Test Laboratory Report 2005 reviewed eleven schools (principals, teachers and students). Overall results are very positive, especially in schools in wealthier areas, but there are concerns about the quality of teachers' training. Many teachers, especially in poorer areas, are overwhelmed by the unfamiliar equipment and are not able to efficiently integrate it into their teaching routines and revert to traditional teaching methods, contradicting the purpose of Enciclomedia. Specific training is not always well co-ordinated and provided after arrival of the equipment. The low quality of some school facilities in general, and concerns about equipment misuse and theft in some areas are also challenges.

CONCLUSIONS

Mexico has made good progress in modernising its economy and has started to successfully address structural problems including poverty and low levels of human capital. The annual GDP growth rate of 3-4% is very encouraging, coupled with low inflation and federal deficits and strong export performance. Programmes such as the IMSS *Oportunidades* have extended coverage of social security benefits to the very poor, while primary school coverage is now almost universal. Promising reforms have been undertaken by the Fox administration especially in citizen services and improving government transparency. Programmes such as e-Mexico which combine infrastructure development with citizen services are very popular and are a further step in the right direction.

However, Mexico's consistently low productivity performance and low growth in GDP per capita need addressing at a time when the general macro-economic climate is favourable for much-needed social and regulatory reforms. ICT investments and use in business can help improve productivity and overall economic performance. Furthermore, ICT policies are an important part of education and labour market reform and need to be better integrated into these policies, which in turn will strengthen business performance. However necessary conditions including political consensus on the direction and scope of reforms and the contribution of ICT policy to the reform process; reducing bureaucracy; and strengthening the telecommunication regulatory environment need to be fulfilled in order to reap potential benefits. If these framework conditions can be fulfilled, Mexico's strategy to move towards a more service oriented high value-added economy will be much more likely to succeed.

Strengths

One of the major strengths in current ICT policies and programmes has been high-level interest by the administration and the President's personal involvement, for example in e-government. This ensures high priority and monthly 'check-ups' in achieving targets. Ministries are under pressure to carry out reforms, good performance is rewarded (*e.g.* the 'Innova award'), there are incentives for government agencies to outperform each other, and reform has continuity. Important features of reform and government programmes that will help to increase the impacts of diffusion and use of ICTs in business and across the economy include:

- *Shared awareness that reform is crucial.* Greater international competition has increased the urgency to: *i)* move towards high value goods and services in domestic firms ('created in Mexico'), *ii)* shift away from labour-intensive manufacturing (mostly assembly, 'made in Mexico'), *iii)* raise productivity and improve the quality of human resources; and *iv)* clarify and enhance the role that ICT can play in achieving these goals.
- *Simultaneous focus on strengthening competitiveness and enhancing domestic ICT use.* There has been wide recognition that Mexico needs to strengthen the competitiveness of its business sector, while at the same time education and training require urgent improvement to underpin continued good economic performance. The strategy to foster domestic industry and capabilities through top-down incentives to the IT industry (innovation and human resources in PROSOFT) and bottom-up enhancement of ICT applications in smaller businesses (via Fondo PyME, CAPs, and similar schemes) is moving in the right direction and is in line with experience in other countries to strengthen the contribution of ICT-producing sectors and ICT-using sectors to productivity.

- *Cross-sectoral collaboration to increase social inclusion and ICT use.* There are a range of programmes which successfully combine greater social inclusion and increased domestic ICT use: *i)* the e-Mexico system provides citizen services, connectivity and free ICT access for the general population including very small businesses. The joint funding structure and local management and running of access centres ensures joint ownership, and the public awareness campaign is well executed. *ii)* The Telmex/Grupo Elektra low-end marketing of PCs and connectivity, although not government sponsored, have increased social inclusion of low-income groups through low cost flexible payments. *iii)* Programmes that encourage on-line purchases, such as ‘Navega protegido’, and the ‘boletazo’ programme which encourages debit and credit card use, have popular appeal and are organised across different interest groups.
- *Focus on ICT education.* ICT education has been decentralised (away from the Ministry of Education, SEP); the private sector now has more influence on ICT education and participates in curricula development and updates to ensure that graduates have the necessary skills to rapidly integrate into the workforce. This is increasingly in line with skill development strategies in other OECD countries. Technology parks have been a successful link between the private sector and universities such as the *Instituto Tecnológico y de Estudios Superiores de Monterrey* (ITESM).
- *Re-orientation and strengthening of ICT-related business initiatives.* There has been an important re-orientation and strengthening of business-related and ICT-focused programmes along the business value chain, with greater focus on product development, innovation and venture capital, and supporting the software industry and increasing ICT diffusion to small businesses. Programmes that focus on ICT innovation and commercialisation have received increased attention and funding (*e.g.* CONACYT’s funds and tax incentives), access to risk financing is being facilitated by the slow emergence of venture capital and guarantee funds such as NAFIN in the public sector which is slowly spilling over into the private sector, the IT sector is receiving more attention through PROSOFT and ICT diffusion is supported through Fondo PyME. The new R&D tax incentives have been very effective in reaching a large number of firms and projects, and programmes with strong involvement of industry associations are effective in extending programme reach.
- *Using government initiatives to increase business uptake of ICTs and raise government efficiency.* ICT use in business has been low and various compulsory initiatives (tax payment, social security contributions) have gone on line and businesses are obliged / encouraged to use on-line filing, although sometimes in a not very sophisticated form. This pulls through basic ICT applications and processes, particularly for smaller firms. The on-line fast-track company registration and set-up system (SARE) is designed to reduce administrative procedures for company creation to two days. It is a good example of a successful initiative, although coverage is still limited to municipalities with the highest commercial activity.
- *Continuing good export performance in ICT manufactures.* Export assembly performance in ICT goods remains strong, there is an overall surplus in ICT goods trade, and FDI to the *maquiladora* industry increased in the last few years. This has been due in part to the implementation of NAFTA and improvements in business regulation. The new focus on services and particularly software and IT service development and export is welcome in terms of shifting towards higher value products and away from industries based on low labour costs.

Weaknesses

Continuing structural weaknesses in the Mexican economy will take time and continuous effort and resources to resolve. The most pressing problems – the fight against poverty, improving education, labour market reforms – require long-term sustained effort, and rapid population increase coupled with poor productivity growth means that Mexico is ‘running hard to stand still’. Productivity needs to grow more rapidly for the whole population to reap the benefits of good economic growth. Having such a large share of the workforce in the informal economy increases inequalities and further burdens the formally employed (loss of taxation for governments and no social security benefits or training for informal sector workers). Other weaknesses that affect the business environment and ICT production and use include:

- *Lack of political consensus and an uncertain climate for continuing reforms.* Political consensus on many reforms has been difficult to achieve, with a divided Congress delaying or rejecting many much-needed initiatives. Planned far-reaching reforms (*e.g.* tax, labour and regulatory reform) are watered down to more superficial administrative reforms which are not sufficient to permanently improve the business environment. Furthermore the climate for continuing reform is uncertain due to annual budget cycles, and the change in administration in 2006 poses a threat to continuity.
- *Inter-ministry co-ordination and responsibilities poorly defined.* Co-ordination and implementation of programmes across ministries are not always clear, an example being the variety of e-signatures introduced across different government activities, leading to more complicated and time-consuming procedures for business and citizens. There is some evidence that digitisation and putting government processes and services on-line has not been preceded by the necessary simplification and adaptation of back-office procedures, making inter-organisation interaction complicated and lead to ‘digitisation of inefficiencies’.
- *Weak regulatory environment.* The communications regulatory environment is weak, resulting in relatively high telecommunication costs for business and citizens. Regulatory reforms undertaken in other OECD countries have successfully contributed to increased competition, faster rollout of new infrastructures (broadband, wireless) and lower prices, and lack of these kinds of reforms is an ongoing issue. An initiative to increase the powers of the telecommunication regulator COFETEL has not been passed by Congress.
- *Quality of education.* Efforts to improve education remain focused on primary education and on increasing coverage. Quality needs to improve at all levels, and curriculum reforms undertaken and embedded in the education system, *e.g.* in ICT education, that are more clearly based on competences, assessment and quality for both teachers and students. The share of ICT specialists in total employment is well below that in other OECD countries and needs further strengthening.
- *Complex business funding procedures.* The funding structure for business innovation and development is complex and in some cases there are too many overlapping funds and/or allocation procedures lack transparency and are too lengthy. For example, despite CONACYT’s welcome shift in focus towards development, innovation and commercialisation, it still has a large number of funds for similar purposes, and Fondo PyME mechanisms to improve the functioning of the very large SME sector lack transparency and have faced lengthy delays.
- *Insufficient definition of the strategic roles of domestic and foreign firms and markets.* Mexico has an underdeveloped services sector, services exports and competitiveness, including in ICT-related services. There is a continuing dependence on foreign firms in programmes which could have a major effect on diffusing new methods into supply chains (*e.g.* FMD). On the other hand, attempts to raise quality and spread certification in the emerging software industry (*e.g.* MoProSoft) need to

be better integrated into global quality certification and internationally recognised if they are to have the desired effect in increasing international competitiveness of domestic software providers. All of these examples suggest the need for a more coherent approach to domestic and foreign firms and markets.

- *Quality of evaluations and improvement of data.* Evaluations are relatively recent and have tended to be on administrative procedures (have the funds been spent?) rather than examining client-driven programme efficiency (are businesses receiving good services?) and programme impacts (do they make any difference, and if so what?). Newer programmes (CONACYT, PROSOFT) are being evaluated more thoroughly, but there is a need to strengthen evaluations more broadly across all programmes. There is a further need to improve data collection to enable evaluations, particularly business sector related data, *e.g.* of the size, shape and performance of the small firm sector, to raise evaluation standards and increase international comparability.

Recommendations

Incentives and programmes to raise the general level of ICT use across the economy (e-Mexico), improve ICT use in education, and linkages from research into commercial innovation need to be continued and strengthened. For example some ‘social inclusion’ programmes could be delivered by the private sector providing this can be done transparently and efficiently, including for example the CCD system of local access points, now that they have been successfully implemented and private cybercafés appear to be thriving. Overall, Federal funding should be more flexible and responsive to business development, and have more effective ways of supporting projects with concrete and measurable results. Better mechanisms are needed to “institutionalise” successful programmes that produce measurable results, and to scale back or terminate unsuccessful ones. Detailed initiatives include:

- *Define, strengthen and clarify strategic directions for ICT policy and programmes.* Goals and aims need to be more carefully enunciated, the overall strategic framework for business ICT policy continually evaluated and the aim of contributing to improved productivity performance and tackling structural problems highlighted. This will help to reinforce policy continuity and help define policy efficiency, based on realistic analysis of available resources and government capabilities.
- *Establish priorities for policy reform and assign clearer responsibilities to each ministry.* Clear policy priorities, programme initiatives and sequencing, and mechanisms for ensuring policy and programme continuity are needed. These will help avoid overlap and dilution of decision making power (for example the multitude of digital signatures). Although recent programmes such as PROSOFT have well-defined goals, in general goals should be better-defined in more concrete and realistic terms, and projects with concrete results strengthened. The focus should be on increasing internal efficiencies and inter-ministry collaboration, using ICTs as a tool to link rationalised government procedures. To enhance reform, support prioritisation and clarify responsibilities, a dedicated policy ministry or similar institution could be considered, such as is in place in some other OECD countries.
- *The regulatory environment, especially in communications, needs to be strengthened.* Competitive conditions need to be improved so that markets can operate more effectively. This will lead to a reduction in communications prices and improved services, with positive benefits for business performance.

- *The focus on improving ICT education and training needs to be continued and strengthened.* Mexico has relatively low levels of ICT professionals compared with other OECD countries. Mechanisms and public-private partnerships to increase training and education through part-time and refresher courses, on-the-job training etc. need strengthening and expanding to ensure that the skill base remains adequate and that ICT skills are continually upgraded and adapted to business needs and global competition and that ICT specialists increase, towards levels in other OECD countries.
- *The ‘dual’ approach of top-down and bottom-up policies and programme should be strengthened.* The top-down approach to foster the domestic IT industry (PROSOFT) and bottom-up approach to enhance ICT applications in smaller businesses needs to be strengthened, expanded and streamlined, focusing on building domestic ICT-producing and ICT-using capabilities and increasing their contribution to productivity performance. This approach needs a strong regional dimension (including active participation with and among State governments) so that established growth poles maintain and further enhance their outward looking, international role (e.g. expanding further into more advanced ICT design, IT services and software and links with global high-tech. ICT development, IT services and software), while poorer regions improve their basic ICT connectivity, access, education and skills. Furthermore, the reach of programmes needs extending with the aim of raising average firm performance closer to best performance.
- *Continue ‘transparency’ programmes and increase effectiveness in policymaking.* Recent policy and programme initiatives in the ICT area have been a step forward in terms of improving transparency and accountability, setting up clearer co-ordination mechanisms and systemising co-ordination across ministries and agencies. This general thrust needs further strengthening and improving (see the example of multiple digital signatures which decreases efficiency and probably weakens the overall aim of encouraging businesses to use on-line processes). Budget allocations to ministries should be made dependant on their performance (increase in productivity, cutting down on red tape). One useful initiative is the on-line information availability via the Institute for Access to Public Information (IFAI) which should be further strengthened to engage citizens in the political process and further increase transparency.
- *Share good practices across sectors and regions.* The e-Mexico Internet access programme appears a successful way of organising, implementing and delivering a grass-roots approach to raising ICT awareness in the population and in very small firms. The strengths, weaknesses, opportunities and challenges to this and similar initiatives should be analysed and evaluated and the experience disseminated.
- *Regional/local ‘best practices’ exchange* should be encouraged, so that enterprises (and the public sector) learn from local experience in building global firm-level competitiveness. This should include learning from the experience of successful Mexican firms (CEMEX, Softtek, and recent entrant SigmaTao) in building competitive capabilities and achieving scale. These examples can also provide insights into how ICT can be used to improve government processes and government efficiency.
- *Evaluation of government programmes needs improving and expanding.* The recent start in undertaking “client-focused” programme reviews and impact analysis needs to be strengthened. These evaluations need to move beyond simple monitoring of implementation, to be more analytical and widely disseminated programme evaluations. Funding should be more explicitly tied to programme evaluations, programme transparency and ease of application and delivery.

- *Data quality needs urgent improvement.* Data needs improvement to undertake the kind of analysis and evaluation that underlies this review. Although the situation is improving, business-level data and information for policy monitoring and evaluation needs improvement and needs to be standardised and made easily accessible. A continuing priority effort (including international co-operation where appropriate) should be made to collect missing data and update existing data, including developing a modern cross-department databank so that government programmes can be better focused and efficiency improved.

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APPENDIX: LIST OF PEOPLE INTERVIEWED DURING THE OECD MISSION

Guillermo Aguirre Esponda, Adjunct Director, National Council for Science and Technology (CONACYT)

Javier Allard, General Director, Mexican Association for the IT industry (AMITI)

Salvador Bonilla Zavala, Director of Informatics, Ministry of Labour and Social Welfare (STPS)

Sergio Carrera Riva Palacio, General Director of e-commerce, Ministry of Economy (SE)

Jaime Chico Pardo, General Director, Teléfonos de México (TELMEX)

Raul de la Parra y Munoz, Adjunct General Director for e-government and IT policy, Ministry of Public Administration (SFP)

Jesus de la Rosa, President, Mexico Digital Foundation (FMD)

Alfredo Figarola, Director of Technological Administration, Jalisco State Council for Science and Technology (JALCYT)

Gustavo Flores Verdugo, Technology and Special Projects Coordinator, Latin American Institute for Educational Communication (ILCE)

Carlos Garcia Moreno, Director of Promotion of America Movil, TELCEL

Claudia Ivette Garcia Romero, Director of e-commerce, Ministry of Economy

Mario Gonzalez Torres, General Director of Labour Policy, Ministry of Labour and Social Welfare

Graciela Gutierrez Garza, External Relations Manager, IBM

Milagros Huerta Coria, Advisor to the Radio and TV Coordinator, ILCE

Pedro Langre Rosado, Government Innovation Programme, President's office

Felipe Lemaitre, Digital Security Manager, Microsoft Mexico

Tomas Miklos, Operations Coordinator, ILCE

Hanna Oktaba, Secretariat, Mexican Association for Quality in Software Engineering (AMCIS)

Jesus Orta Martinez, General Adjunct Director for e-commerce, Ministry of Economy

Alfredo Pacheco Vazquez, Director of the Centre-South office, National Chamber of the Electronics, Telecommunication and Informatics Industries (CANIETI)

Luis Humberto Parra Visoso, Director of International Productive Chains, Development Bank (NAFIN)

Jorge Luis Paz Rodriguez, e-commerce Manager, Mexicana de Aviación

Miguel Angel Peralta, Director of Business Solutions, Mexican Association for E-commerce Standards (AMECE)

Alejandro Pisanty Baruch, General Director of Academic Computing Services, Universidad Autonoma de Mexico (UNAM)

Rafael Rangel Marshall, Director of New Business Models, BBVA-Bancomer

Alfredo Reyes Kraft, Vice President, Mexican Internet Association (AMIPCI)

Omar Rodriguez Alarcon, Director of Labour Policies, Ministry of Labour and Social Welfare

Igor Rosette Valencia, Director of Innovation and Technological Development, Mexican Social Security (IMSS)

Rodrigo Rubio Maqueo, Deputy Director for business services, TELMEX

Maria del Rocio Ruiz Chavez, Deputy Minister of Industry and Commerce, Ministry of Economy

Patricia Ruiz Velasco, General Adjunct Director for International Affairs, PROFECO

Guillermo Safa Barraza, Director for Software, Knowledge City (Monterrey)

Ignacio Salgado Robles, Deputy Director of Science, Technology and Industry, National e-Mexico system co-ordination

Lourdes Sanchez Guerrero, President, National Association of Informatics Educational Institutions (ANIEI)

Juan Jose Sanchez Rueda, Director of Communication and Evaluation of the Enciclomedia Programme, ILCE

Victor Sandoval Rivera, General Director of Training and Technological Innovation, Ministry of Economy

Abraham Sotelo Nava, Unit head, Government and Electronic Services, Ministry of Public Administration

Javier Vega Flores, Unit head, Strategic Planning, Tax agency (SAT)

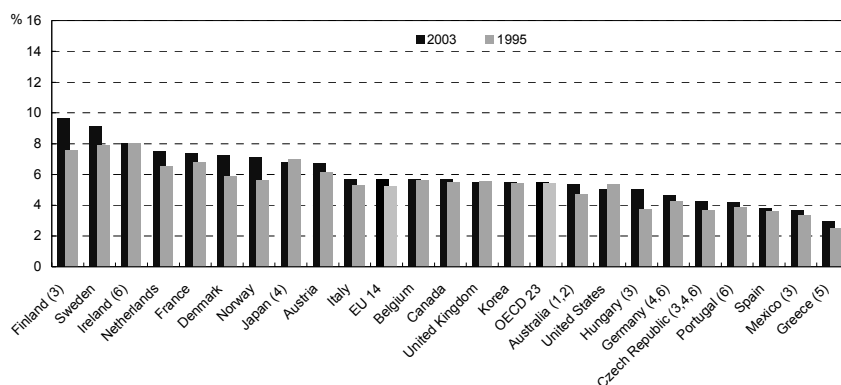
Antonio Villalobos, Cementos de México (CEMEX)

Alejandro Villalon, General Director, Tienda Kit

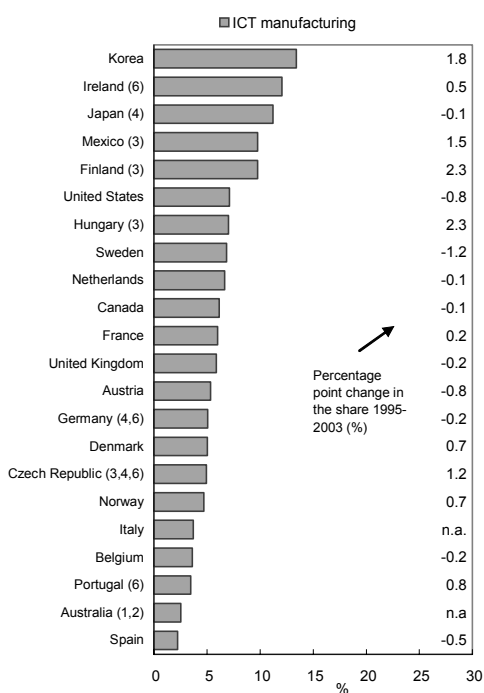
ANNEX A

ICT employment in business sector employment

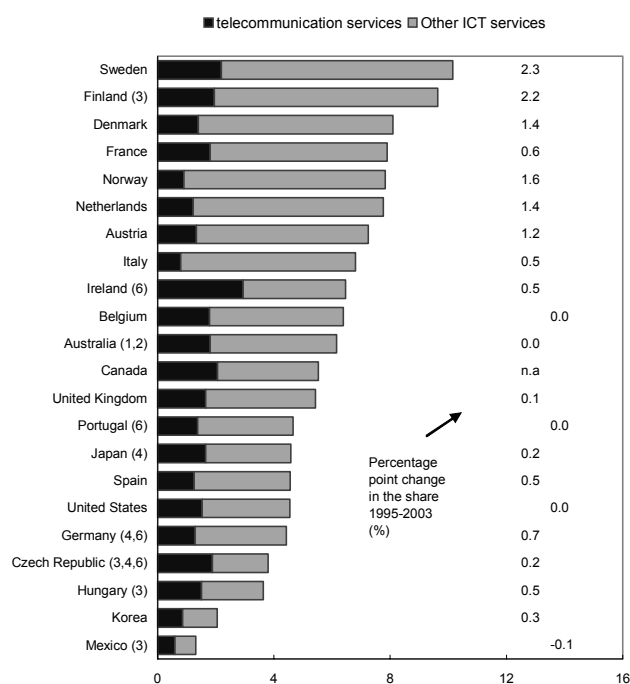
Share of ICT employment in business sector employment, 1995 and 2003



Share of ICT manufacturing in total manufacturing employment, 2003



Share of ICT services in total business services employment, 2003



1. 1998 instead of 1995.
2. 2000 instead of 2003.
3. Based on employees figures.
4. ICT wholesale (5 150) is not available.
5. Telecommunications services (642) included in Postal Services.
6. Rental of ICT goods (7123) is not available.

Source: OECD estimates, based on national sources; STAN and National Accounts databases, March 2006.

ANNEX B

Table B.1. Number of IT and software professionals by education level and occupation, 2000-2014
(Conservative estimates)

	2000	2001	2002	2003	2004	2005	2006	2010	2014
Total IT professionals	362 775	354 170	399 437	414 805	427 249	478 510	520 306	678 576	880 783
No IT education	30 110	28 842	31 903	32 482	32 788	35 648	37 778	45 841	56 142
Technical ¹	169 818	169 111	194 470	205 841	216 022	248 375	275 969	380 461	513 962
BA and higher ²	162 846	156 217	173 063	176 481	178 439	194 487	206 559	252 274	310 679
IT professionals: Non-software related activities	117 902	115 105	129 817	134 812	138 856	155 516	169 099	220 537	286 255
No IT education	9 786	9 374	10 369	10 557	10 656	11 586	12 278	14 898	18 246
Technical	55 191	54 961	63 203	66 898	70 207	80 722	89 690	123 650	167 038
BA and higher	52 925	50 771	56 246	57 356	57 993	63 208	67 132	81 989	100 971
IT professionals: Software	244 873	239 065	269 620	279 993	288 393	322 994	351 207	458 039	594 528
No IT education	20 324	19 468	21 535	21 925	22 132	24 063	25 500	30 943	37 896
Technical	114 627	114 150	131 267	138 943	145 815	167 653	186 279	256 811	346 924
BA and higher	109 921	105 447	116 818	119 125	120 446	131 279	139 428	170 285	209 708
Software professionals by occupation	244 873	239 065	269 620	279 993	288 393	322 994	351 206	458 039	594 529
Project Manager	N/A	N/A	N/A	N/A	13 929	14 561	15 210	20 398	23 758
Software architect	N/A	N/A	N/A	N/A	21 456	22 388	23 342	31 238	36 069
Technical project leader	N/A	N/A	N/A	N/A	25 782	27 244	28 762	39 056	47 723
Software developer	N/A	N/A	N/A	N/A	41 817	45 529	49 501	69 570	95 267
Software testers	N/A	N/A	N/A	N/A	90 642	96 083	101 751	138 673	171 705
Operations and support	N/A	N/A	N/A	N/A	94 766	117 189	132 642	159 104	220 169

1. Includes basic, upper intermediate and upper levels.

2. Includes BA, MA and doctorate levels.

Sources: INEGI, 2000; ANUIES, 2002; Select, 2004.

Table B.2. Expenditure on science and technology, 2005 (1)
By financing sector, million USD

Activity	Public sector						Higher education	Private sector				Total	% of National S&T expenditures	% of the GDP
	Federal investment			Fiscal incentive	States (2)	Total		Family investment	Private sector	International	Total			
	Sectors	CONACYT	Total											
R&D	1 573	252.04	1 825	275	27.39	2 128.58	254.23	156.81	1 319.44	24.74	1 344.17	3,727	61.2%	0.49%
Post-graduate	393.63	199.84	593.46		41.29	634.76	103.35		62.58		219.39	957.5	15.7%	0.13%
S&T services	333.76	47.36	381.12			381.12	113.77		907.16		907.16	1 402.06	23%	0.19%
Total	2 301.26	499.23	2 800.49		68.68	3 144.45	471.36	156.81	2 289.18	24.74	2 470.73	6 086.55	100%	0.81%
	37.8%	8.2%	46%	4.5%	1.1	51.7%	7.7%	2.6%	37.6%	0.4%	40.6%	100%		

1. Preliminary figures. 2 State contributions to mixed funds and post-graduate education.

Source: CONACYT.

Table B.3. Fondo PROSOFT: Source of Project contributions, 2005

Entity/promoting organisation	Number of projects	Contributions by organisation (thousand USD)					TOTAL
		PROSOFT	Promoting organisation	Private sector	Academic sector	Other	
Jalisco	14	3 488	1 625	13 088	58	479	18 737
Nuevo Leon	32	2 496	1 835	4 617	0	257	9 205
AMITI	10	2 685	0	3 391	353	3 989	10 419
Sonora	16	1 462	1 451	225	96	0	3 235
Veracruz	10	918	918	971	385	0	3 191
Baja California	9	869	627	1 287	39	214	3 036
Sinaloa	5	800	497	594	97	559	2 547
Durango	3	480	480	720	0	0	1 679
Aguascalientes	15	655	351	1 463	0	17	2 485
Chiapas	3	409	409	22	0	0	841
Tamaulipas	8	339	349	694	0	0	1 383
Chihuahua	2	285	227	220	0	0	733
CANIETI	13	1 327	0	4 210	54	83	5 673
Yucatan	7	178	178	356	0	0	712
Queretaro	5	177	177	32	0	0	682
Guanajuato	10	162	163	326	0	0	651
AMCIS	2	141	0	381	0	0	522
Tlaxcala	3	55	55	26	0	0	136
Oaxaca	1	23	9	0	0	24	56
Morelos	7	284	184	319	140	37	964
Puebla	5	360	309	284	0	1 041	1 994
Zacatecas	1	69	69	147	0	0	285
TOTAL	181	17 663	9 913	33 668	1 223	6 698	69 165

Source: Ministry of Economy.

Table B.4. Fondo PyME: Number of projects and amounts disbursed, 2004-2005

Category	Subcategory	Number of projects		Amount disbursed (thousand USD)		Complementary funding index	
		2004	2005	2004	2005	2004	2005
I. Creation and strengthening of enterprises, technological development and innovation	Entrepreneur training	3	2	84.9	34.9	1.00	1.14
	Enterprise incubators	59	120	3 662	5 629	1.67	1.46
	Technical development	30	34	31 911	11 007	1.01	0.76
	Enterprise development centres	59	55	1 707	2 196	0.63	0.39
	Enterprise accelerators	N/A	6	N/A	3 942	N/A	1.23
	Training and consulting		77		13,872		0.91
	Institution training and consultants	101	13	13,670	539	0.93	1.06
	Promotion		19		47.7		2.25
	Subtotal		252	326	51 035	37 698	1.03
II. Sectoral and regional production	Productive projects	15	13	4 345	27 002	3.65	29.96
	Productive Centres	48	30	6 306	9 605	1.71	0.32
	Productive infrastructure	79	48	8 361	7 196	5.10	5.94
	Training and consulting		39		5 123		0.90
	Methods and contents		18		832		0.26
	Institutional training and consultants	164	1	6,145	37.3	1.48	1.00
	Studies and projects		49		2 414		1.10
	Promotion		41		1,749		1.17
	Institutional strengthening	38	23	725	538	1.83	1.45
Subtotal		344	262	25 882	54 497	3.12	15.88
III. Access to markets	Micro-enterprise service centres	19	2	1 230	181	1.38	1.90
	Data banks	2	2	9 176	3 973	1.00	1.00
	Integral Assistance Programme for PyMEs (PIAPYME)	1		3 129		1.12	
	Marketing and distribution of products	N/A	9	N/A	1 634	N/A	0.85
	Training and consulting		26		4,423		1.47
	Institutional training and consultants	39	1	4,828	0,917	1.31	6.20
	Studies and projects		7		752		1.26
	Promotion		61		3 285		1.30
	Subtotal		61	108	9 197	10 281	1.25
IV. Access to financing	Credit brokers	13	6	7 729	1 009	0.18	0.36
	Guarantee funds	11	12	6 632	40 191	0.44	0.00
	Financial, non-bank intermediaries	1	3	22,940	357	1.00	1.02
	Seed capital	N/A	2	N/A	18 352		1.76
	Investment risk fund (Opcion PyME)	2	1	115	2 753	2.48	0.00
	Training and consulting		5		249		0.49
	Methods and contents	19	1	5 173	45	0.78	0.12
	Studies and projects		4		122		0.95
	Subtotal		46	34	19 674	63 078	0.44
V. PyME events and promotional activities		N/A	27	N/A	1 344	N/A	1.67
	Subtotal		N/A	27	N/A	1 344	N/A
	TOTAL	703	757	105 787	166 897	1.44	5.70

Source: Ministry of Economy, PyME subministry.