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List of Abbreviations

BIP	Border Industrialization Program
BPO	Business Process Outsourcing
CANIETI	National Chamber of Industry, Electronics and Telecommunications and IT
CMMI	Capability Maturity Model Integration
CMM-SW	Capability Maturity Model for Software
IADB	Inter-American Development Bank
ICT	Information & Communication Technology
IT	Information Technology
ITES	IT Enabled Services
MNC	Multinational Corporation
NAFTA	North American Free Trade Agreement
SME	Small and Medium Enterprises

In 2003, *Business Week* posed the alarming question of whether the jobs of white-collar workers in developed countries were on the verge of being offshored to developing countries. In this article Mexico was not even mentioned, but by 2006 the assessment had changed, as *Business Week* published an article on the offshoring of engineering jobs that focused entirely upon Mexico. What a difference three years makes. My thesis explores the offshoring to Mexico of knowledge-process based work, or what is currently described as “administrative and technical services.” Mexico is an interesting case study because it has a unique location, as it is the closest low labor cost neighbor to the U.S. Further, it has a history as a destination for offshored activities from the U.S., predominantly in manufacturing. However, manufacturing work in Mexico has suffered significant competition from East Asia; first Taiwan and now China, particularly in electronics assembly (Lowe and Kenney 1999) and also in other sectors such as garments, with certain exceptions such as categories that require fast turn around (Abernathy et al. 1999; Bair and Gereffi 2001). The other industry within which Mexico has remained competitive is automobile and automotive parts production (Gerber and Carrillo 2002). The greatest threat to Mexican maquiladora manufacturing success has been the emergence of China as the workshop for the world, and its rerouting of international trade in manufactured products (e.g., Dicken 2003).

The sheer number of services activities that might be offshored over the next two decades is remarkable. On the more conservative side, the McKinsey Global Institute (2006) suggests from a study of U.S. industries that approximately 11 million jobs from the developed nations are potentially offshorable in the next five years, of which the U.S. would, by our estimation, account for probably 60 percent or 6.6 million. Alan Blinder (2006; 2007) has

made even more dramatic estimates suggesting that “The total number of current U.S. service-sector jobs that will be susceptible to offshoring in the electronic future is two to three times the total number of current manufacturing jobs (which is about 14 million)”(Blinder 2006:122). In other words, according to his estimate, approximately 28-42 million service jobs are at risk.

Regardless of which forecasts one accepts, the numbers could be very large, and currently in India alone there are 1.25 million employees producing services for the global economy, and of these approximately 60 percent or 750,000 service the U.S. Since 2000, employment in the Indian IT and service export sectors has experienced a compound annual growth rate of 24 percent per year (Nasscom 2007). As important, services offshoring appears to be only in its infancy and almost surely will continue to expand rapidly. If Mexico could divert only a small percentage of these jobs from India, it would be an important benefit to Mexico particularly since these jobs would require an educated Mexican workforce (García Romero 2007).

It is now accepted that the development of successful industries is a process by which a community of firms and institutions, such as labor markets, educational institutions etc. become specialized in providing industry-specific inputs (Porter 1990; Aldrich and Fiol 1994). In the most simplified form, this community of firms can provide the agglomeration economies suggested by economic geographers (Krugman 1991). More recent work has suggested that these communities provide other valuable inputs that are indirectly traded in the marketplace (Storper and Venables 2004; Pinch et al. 2003). These benefits are assumed to be spatially circumscribed to what some have termed clusters, which are predicated upon proximity. Though our study approaches service offshoring at the national level, there are in fact only

three locations that have significant concentrations of service providers within Mexico: Guadalajara, Mexico City, and Monterrey (see Figure 2).

Mexico is an upper middle income nation that is the home to a number of large firms and government organizations that have software and other service needs, so they are also potential customers. Put differently, Mexico has an internal market that is attractive for both domestic and foreign firms. Though this point was raised in a number of our interviews, we were unable to identify the size of the market or to find any classification of the service firms in the Mexican market on the basis of whether they are serving the domestic or international market. Classification is made even more complicated because, at least, some of the R&D activities in MNCs is for factories located in Mexico, which export most of their manufactured output.

With the Mexican development model based on manufacturing exports experiencing competition, this paper examines whether Mexico, given its favorable proximity to the largest market for services in the world, can participate in and benefit from the services globalization wave. To answer this we examine the development of Mexican ATS offshoring activities by exploring the history, location, types of firms and activities, and policy environment.

In this process Mexico is compared to India where an extremely rich and diverse service provision ecosystem is emerging (Dossani and Kenney 2007). Mexico was initially the leading destination for manufacturing offshoring by U.S. firms, but rapidly lost its advantage to East Asian nations. Now there is yet another enormous wave of offshoring underway, and the question for Mexico is what are its prospects for capturing a significant share of this opportunity and thereby developing a robust Mexican service provision ecosystem? To answer

this question, the evolution of the manufacturing maquiladoras is briefly reviewed and the development of the Mexican service ecosystem is discussed.

The methodology for this study is, as follows: First, we searched the Internet and read all of the existing materials on services offshoring to Mexico, in particular, but also reviewed all the written materials on offshoring to Latin America in English and Spanish. We also consulted with the trade press in particular, *Global Services* and *Global Sourcing*, the two most prominent industry publications on services offshoring. Not surprisingly, in comparison to the copious writings on services offshoring to India, there was far less on services provision in Mexico. Also, while in India the activities of the industry are covered in great detail by the press, the Mexican press has little coverage of services offshoring. Moreover, in contrast to India that has an industrial association, Nasscom, providing high-quality and timely data on services, in Mexico there is no single source of high-quality data.

The lack of data meant that it was necessary to conduct interviews with key persons in the Mexican service provision industry, including IT service MNCs (both from the U.S. and India), small and large Mexican IT service firms, the national and state governments, Mexican high-tech associations and organizations, international organizations, and the few Mexican academics studying the industry. Eighteen interviews were conducted with a variety of the industry's most significant players in Ciudad Juarez, Monterrey, and Mexico City.

Unfortunately, many large U.S. firms such as IBM could not be contacted for interviews.

Those interviewed were asked questions on topics including: background information on their firm/organization, their interaction with the Mexican business and political environments, the quality of labor they work with or employ, their thoughts and experiences with Mexican high-tech entrepreneurship, the relationship between Mexico and India in the sector, as well as their

thoughts on the future success, opportunities and challenges for the Mexican industry. We have no reason to believe that the respondents had any reason to answer questions misleadingly, and from our literature review we found no obvious contradictions.

Mexico and the Globalization of Manufacturing

In response to Asian competition in the late 1960s, many U.S. firms simultaneously embarked upon relocating production to Mexican cities along the U.S. border and to East Asia to take advantage of cheaper labor costs. In Mexico, the movement began with Mexico's Border Industrialization Program (BIP) that encouraged foreign firms to establish industries within a 12.5-mile strip along the border. The BIP allowed for the import of machinery, equipment, and manufactured components duty-free for processing and assembly for foreign firms, provided that all imported products were reshipped abroad for final assembly and distribution (Sklair 1989; Shaiken 1990). It also provided for substantial tax holidays. From 1965 to 1969, the number of employees in the maquiladoras increased rapidly from 3,000 workers to 17,000. This rapid expansion encouraged the government to gradually loosen the earlier restrictions that foreign firms encountered. Given the periodic economic crises Mexico faced, and the fact that the maquiladoras were the most dynamic part of its economy, the government soon opened the entire country to foreign investment. Whereas initially the maquiladoras were under strict customs controls and Mexican sales of products built in the maquiladoras was forbidden, as the program evolved domestic sales were also authorized (Kagami 1996).

Although the maquiladora program began with simple assembly operations, there was a slow and uneven process of industrial upgrading within certain sectors including apparel,

electronics, and autoparts. Jorge Carillo and Alfredo Hualde (1999) suggest that, at least, some maquiladoras have evolved through three generations. The first generation was low value-added assembly work employing a low skilled and low wage labor force. In the 1980's a second generation of maquiladoras emerged that began to implement organizational structures and practices consistent with Japanese manufacturing models. These included work teams, quality circles, and "multi-qualified" personnel that emerged within plants along with new practices in manufacturing (see also Abo 1994; 1998). There was some debate about the exact level of implementation of the Japanese manufacturing models, as Kenney et al (1998) found that in the Japanese electronics maquiladoras the implementation was only partial. By the mid 1990s these plants came under significant pricing pressure from their "sister" facilities in China.

By the late 1990s, there was a shift in some maquiladoras to producing complex products and using advanced production processes. Within these facilities there was greater focus on information technology, an increase in R&D capacity, and advanced manufacturing capabilities. Though, in the case of televisions, which was the major electronics product assembled in Mexico (largely because of NAFTA and the Mexican government's promotion of the domestic television industry), as the display shifted from a picture tube to a flat panel, picture tube production in Mexico was discontinued and not replaced by flat panel production, which remained in Asia. So, the primary value-added components of the television were no longer made in Mexico. The primary avenue for climbing the ladder was an increase in the amount of R&D, product testing, and design as well as complementary investment in computational resources and software.

A similar upgrading occurred in certain segments of the apparel industry, particularly blue jeans manufacture in Torreon (Bair and Gereffi 2001). Finally, as Clemente Ruiz-Durán (2002) points out, a small Mexican software industry emerged in the Guadalajara area that hosted the computer assembly operations of IBM and HP, though these operations are now largely discontinued. This fledgling software industry was directly related to the more advanced activities undertaken in the MNC facilities. Finally, the expanding auto production operations in Mexico gradually attracted some production engineering and simple design work. However, it is also fair to say that the amount of true research was minimal, as witnessed by the fact that Mexican patenting at the U.S. Patent and Trademark Office (2006) has stagnated for the last 25 years at approximately 100 per annum.

The centrality of the maquiladora program to Mexico is difficult to overestimate, as it was responsible for much of Mexico's economic growth overall in the 1980s and 1990s and is of continuing importance today. With the passage of NAFTA some believed that Mexico would become the offshore manufacturing supply center for the U.S. However, in the 1990s China emerged as the global center for low-cost manufacturing. As a result, though Mexican manufacturing exports continued to expand (particularly in goods for which transportation was expensive, where NAFTA local content rules were extant, or where short turnarounds were necessary), the focal point of manufacturing offshoring moved inexorably towards China and East Asia. In 1999 at the height of maquiladora operations more than 1.3 million Mexicans were employed in the manufacturing sector. By 2003 employment had fallen to 1 million, though it recovered to slightly under 1.2 million by 2006. Despite the recovery, few believe that maquiladora employment is likely to grow as rapidly as it had in the 1990s (Federal Reserve Bank of Dallas 2007). For the Mexican government the realization that its growth

potential in export-oriented manufacturing was limited came rather abruptly in the recession beginning in 2000. This prompted a search on the part of the Mexican government for export industries within which Mexico might find employment opportunities. It was within this context that the services exports industry was recognized, as a new opportunity for securing export-led growth.

The Globalization of Services and Mexico

Services globalization refers to the relocation of service provision from high-cost developed nations to lower cost nations, and in this way is similar to the earlier relocation of manufacturing, or to put it into the vernacular of economists, the services became tradable (Jensen and Kletzer 2005). Prior to digitization much of the object of service work was carried on physical media such as paper, which is bulky and relatively expensive to transport, thus making work using that information largely inefficient. With only a few exceptions such as call centers and data entry, the initial large-scale offshoring of service work was in software programming and coding (Heeks 1996; Arora and Arthreye 2002), and it was India that was the major recipient for this work. However, the real growth in offshoring came in the late 1990s due to a shortage of software programmers during the Internet Bubble (Dossani 2004). It was also in the 1990s that other services, what the Indian software industry association, Nasscom, terms “information technology-enabled services” also began to be relocated, again with India as the leading destination (Dossani and Kenney 2007).

The acceleration in the services offshoring after 2000 was facilitated by the increasing standardization and need to digitize information that had formerly been encoded on paper. This was enabled by the global bandwidth expansion during the Internet Bubble that led to a

dramatic drop in data transmission costs. This was accompanied by dramatic drops in the cost of computing and the increasing ubiquity of high-speed scanners that allowed the low-cost preparation of forms for transfer. The Y2K problem provided Indian software service vendors an important entree into the U.S. market, and also permitted them to grow very quickly. As a result, the Indian software and IT-enabled services sector grew from 152,000 employees in 2000 to 1.25 million in 2007, a 24 percent compounded annual growth rate (Nasscom 2007). Moreover, the Indian growth occurred on the following three dimensions: in terms of number of employees, higher value-added, and types of activities (Dossani and Kenney 2006).

For the types of organization providing services there are two meaningful dimensions; outsourcing, which is the contracting for the discharge of a function to another legally separate entity, and offshoring, which is the relocation of work to another nation. For the sake of analysis we further partition service provision organizations in Mexico into those outsourcing and those that do not. Among the organizations undertaking outsourcing, they could be interested in the domestic Mexican or foreign markets, and most are interested in both.

For outsourcing there are four separate categories: First, there are the developed nation outsourcing firms transferring work to their offshore subsidiaries. This first category includes developed nation outsourcing firms such as Accenture, CapGemini, EDS, Genpact, HP, IBM etc. operating offshore facilities to provide the contracted services to their customers in the developed nations. In the case of Mexico, there is another category of foreign firms including Indian firms led by the Indian giants, TCS, Infosys, and Wipro, namely outsourcing firms from developing nations that are expanding their global footprint to better compete with the developing nation outsourcing firms. A third category consists of Mexican outsourcing firms such as Softtek, Neoris, and Hildebrando that offer service provision abroad. The fourth and

final category is firms establishing subsidiaries abroad to receive services they want to relocate from their developed nation operations. Very often, these are higher value-added core activities that the firm wishes to offshore, but would like to perform in a lower cost environment. In the case of Mexico, this polyglot category includes General Motors, General Electric, Delphi and many others.

Mexico has a long history of providing services to the U.S. economy through the movement of immigrants that provide many in-person services to U.S. citizens. However, in terms of exporting services, Mexico was not an early entrant. Also, it was not an especially fast adopter of the Internet or leader in the developing world in the movement online (Curry et al. 2004). For the most part, Mexican white collar and technical personnel have focused on the Mexican market. The most important exception to this statement was the gradual growth in the numbers of Mexican engineers doing design, production engineering and other services in the “third generation” maquiladoras (Gerber and Carillo 2002). Though this is not usually considered the export of service work since its value is embodied in physical exports manufactured by the factories, there is a sense in which it can be considered a services export.

However, roughly within the last ten years, Mexican service offerings have become a much more formal part of the economy. Firms have been established throughout the country that do IT service work similar to that done in India. Services are becoming increasingly important in the domestic economy and have experienced notable growth in the last few years. Current estimates put its growth rate at 13.85% for 2007 (Select IDC 2006). Although the industry has grown, its overall revenue and contribution to GDP has been minimal. For example, in 2005, it amounted to only \$3 to 4 billion of Mexico’s \$768 billion GDP (Medina; Economist Intelligence Unit 2006). As the 13th largest economy in the world (just one place

behind India) IT services amount to only 0.4 to 0.5 % of GDP, with software only contributing 0.1% of this total (De La Rosa 2005). Broken down by industry, the software sector was responsible for roughly \$1.3 billion of the 3 to 4 billion in revenues in 2004, and IT services were valued at \$2.3 billion that same year (Business Monitor International 2007).

According to the Ministry of the Economy and CANIETI, The IT service sector in Mexico is comprised of 2,095 firms, 55% considered micro, and only 5% considered large. Although there are few large and internationally competitive firms, Mexico boasts a growing number of firms with international certification. The Ministry of the Economy states, “Mexico has several companies assessed at CMM-SW (the Capability Maturity Model for Software), four at level five, one at CMMI-5 (Capability Maturity Model Integration), twenty-six with levels 3&4 CMMI and at least 125 other companies to be assessed” (Secretaría de la Economía 2006). CMMI ratings are awarded by appraisers who are authorized by the Software Engineering Institute of Carnegie Mellon University and the system is used to assess an organization on five process maturity levels that are standardized to the particular project subject area. Although Mexico does not promote any specific IT service niches, most companies focus on financial services, manufacturing, telecommunications and government agencies (Secretaría de la Economía 2007). The makeup of the industry can be seen in Figure 1, which shows that integration and development services make up the largest part of the industry, and software and hardware support are not far behind.

The areas with the most successful IT service clusters are Mexico City (which has 42% of Mexico’s IT service firms), the states of Nuevo Leon (13.4%) and Jalisco (4.2%) (Ruiz-Durán 2002). Figures 2 and 3 illustrate the number of IT service firms throughout Mexico, state by state. Although Mexico City has the largest number of IT firms, their large presence in

the industry is a reflection of the great degree of business interactions that take place in a city as large as Mexico City, rather than a regional effort to promote IT services in the area. In fact, interviews with several prominent members of the IT service community in Mexico stated that Mexico City was more oriented toward traditional commerce and politics, and there was less interest among both politicians and businesspersons to pursue technology and technology-based industries. Instead, interviewees cited that the cities of Guadalajara and Monterrey had the highest potential for increased growth.

Nuevo Leon (home to Monterrey) and Jalisco (home to Guadalajara) are home to two dynamic IT service clusters that have experienced significant investment and growth. Last year, Guadalajara had an IT service revenue of \$650 million, and the sector in Monterrey generated revenues of nearly \$220 million (Medina 2007). Guadalajara is important to examine because, as stated above, it only accounts for 4.2% of the IT service firms in Mexico, yet has a much larger revenue in the industry as compared to Monterrey which has a larger percentage of IT service firms. Large MNCs, such as IBM and HP, are responsible for this statistic as they contribute a large percentage of this total revenue. Guadalajara has proven to be competitive in many niches that have made it a viable IT service location. It is particularly competitive in microelectronic design, embedded software and multimedia, which stem largely as a result of its importance in the electronics sector during Mexico's era of manufacturing.

Monterrey, on the other hand, has a very strong entrepreneurial environment and a vibrant indigenous IT industry with a number of firms that compete well in international markets. As stated above, it makes less revenue as a sector as compared to Guadalajara, but it is home to a larger percentage of the total amount of IT service firms (13.4%). Unlike the role of MNCs in Guadalajara, most of the sector's activity in Monterrey is attributed to the

relatively large number of small Mexican firms that are established in the city, with few large indigenous companies like Softtek as an exception. Monterrey is also the home of the Tecnológica de Monterrey, (the “MIT” of Mexico), and due to its geographical proximity, a strong connection to Texas-based technology companies. These two cities represent two different strategies for developing IT service sectors, but together have two of the strongest IT and ITES establishments in Mexico and have state-level policies in place to promote their industries both at home and abroad.

Although Nuevo Leon and Jalisco have had the greatest success, research by the Secretary of the Economy has found that nearly every state in Mexico has some amount of IT activities. It is important to note that Mexican scholars have done several state and city-level analyses of IT clusters including Jalisco, Aguascalientes, Nuevo León (and more specifically Monterrey) and Mexico City (Contreras and P. Millán 2006; Ruiz-Durán 2002). However, some states have been receiving increasing amounts of attention in the industry lately. For example, in a 2006 World Bank report Aguascalientes was noted because of the state’s efforts to create programs to improve the ease of doing business (World Bank 2006). Ciudad Juarez in Chihuahua has also received attention because of the Indian firm Genpact’s increasing presence throughout the city. Queretaro has been growing as well, especially in the areas of Business Process Outsourcing (BPO) and call centers. Finally, Baja has experienced success in the fields of software and embedded electronics, and its proximity to San Diego gives it quite an advantage. Although all of these areas have experienced growth, none have grown to scale yet, so it remains to be seen how they will emerge in the sector.

Mexican IT service firms

Domestic Demand:

With a population of 103 million, Mexico creates a large demand for IT services itself and this demand has been the focus of many of the country's domestic service firms. In fact, up to 90% of Mexico's demand for these services, which is currently valued at close to 3 billion dollars, is satisfied by domestic companies. However, there is still room for growth in the national industry; estimates from Prosoft indicate that the potential domestic demand for IT services is valued at over \$3.7 billion dollars, and they highlight Mexico's regional importance because it accounts for 26% of all of Latin America's expense for ICT (Secretaría de la Economía 2006).

For the most part, a wide variety of *small* domestic firms are responsible for supplying these services to the national economy, although there have been some large Mexican companies that have recognized the domestic opportunity and begun to fulfill these needs as well. For example, SigmaTao, a telecommunications company in Queretaro that does work for Telmex among others and employs 600 engineers, noticed this domestic market niche and has recently turned its attention from the export market to become a service company completely focused on domestic demand. Hildebrando also feeds this demand, although they also service a growing export market. Hildebrando, a large technology and consulting company specializing in systems development and business solutions, performed 50% of its work for the domestic market and 50% for export last year. Based out of Aguascalientes, it is one of the largest IT service companies in Mexico, employing over 1,500 people and generating over \$100 million in revenue in 2006. And, as they devote half of their services to the domestic economy, this shows the increasing potential for firms to take advantage of the size of the national demand.

Services Exports:

Although it is unknown exactly how much Mexico exports in IT services yearly, we do know that in 2005, Mexico exported nearly \$300 million dollars in software, which is expected to grow, and that service export revenues are likely higher (Mexico Connect 2006). In contrast to the domestic market where small firms provide much of these services, *large* and *medium* size enterprises primarily attend to the IT service export market in Mexico. The large and medium sized firms that are the main Mexican companies providing IT services can be seen in Figure 4. Because of the large Spanish speaking population in the United States, geographical proximity and cultural similarity it is no surprise that 51% of Mexican IT exports go to the United States, 20% go to South America, and 17% to Central America with Western and Eastern Europe and Asia composing the remainder (Secretaría de la Economía 2007).

Industrial Structure

In global terms, the industrial structure for the Mexican IT service industry is divided into many small firms and a very few larger firms. Gustavo García (2007) reports that of the 2,095 IT service firms in Mexico, only 5% are reported to be large (more than 20 employees), while 10% are medium (10-20), 30% small (5-10), and 55% micro (less than 5) (García 2007). Garcia's (2007) numbers indicate that there are only a few firms large enough to be considered globally visible. The largest of these is Softtek (discussed in greater detail below) that employs 4,500 persons and Neoris (also discussed in greater detail below), which employs 2,000. It is worth mentioning that these employment statistics, although large in relative terms, still make these companies less than one-tenth the size of the Indian giants, such as TCS (89,000 employees), Infosys (72,000), or even the Indian second-tier firms. This divided industrial

structure means that the Mexican leaders have little domestic competition, and thus offer little opportunity for the development of a rich ecosystem.

The enormous number of small firms and absence of many larger firms suggests an underdeveloped industry. To better understand the reasons for this industrial structure, in our interviews, we probed for an explanation for the abundance of small IT firms. The answers were rather vague, but nearly all respondents suggested the following reasons: First, they argued that there was a lack of an aggressive business mentality on the part of many Mexican entrepreneurs. Second, they believed that there was a general lack of trust and teamwork among Mexicans. Third, there was insufficient access to credit.

On the issue of a perceived non-aggressive business mentality, *The Economist* (2006: 70) relies upon the cultural argument that those Mexicans remaining at home are not as ambitious as its migrants. The Global Entrepreneurship Monitor (2006) also finds that Mexico ranks quite low on early-stage entrepreneurship. The Economist argues that this is because Mexico has “a long history of authoritarian rule [that] has discouraged risk taking.” Oddly enough, this argument is not used to explain China’s entrepreneurial behavior. The weight these historic-cultural arguments should receive is unclear, but it is possible that they provide some explanatory power.

There is a general belief among observers that Mexican entrepreneurs appear to be very conservative; more motivated by owning and controlling their own business and not as focused on expansion or growth. They also tend to be emotionally attached to individual firms and unwilling to sell them. The reluctance to sell one’s firm discourages growth through merger. This eliminates the possibility of selling the firm for the large capital gains that might act as a signal to bring yet more entrepreneurs into the environment. One interviewee from an Indian

outsourcing firm operating in Mexico gave the example of the Indian software firm I-flex whose founders began with \$500 and then, more than a decade later, sold their company to Oracle for approximately \$1 billion. Without these demonstration effects, few can be encouraged to venture to grow their firms to a substantial size.

The second problem that appears to limit the growth of Mexican firms is a generalized lack of trust and teamwork. Although it is likely that trust and teamwork issues could be cited as barriers to business the world over, an Inter-American Development Bank (2002) study on entrepreneurship in Latin America singles out Mexico as especially unusual. In the IADB's report they found, "In all the countries, with the exception of Mexico, teams of entrepreneurs, particularly in Argentina and Brazil, founded most of the dynamic new enterprises (as seen in Figure 5). This is true for approximately 9 out of 10 companies in Argentina and Brazil, as compared to 8 out of 10 in Costa Rica, 6 of 10 in Peru, and only 4 of 10 in Mexico" (Ishida, Kantis, and Komori 2002: 40). In the Global Entrepreneurship Monitor's survey of 30 nations, Erkkko Autio (2007) found that entrepreneurs in Mexico and Jamaica were the least likely to establish firms that they expected to grow to 20+ employees. In other words, they were not forming firms with the expectation of building a large firm.

The fact that so many start-ups come from individuals and not group collaborations has been interpreted as indicating a lack of trust within the Mexican business environment. One interesting illustration is one large IT company uses its subsidiary in order to do its accounting instead of using its own employees in Mexico because it does not trust its own people to handle the bookkeeping (Earley 2007). This lack of trust and fear of unfaithful employees is likely to inhibit business cooperation and, quite possibly, contributes to the abundance of small firms throughout the country (Lora 2001: 8).

The final issue that hinders entrepreneurs throughout Mexico is an inability to obtain financing for new business ventures. In Mexico most companies are started using an entrepreneur's personal savings, and a very small percentage of firms receive loans or financial support from banks (Ishida, Kantis, and Komori 2002). This lack of non-familiar financing is particularly troublesome in the IT sector, where small start-ups rarely have the collateral necessary to receive a loan. As their assets are software and personnel this makes these firms appear risky to the banking sector. This concern is exacerbated because the legal rights for borrowers in Mexico are well below the Latin American average thus incorporating an extra element of risk for lenders (World Bank 2007).

With limited support from financial institutions, those seeking financing for their business ventures have few places to turn, and unfortunately there is a lack of venture capital in Mexico. Christina Kappaz of the Latin American Venture Capital Association in part attributes this shortage to the fact that Mexican corporate forms lack fiscal transparency. The situation for VC firms is also difficult because, as she states "(Mexican corporate forms) do not allow for an entity to serve as a tax pass through in which taxes are assessed only to the owners and not to the corporation. Thus, incorporation in Mexico potentially results in double taxation, that is, taxation of the fund and also of the investor"(Kappaz 2004:1). She also attributes the shortage to Mexican corporate laws that prohibit many rights of minority shareholders, legal uncertainties associated with the Mexican judicial system, and implausible exit strategies for investors (Kappaz 2004: 1).

The structure of the Mexican IT industry and national political economic institutions are not conducive to IT-related entrepreneurship. Mexico has a large number of small firms that are probably below the minimum size to be competitive. This plethora of small firms is

exacerbated by Mexican entrepreneurs being unwilling to merge in an effort to create larger organizations. The result is that, while it is possible for these firms to survive, it is extremely difficult for them to move up the value ladder to undertake bigger and more lucrative contracts. For the Mexican IT services industry there is little of the beneficial competition that India experiences due to the large number of similarly sized rivals.

Softtek

The leading Mexican IT service company that provides much of its services for export is Softtek. It is a large company by Mexican standards as it currently employs 4,500 people and in 2006 reported revenues of \$185 million. It is also recognized internationally having received a CMM 5 rating in 2005. In 2003 Softtek purchased General Electric Company's Global Development Center in Mexico (GDC) with 500 employees including a U.S. subsidiary, GE Ddemosis. Though it is unclear how important this acquisition was to spreading the Six Sigma doctrine (Six Sigma is a program focused on quality and management), Softtek is committed to Six Sigma programs. Parenthetically, it is important to note that in India, GE's subsidiary, since spunoff and renamed Genpact, was extremely important to the spread of the Six Sigma program that was central to India's acknowledged service quality (Dossani and Kenney 2007).

Softtek has operations and development centers in four cities throughout Mexico (Monterrey, Mexico City, Aguascalientes, and Ensenada) and global development centers in Brazil and Spain. Its operations include a full range of IT services from application services, infrastructure support to BPO and its clients include five Fortune 500 companies. Softtek's network has become increasingly global as they provide services for customers in the United

States, Latin America and the European Union. It also operates facilities in Argentina, Brazil, Bolivia, Chile, Colombia, Paraguay, Peru, Puerto Rico, Spain, Uruguay, and Venezuela.

The company was established in 1982 because entrepreneur Carlos Lopez recognized that companies focused on software engineering were relatively nonexistent in Mexico. Among the firms that did exist, little attention was given to quality and follow-up consulting services. Although Softtek struggled initially, by 2000 it was the largest privately owned IT company in Latin America. In the last few years growth has accelerated, and in 2007 it is expected to grow by 45%. Moreover, the company has been expanding its presence in Mexico and internationally. It plans to open its 5th center in Mexico later this year and also to open a 200-person facility in China to promote business nearshoring in Asia.

Softtek's success is largely based on its self-promotion as a near-shore location for IT outsourcing. The term "nearshoring" describes the situation in which offshoring is transferred to an offshore location that is in relatively close proximity, but still provides lower costs. Softtek advertises the advantages that geographic and cultural proximity give it for making IT outsourcing much more efficient. The advantages of "nearshoring" are common time zones, relatively short transportation times, and lower costs for transportation and communication. There is a further advantage of special visa dispensations for NAFTA nations, thereby simplifying the visa process. Moreover, Softtek's stated strategy is not to replace the Indian service providers, but rather capture a portion of the outsourcing market, specifically from firms wishing to diversify risk (Aggarwal et al, 2006). The strategy appears to be working as Softtek now counts GE (partially a legacy of the earlier acquisition), Citigroup, Onyx, HP and EMC as customers.

Softtek is also significant in the Mexican IT service landscape because it has one of the most well-trained and educated workforces. It trains its employees in at least 3 or 4 semesters of CMMI and Six Sigma, as well as English education. As part of its effort to recruit the best students, it has partnered with the Universidad de Mexico, Tecnológico de Monterrey, and Tech Millenium, to name some of the most prominent universities. An illustration of the closeness of the relationship is the location of Softtek's Mexico City office on the Tecnológico de Monterrey campus.

The relationship Softtek has with top universities, its presence throughout the country and its ability to do high quality work for international clients has proven successful. Its success is significant for two reasons. First, although it is the largest Latin American IT service firm, it is still much smaller than its MNC or Indian counterparts. This indicates that Latin American IT service firms will be severely challenged if they have ambitions to go beyond their nearshoring niche. On a more optimistic note, it also indicates how large they might become if they can sustain their growth. Certainly, Softtek demonstrates that IT service firms from nations outside of India can grow successfully and rapidly. Softtek's success illustrates the opportunities for entrepreneurship and rapid growth.

Neoris

Softtek's largest competitor is Neoris, which also provides IT value-added consulting, emerging technology solutions, and nearshore outsourcing services. With offices in Monterrey and Mexico City, (as well as the United States) it has over 2,000 employees working in nine countries and their 2006 revenue is projected to stand at over \$200 million dollars. Although the company grew out of its in-house technology consultancy with CEMEX, and it continues to

do a large portion of work for them, its international presence is expanding rapidly. However, Neoris is one of a very few Latin American competitors for Softtek.

MNC IT Service Firms Operating in Mexico

Mexico hosts a number of multinational IT service firms (MNCs). Most significantly, there are large MNCs from both the United States and India with subsidiaries in Mexico. The most important of the service MNCs operating in Mexico are listed in Figure 6.

U.S. IT Service Firms Operating Mexico

The role of the U.S. IT service firms in Mexico is complex and for a number of firms is multifaceted. They may provide IT services from Mexico to the U.S., they may provide services to Mexican firms, or they may serve other Latin American nations from Mexico. Also, the larger more established firms may do any combination of these. In this section, we review their activities.

IBM Global Services (IBM GS) is the world's largest IT service provider and it is the largest U.S. IT service provider in Mexico. IBM employs about 330,000 persons globally; of these approximately 150,000 are in IBM Global Services. One consulting firm has suggested that by 2010 IBM will have 100,000 employees in India up from, at least, 39,000 in March 2006 (McDougall 2006c). IBM's Mexican operations supply services to IBM itself internationally, for IBM's clients in the U. S. and other locations clients, and to the domestic Mexican market. IBM has operated in Mexico since 1927 and became particularly influential during the 1990's with its personal computer manufacturing operations in Guadalajara. Since the late 1990's IBM in Mexico began transforming its operations from manufacturing to

services. In 2005 the IBM software center in Guadalajara was one of the earliest CMM5 certified centers in the country. IBM Global Services is responsible for 50% of IBM's total revenues in Mexico, while software provides another 25% of Mexican revenues (De la Rosa 2005). IBM GS's activities in Mexico include application development and systems integration, financial and human resource administration, supply chain optimization and business strategy support.

IBM does not report its revenues in Mexico separately so it is impossible to know how much the Mexican operation contributes to global service revenue (which was \$64.5 billion in 2005). However, IBM's significance in Mexico is great. According to current reports, in 2001 IBM Mexico's software revenues of \$160 million was 25% of the all Mexican software revenues (Chandrasekhar and Ghosh 2006; Ruiz-Durán 2002). In 2002 IBM employed 1,200 people in their Guadalajara and Mexico City application divisions and had signed deals with some important Mexican firms (Overby 2002). Its strength in the Mexican market appears to be continuing. For example, at the end of 2006 it signed two multi-million dollar agreements, one with ScotiaBank of Mexico (a wholly owned subsidiary of Bank of Nova Scotia in Canada) and the other with Grupo Modelo, a large Mexican brewing company, to revamp their IT environments (IBM Global Services 2006; McDougall 2006a). IBM is the largest foreign IT services vendor in Mexico, though in overall Mexican employment it is smaller than Softtek.

HP's relationship with the Mexican IT service economy resembles much of that of IBM. HP is largely concentrated in Guadalajara where its IT services operation emerged from its earlier manufacturing operations. From Guadalajara, HP provides services including purchasing of parts for global manufacturing, internal BPO, payroll for all North America HP, order processing for all of HP in the Americas, compensation payments, legacy system

engineering, some programming, code patching, and repair operations. In 2005, HP's global service revenues were \$14 billion (Musich 2005), however the contribution by its Mexican operations are also unknown. What is certain is that HP's Mexican operations are substantial. For example, the Business Monitor International (2007) states that the global center in Guadalajara provides 50 percent of the total services processing for HP's financial and business operations. HP has continued to show interest in its Mexican operations, as HP has recently announced plans to invest \$2 billion and create 1,200 jobs in Mexico (Business Monitor International 2007). HP also has forged a strategic partnership with ASCI, a Mexican software solutions company to provide a full range of management solutions that ensure around the clock business continuity, increasing productivity, and revenue (HP 2007).

Electronic Data Systems (EDS) is another significant U.S. IT service firm with operations in Mexico. EDS' was acquired by General Motors in 2004 which hired to the company to perform its internal IT work; a relationship that both companies took south of the border in 1985. EDS, although now global in focus, was a leader in the Mexican IT services market with 2004 revenues of more than \$200 million. EDS also supplies BPO services to many domestic Mexican firms including Grupo Nacional Provincial and food manufacturer Grupo Bimbo (Manda 2005).

Another large U.S. IT services firm operating in Mexico is ACS (Affiliated Computer Services). Nearly all of the services by its Mexican operations are for export (95 % for the US, the other 5% for global companies). From Mexico it provides desktop support to help desks, operation systems support, UNIX, mainframe support, databases, network engineering, and consulting. ACS had experienced significant success with its Mexican operations, which employed 100 professionals in 2004 and it was reported in 2005 that the ACS operation would

grow to about 600 by the end of 2005 (Manda 2005). However, in 2006 a popular press article suggested that ACS would make major cuts in Mexico, and relocate the jobs to a lower-cost location, presumably, India (McDougall 2006b). This suggests that the Mexican operations are in a competition with lower-cost locations particularly India.

Firms operating in Mexico have attracted work from many high profile U.S. clients. Currently, the largest US-based clients of IT service providers in Mexico are American Express, Citicorp, Compaq, Direct TV, Epicor, General Electric, HP, IBM, Junot Systems, Microsoft, XEROX, Nissan, Motorola, NBC, NCR, Onix Software, Oracle, Principal Financial, Shell petroleum, Volkswagen, Wal-mart, Procter & Gamble, Chrysler, and General Motors. (Portal de Inversion Extranjera 2002). Some of these companies use Mexican services to support their firms in the United States, while others use these services to provide support for their Mexican operations, as is especially the case within the manufacturing industry.

As much of the IT service movement emerged from the growth of manufacturing throughout Mexico, firms like Delphi, GE, and GM all have service operations handling their IT needs in Mexico. GM in Mexico, as stated above, has its former subsidiary, EDS doing most of its service work. GE has its Indian subsidiary Genpact in Mexico doing some of its BPO work and higher-end manufacturing support services. However, it is important to note that only 6% of GE's work goes to Mexico, while 90% of IT service needs are supplied from India. Recently, Delphi also signed a deal with Genpact to relocate 650 finance jobs to Mexico, which suggests that IT service operations in Mexico have an attraction to manufacturing firms.

Indian IT Service Firms

There are a growing number of Indian IT service firms establishing operations in Mexico. The catalyst encouraging Indian firms to launch operations in Mexico has been to establish closer proximity to their U.S. customers and create a near-shore option for their global delivery models. Two of the largest IT service companies in India, Infosys and TCS, have set up or are setting up operations in the country, and the other giant Wipro is evaluating Guadalajara as a potential site too. Currently, Infosys is in discussions with the Mexican Secretary of the Economy regarding a future 150-person operation in Monterrey to supply services to the U.S. market. TCS is the leader in establishing Latin American and Mexican operations that are located in Monterrey and Mexico City. Recently, it has disclosed plans to establish a global delivery center in Guadalajara to complement its other sites (Carmona 2007).

Other Indian firms are establishing BPO in Mexico. Infosys provides BPO as a part of the portfolio of services offered from Mexico. However, the real leader is Genpact, the former GE subsidiary that specializes in BPO. Genpact operates a 2,500-person facility based in Ciudad Juarez, which is on the U.S. border and thus is in close proximity to its U.S. clients. Genpact also has plans to expand its presence in Latin America, and is contemplating the establishment of a second facility in Guatemala. The presence of these firms and the interest by other Indian firms suggests that they are having sufficient success in Mexico to warrant their increasing expansion. And, as Alejandro Camino (2007) the VP of Marketing & Communications of Softtek put it, “the presence of India in the country shows that the Mexican model for the delivery of services works.”

India’s IT firms operating in Mexico can take advantage of the many agreements Mexico has with the United States, such as NAFTA and certain provisions under the maquila

treaties for the export of their services. However, from the perspective of the Indian managers we interviewed, there appears to be reluctance on the part of Mexico to significantly open up to Indian companies and this has caused several Indian IT firms to encounter operational problems in Mexico. There is a suspicion on the part of the Mexican government and some firms in Mexico that these Indian firms may be entering solely to exploit Mexico's agreements with the United States. The Indian executives suspect this is the reason that visas for Indian professionals intending to work in Mexico are granted only very slowly and that the bureaucracy is so strict regarding their stays. For example, to obtain a work visa, Indian firm officials said the process is drawn out over 2 to 6 months, and is quite expensive. Despite these drawbacks, Indian firms are increasingly interested in operating in Mexico, and the operations by Indian firms are likely to continue expanding.

Tata Consultancy Services (TCS)

The TCS operation in Mexico is relatively recent having opened their offices in Mexico in 2003, as part of a push into Latin America. Its headquarters are in Mexico City while operations are in Monterrey, and a new global development center is planned for Guadalajara. The motivation for entering Mexico is to better serve its U.S. clients that want nearshore operations in Mexico or other nearby locations. The nearshore model ameliorates client anxiety about not being able to monitor the work they offshore to distant locations, and the time zone differences that frustrate the instant communication so often necessary to effectively undertake a difficult task. It is for this reason that TCS has expanded globally. In fact, beyond Mexico, TCS in Latin America has partnerships with firms in the Andean and Caribbean region, offices in Argentina, Brazil, and Chile, and in 2002 opened a Global Development Training Center in

Uruguay which has achieved level CMMI-5, which is the first facility in Latin America to operate at this standard.

This training center in Uruguay, which like India gets products before the market does in order to train with, has proven to be especially beneficial to TCS Mexico. Instead of having to collaborate with Indians on new products and projects, Mexican TCS service technicians and professionals travel to Uruguay where there are no requirements for a visa, the travel times are shorter, and they share the same language. These features ease the difficulties and costs of training.

TCS Mexico has encountered obstacles that have affected growth that illustrate the barriers that Indian IT service firms experience. First, the quality of Mexican engineers, particularly in terms of experience, is not as high as their Indian peers even though Mexican wages are higher. Second, the visa process is problematic and our respondents estimate that it takes three months to get visas for their Indian employees to travel to Mexico. The time delay can be very problematic for projects that have strict deadlines.

Even with these barriers, TCS seems to be operating with many advantages. Its testing facility in Uruguay is particularly important because it points to the possible collaborative relationships that firms can have throughout Latin America or that Mexico could have with other countries in the region, making the region as a whole more competitive. The sophisticated IT service endeavors that it carries out in Mexico also illustrate that firms in the country are capable of doing the same types of highly skilled projects common to India.

Genpact

Genpact is significant because of its presence on the United States/ Mexican border in Ciudad Juarez, and because it largely depends on a low-skilled population for its business process outsourcing work, which stands in contrast to many of the other firms studied. Although BPO is the main component of their Mexican operations, Genpact does a variety of processes in the country that range from finance and accounting, data entry, data storage, enterprise content management, to higher level processes including asset intelligence, health care services and customer service for manufactured goods. Genpact in Mexico employs about 2,500 people, a sizeable amount as compared to the 25,000 people that Genpact in India employs. The company services very high-end customers including Fedex, GE Money, Delphi, Wachovia, Penske and Nissan among others.

What's interesting is that in some BPO work, Genpact has advantages by operating in Mexico as compared to India. First, Genpact Mexico can be extremely competitive in labor costs. For BPO work done in Mexico, Genpact tends to pay half as much as paid for the same work in India. Its ability to do this stems largely in part from the company's location on the border. The border population in Ciudad Juarez contains many high school and lower-educated people that can speak English. This is completely the opposite of India, which has an advantage in its plethora of *highly-educated* English speakers. Because of this unique feature of the border population, Genpact Mexico is sometimes more cost effective in BPO work because English-speaking employees can be hired at a fraction of the cost. The border offers other advantages to the firm as well. Its infrastructure is comparable to that in El Paso, the company has a special ability to do business with the Spanish speaking U.S. population, and it

is able to use a U.S. Post Office Box address and still receive mail quickly, which increases comfort for customers and clients throughout the United States.

The problems that Genpact face in Mexico are not unique to the type of work they perform. First, one of its biggest obstacles is that they have a 53% attrition rate among their BPO employees. Although they have identified and fixed some of the causes of this problem the fact remains that some employees who do BPO work at Genpact use it as seasonal employment, and choose to work in the agricultural sector in different seasons throughout the year. The unique problems Genpact in Mexico encounter have to do with its location on the U.S./Mexican border. Because there is a large flow of mail, people, information and high-technology equipment back and forth across the border, management of these items can often be a time consuming process for the company, sometimes causing problems. For example, issues with taxes have been particularly painstaking for because Genpact has assets on both sides of the border, and customs and licensing for these assets can be quite an ordeal. As an example, when the company wanted to install software onto their computers in Mexico, it could not get the software through customs so they had to set up a remote station in El Paso to do the procedure from there, an obviously costly process.

Ultimately, Genpact has advantages in performing BPO work in Mexico and a large portion of its success has to do with its location. However, the things that make it competitive (location and low-wage labor force) can also sometimes be a detriment, especially with regard to employee retention. Regardless, Genpact's operations in Ciudad Juarez have been successful as demonstrated by the fact that it is continuously signing on new clients and it continues to expand its operations throughout the city. It also is representative of the broad scope of IT service operations being performed in Mexico.

Mexico's Advantages and Disadvantages

Mexico's overwhelming advantage over other nations and particularly South and East Asia is proximity to the U.S. market. To Mexico's benefit, operations offshored to Mexico operate on comparable time zones to those in United States. The advantage here is that when there are issues that need interaction, both parties can interact during normal working hours. Proximity is also important when in-person interaction is necessary (Lopez 2006), and by having operations in Mexico, representatives from either party can more quickly and inexpensively travel to the appropriate location. Of course, having similar time zones is not entirely an advantage, because for some projects the difference facilitates 24-hour work days (i.e., "follow-the-sun" development or beginning of next day delivery). Thus similar and dissimilar time zones provide different benefits.

The important advantage of proximity revolves around the ability to interact conveniently. So, for example, it takes at least 17 hours to send someone from India to the U.S. or vice versa, not to mention the time lost to jet lag. In contrast, someone can be sent from Mexico to the U.S. in less than 7 hours. The savings in terms of time are significant, and more importantly, it is much easier to undertake the trip.

Lower telecommunications costs are another benefit and Mexico's proximity ensures that it has lower telecommunications costs than India. However, the importance of telecommunications costs differ by sector. They are very important for call centers that require significant bandwidth, while IT services do not require as much bandwidth. Securing cost estimates for telecommunications linkages has been difficult, though as a rough estimate we examined phone card rates per minute from the U.S. to both India and Mexico. The lowest

rates we found were 34 US cents per minute to India and 11 U.S. cents per minute to Mexico (commercial rates). This ratio of approximately 3 to 1 appears to be relatively invariant suggesting that comparative costs of telecommunications for both nations are decreasing at similar rates. The important point to make here is that though the Mexican advantage remains intact, because of continuing price decreases telecommunications costs are becoming an ever-smaller portion of the overall costs, thereby eroding the importance of this advantage.

Nearshoring provides more than physical proximity. Our interviewees in Mexico suggested an advantage over other locations in terms of cultural proximity to the U.S. and other Western countries. The United States' culture has permeated much of Mexico, especially with 10% of the Mexican population living in the United States. Guadalajara has used this cultural similarity to its advantage in creating a successful niche for animation services, which Francisco Medina (the executive director of the Jalisco State Council of Science and Technology) attributes to the fact that Mexicans share a similar sense of humor with the United States making them a "natural" choice for these types of services (Medina 2007). This paper does not attempt to evaluate these debates about cultural similarities and its importance. A plausible counter argument might be that Indian management in the offshored service industries have a significant amount of global-class management expertise. Moreover, they are able to draw upon Indians that have worked in management and executive positions in the U.S. To gauge whether Mexican or Indian cultures are more similar to that of the U.S. in ways that matter is therefore difficult.

As an upper middle-income nation, Mexico has a superior infrastructure to that of India. Mexico's physical infrastructure is well developed in terms of its airports, hotels, transportation, and hospitals. It also has world-class financial, medical, transportation, and

lodging services. However, perhaps the most significant difference is in terms of energy supply. In contrast to India, in Mexico backup generators are rarely if ever used, though, of course, all operations do have an onsite generator set. On another issue, whereas a decade ago broadband connectivity or mobile phone coverage may have been an issue in India, this is no longer the case. However, India has enormous infrastructure deficit in terms of airports, public transit, hotels, and transportation services. To further the point: in terms of public transit, all Indian firms must provide at the employers' cost transportation to its workers- a burden that employers do not face in Mexico.

Though the Indian government is straining to relieve these burdens, the pace of growth and fiscal difficulties mean that at this point needs are outstripping the best efforts to meet them. Thus, Mexican infrastructure is clearly superior to that of India. Furthermore, Mexico not only has many English language speakers, but also can offer services in Spanish, a particularly important advantage for voice-related services, but not as important for other business processes. For consumer-oriented services the advantage is that one center can service the two largest U.S. language groups.

Labor Force and Education

Ultimately, service offshoring is about access to capable labor, and, for the most part, this refers to those with college education, though as we found for call center work Genpact employs high school educated Mexicans that have good English language skills, i.e., their educational attainment is similar to that of U.S. call center operators. By one estimate, there are 451,000 Mexican students enrolled in full-time, undergraduate engineering programs (Smith May 2006). In fact, the Secretary of the Economy in Mexico states that 60,000 IT students

graduate from universities and colleges every year (Secretaría de la Economía 2006). Unfortunately, the accuracy of the number is difficult to assess. As a point of information, the U.S. only has 370,000 students enrolled in the same programs (Smith May 2006). Of course, the large number of Mexican graduates does not necessarily speak of their quality. Labor force quality issues are also similar in India, which graduates 441,000 technical graduates, 2.3 million other graduates, and 300,000 postgraduates every year. Kiran Karnik, the president of Nasscom explains, “the varying standards of tertiary education (are) concealed by these figures: one-fifth world class, one-fifth passable, and three-fifths lamentable” (*The Economist* 2006: 58).

In comparison with Mexico, India has a larger labor pool with better average skills. However, Mexico’s position (in terms of college graduates) relative to other emerging economies in Latin America is quite good. For example, when examining undergraduate mathematics/computer science and engineering degrees, Mexico produces considerably more graduates than Brazil, Chile, and Argentina- all of which boast budding IT service industries. For example, Mexico awarded 68,239 undergraduate mathematics/computer science and engineering degrees in 2002, while Brazil awarded 44,434 (2001), Argentina 8,787(2002), and Chile, whose statistics are limited, had 3,657 engineering graduates in 1996 (NSF 2006a). Interestingly, Brazil produced noticeably more Science and Engineering (S&E) doctoral graduates than Mexico in 2002 (the most recent year reported for the statistic). In 2002, 577 people earned doctoral degrees in mathematics/computer science and engineering in Brazil, compared to 186 in Mexico (NSF 2006b). This illustrates the increasing headway that Brazil is making in high-technology industries, and sheds light on the degree to which it might be able to compete with Mexico.

Regardless of Mexico's position relative to the rest of Latin America, labor force quality becomes a particular concern in Mexico because IT salaries in the country, although much lower than the United States, are still higher than in India, and its engineers may not be as comparable to those in India.. Salary comparisons between are difficult because there are a variety of variables including regional location and university quality. So in India, Bangalore and Mumbai have the highest wages and third-tier cities have significantly lower wages. In the press, Azim Premji in November 2006 was quoted as saying Wipro's average cost for a fresh engineering graduate was \$7,500 per annum (Cnet.com 2006) while *Business Week* (2006) found that a good quality Mexican engineer received \$15,000 per annum. (*Business Week* May 22, 2006). This cost differential is a significant challenge to overcome because there is little evidence that the Mexican engineers are superior in terms of productivity.

The Mexican education sector has been slow to respond to the opportunities for students trained in engineering. Mirroring complaints in India, our interviewees in Mexico thought that there was too much rote learning and teamwork was not taught. They also commented that the English language was not sufficiently stressed. The Tecnológico de Monterrey is acknowledged as producing the highest quality engineering graduates throughout Mexico and Latin America and is well-recognized internationally. This provides Monterrey with an advantage regarding attracting IT and engineering services firms. In fact, one interviewee went so far as to say that outside of Monterrey high quality engineers are found at a ratio of 1:10. This suggests that while Monterrey has high quality engineers, the national average is far lower. In terms of selection, one firm we interviewed compared Mexican and U.S. engineers in this way: in order to hire one Mexican engineer he had to interview 40 to 50

applicants, while with U.S. applicants it was only necessary to interview five to find a suitable candidate for the job.

Attrition rates are also a problem in Mexico, though our interviewees with experience in both India and Mexico found that attrition was not as great a problem as in India. Although sector-wide attrition rates for IT work in Mexico are unknown, firm level attrition rates varied by activity. In the call centers and low-end business process outsourcing, Genpact suffered from annual attrition rates as high as 53% (Earley 2007). However, this is not as large a problem as it first appears because there is much seasonality in the Mexican context. In the more highly skilled IT work, attrition rates were as low as 15% per annum as experienced by ACS (Maya 2007). The interviewees attributed attrition from higher-end jobs to a lack of challenging work and/or a favorable job market that permitted persons to resign and find other positions with better pay and benefits.

Despite neighboring the U.S., there are only a limited number of engineers and others that speak English well; a significant deficiency if they are to deal with U.S. customers. Remarkably, there is no mandate by the central government for English language training, so each state can set its own standards. Not surprisingly, the standards vary widely. English language capabilities are acceptable in the Northern border regions and among the more highly educated sectors of society. In the border region, there is a large population of English speakers giving firms located there a competitive advantage in hiring English language speakers for low-skilled BPO work, but the universities and technical institutes in the border areas are not as good, so the skill levels are lower. In response, the Tecnológico de Monterrey has increased its TOEFL requirements for undergraduates. The public universities however do not have such requirements, and there have been no reports of other universities encouraging English

language skills in either the universities or in technical education, generally. Some firms interviewed stated that they had trouble finding candidates for senior technical positions with sufficient English language capabilities despite their excellent technical expertise. This contrasts unfavorably with India where senior engineers are likely to be more fluent in English (Entwistle 2005).

Tied to the issue of labor force quality and education are transnational labor flow aspects that affect the Mexican industry. One reason why Mexico may not have the same global-class software engineering capacity as India may be linked to the large number of highly educated Indian visa holders who have migrated or, at a minimum lived or studied in the United States. In contrast, far fewer highly educated Mexicans migrate to the U.S. This is significant because skilled Indian immigrants come here on temporary visas and also experience learning from customers. Their work in firms boosts the reputation of India as a capable participant in high technology work, which is an 'advertisement' that Mexico lacks.

For decades the United States has employed immigrant Indians in the information technology sector. Changes in of the U.S. immigration policies, starting in the mid-1960's, instituted a selection process that facilitated the immigration of well-educated Indians. This continues as the U.S. government has repeatedly increased the quota for H-1B visas given to specialty migrant workers (largely from India and China) that particularly targets the high-technology sectors (Money and Falstrom 2006). As an illustration of the differences in human capital- 87% of Indian immigrants to the United States had a high school degree, and 65% a college degree (Alarcón 2000). In contrast, only 24 % of Mexican immigrants had a high school diploma, and only 3.5 % had college degrees (Alarcón 2000: 10). As Figure 7 illustrates, with regard to temporary H-1B visas; far more Indians have an H-1B (Alarcón 2000).

In addition, Indian immigrants are employed in higher level/ managerial and professional positions in far greater numbers, while Mexican immigrants are more likely to be employed in the fabrication, labor, and service sectors (see Figure 8). Rafael Alarcón concludes, “Mexican immigrants constitute the largest group of unskilled workers, especially in the agricultural sector because geographical propinquity has lessened the selection process by lowering the economic and social costs of immigration. In addition, specific U.S. immigration policies, direct recruitment, and the development of social networks have encouraged the immigration of unskilled workers” (Alarcón 2000: 15). Further, in terms of positioning in the global economy, while India was advancing its export services sector, Mexico was promoting itself as a manufacturing center. This set of historical legacies is undoubtedly inhibiting Mexico’s efforts to position itself as a services export leader.

Government Initiatives

Mexico’s incentives for promoting the IT industry are recent and prior to the formation of ProSoft have been minimal. Only recently has the IT sector received attention from the Mexican government. Not surprisingly, government attention was focused on the existing industries of oil, auto-manufacturing, and tourism instead. Furthermore, Mexico’s emphasis on state, fiscal, labor, and social security reform has also delayed the creation of a national IT agenda. Although there are some governmental incentives for promoting Research and Development that benefit the IT sector, these initiatives are not industry specific. For example, a 30% R&D tax credit, which is offered through the Ministry of Finance and the National Council of Science and Technology (CONACYT) is applicable to any industry R&D, not just that of IT firms (Hugo Estrada de la O 2007).

Given the continuing global and Mexican expansion of the IT sector, and the increasing opportunities for IT service exports, the Mexican government established ProSoft in 2003 under the Secretary of the Economy. ProSoft was meant to spearhead Mexico's efforts to shift its industrial promotion efforts from manufacturing toward the promotion of a more knowledge-based economy. The advocates of Prosoft believed that Mexico was no longer as competitive as it once was in manufacturing, and the country should turn to higher-skilled processes for economic development. In its effort to promote the IT services sector from 2004-2006 ProSoft invested nearly \$250 million dollars and its goal for the sector is to reach \$15 billion (US) in IT service production yearly by the year 2013 (of which \$5 billion should be in software). The expectation is that Mexico can develop the leading IT industry in Latin America. Their program focus is on seven areas: increasing foreign investment, human capital capabilities, digital economy legal framework, improving the domestic IT market and local IT industry, increasing process capabilities, and IT cluster development (Secretaría de la Economía 2007).

To encourage deepening and upgrading of the Mexican software services sector, ProSoft has initiated a program of cash grants equaling 50% of total project cost to used for training and certification, software and equipment, standard implementation and certification, R&D, technology transfer and royalties, supplier development programs or tailor-made programs with universities. The conditions that ProSoft places on their grants are the following; they must be used during the same year they are granted, they can support a project for up to three years provided they are re-approved each year, they may not be used for salaries or construction, and if a project does not reach its goals, grants must be reimbursed (Secretaría de la Economía 2007).

Although ProSoft is well received by large and small firms alike, there is controversy concerning the role of large and small firms in Mexico's IT sector. Small companies interviewed liked ProSoft because it provided money for certification and standards implementation, which was advantageous for them. However, since ProSoft only supported 334 projects in 2006 and there are over 2,000 IT firms in Mexico, there are concerns about how many firms ProSoft actually reaches (Secretaría de la Economía 2007). Larger firms, although grateful for Prosoft's support, believed that support of small firms should be reduced because they are unstable and have a high mortality rate. These large firms believe it would be better to support them because they are the ones most important in the international market.

Realizing that many of Mexico's small firms could not compete in the global economy, but that they had potential in the local market, the government initiated with a certification scheme along the same lines as ProSoft, entitled MoProSoft, in order to standardize the local industry. MoProSoft is a less rigorous version of international certification standards. For example, a firm can be level 5 MoProSoft (the equivalent of level 2 CMMI) and can use this certification to prove its capabilities and standardization to a local buyer. However, it is debatable whether this will have a positive effect on the domestic economy, and whether the local market is large enough to make such a non-standard certification training effort worthwhile (García 2007).

Besides the efforts of ProSoft, which are national, there are many other programs that have been developed at different levels of government, which have directly and indirectly promoted the IT services industry. First, PyME (Small and Medium Enterprises), with support from the Secretary de Economy has created diverse programs to assist small companies throughout Mexico. One of their programs has been the "Business Acceleration Program"

which is meant to assist small companies in utilizing business schemes and integrating commercial channels, optimizing processes, product development, and expert capacity in order to help them compete in the domestic and global economy.

State governments vary in their support for their IT industries. For example, some states offer water and electricity stipends to firms conducting R&D, others offer tax holidays or tax incentives to the industry. Despite these benefits, the IT service firms we interviewed wanted even greater benefits.

Conclusion

Mexico has significant potential to increase its participation in the global IT service economy, both through foreign investment and the continuing growth of domestic firms. Mexico is endowed with geographical advantages, a ready workforce, an increasing interest in diversification of service locations for business continuity reasons, and a gradually narrowing wage gap with India. Despite these advantages, Mexico is also competing with many other nations for investment. Strategically, Mexico is no position to compete directly with India, rather it must develop niches based on its comparative advantages. Mexico must focus on improving the quality and quantity of education in high-technology fields, improve access to capital for entrepreneurs, and promote the industry through technical and business management skill upgrading.

With so many players in the industry all providing services for different niches, the ultimate question then becomes how best to promote the IT service sector in Mexico. Rather than picking winners, the government should work to promote the foreign investment from U.S. and Indian firms, while also encouraging the growth of its indigenous firms. The problem

with so many small local firms will be difficult to solve, but encouraging rationalization of these firms is probably wise. India has successfully managed foreign and domestic firms by not over-regulating.

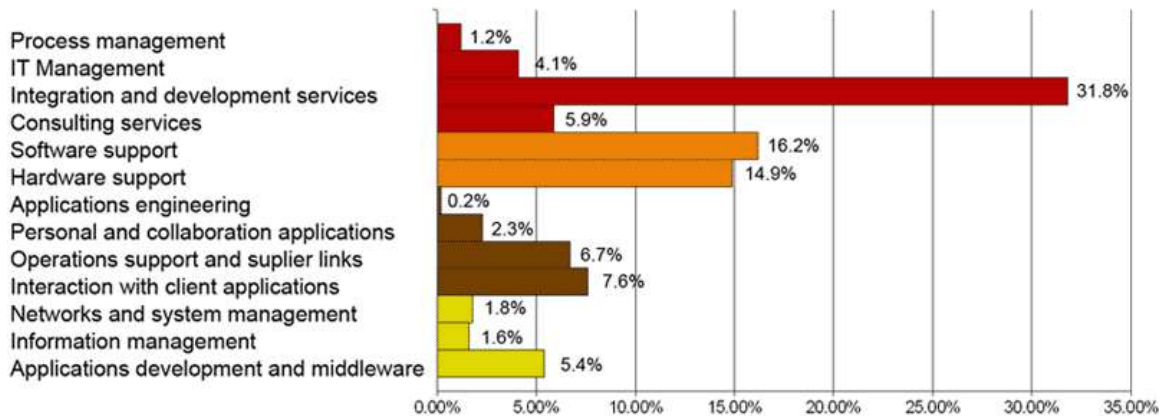
The government also may have a role in a general campaign to promote Mexico as a destination. Though self-serving, all of our interviewees believed that decision makers in the U.S. and Europe do not fully understand Mexico's capabilities. Some interviewees suggested that the monetary incentives should be scaleable and not capped. Of course, this would work to favor the larger firms; something that is a policy decision that might be difficult to make.

Finally, Mexico needs to more effectively monitor the developments in the global IT service industry so that it can better identify emerging opportunities. Changes in other nations will impact the Mexican industry. For example, China has begun expanding its IT industry and Softtek's entry into China is evidence of this. Of course, there are many business opportunities in Latin America. The creation of a more integrated Latin American market should help not only foreign MNCs, but also the stronger national players helping them achieve scale economies. For example, it might be possible for countries or firms throughout Latin America to cooperate and together become internationally competitive. Mexico must act promptly and efficiently in order to take advantage of the advantages it now has and develop further advantages and competencies.

Figure 1

Sales Structure for Leading Businesses by Type of Product and Service

(Total sales porcentaje)



(AMITI 2004)

Figure 2



Data of 840 recorded firms

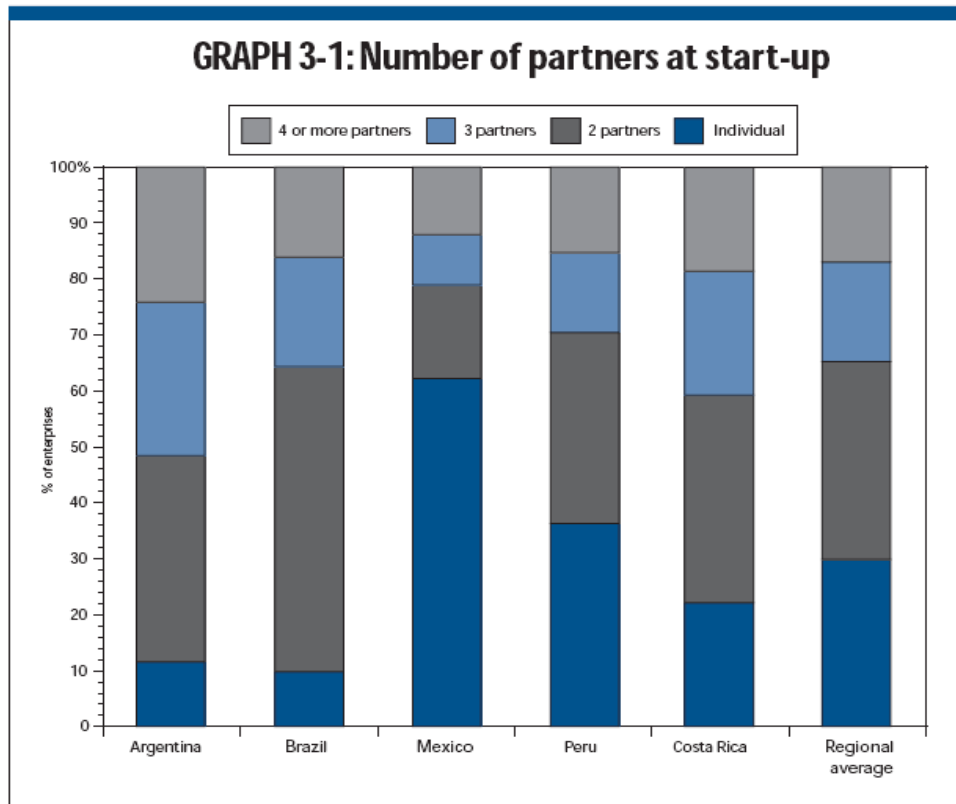
(Sistema Nacional de Indicadores de la Industria de
Tecnologías de Información 2007)

Figure 3

STATE	# of firms
Aguascalientes	23
Baja California	30
Baja California Sur	5
Campeche	3
Chiapas	9
Chihuahua	5
Coahuila	13
Colima	22
Distrito Federal	242
Durango	5
Estado de Mexico	49
Guanajuato	26
Guerrero	3
Hidalgo	5
Jalisco	52
Michoacan	18
Morelos	18
Nayarit	1
Neuvo Leon	76
Oaxaca	12
Puebla	39
Queretaro	17
Quintana Roo	10
San Luis Potosi	5
Sinaloa	8
Sonora	40
Tabasco	26
Tamaulipas	11
Tlaxcala	6
Veracruz	39
Yucatan	16
Zacatecas	3

(Sistema Nacional de Indicadores de la Industria de Tecnologías de Información 2007)

Figure 5



(Kantis; Ishida; Komori 2002: 40)

Figure 7

Table 3 Temporary Migrants with Specialty Occupations (H-1B Visa Holders) 1994

		%
India	16,948	16.0
United Kingdom	13,696	12.9
Japan	7,317	6.9
The Philippines	5,098	4.8
France	4,548	4.3
Germany	4,042	3.8
Canada	3,527	3.3
Mexico	3,256	3.1
China	2,721	2.6
Australia	2,676	2.5
Brazil	2,354	2.2
Italy	2,107	2.0
Soviet Union	2,104	2.0
Netherlands	2,068	2.0
Israel	1,897	1.8
Other countries	31,540	29.8
Total	105,899	100.00

Source: Immigration and Naturalization Service, 1994.

(Alarcón 2000: 6)

Figure 8

Table 4 Immigrants Admitted by Major Occupation Group and Country of Birth, 1994

	All Immig		Mexica n		Indian	
Professional & Technical	67,286	8.4%	843	0.8%	6,202	17.8%
Executive, Administrative & Managerial	26,931	3.3%	428	0.4%	1,786	5.1%
Sales	13,024	1.6%	1,590	1.4%	386	1.1%
Administrative support	21,590	2.7%	1,438	1.3%	747	2.1%
Precision Production, Craft & Repair	24,518	3.0%	3,409	3.1%	192	0.5%
Operator, Fabricator & Laborer	67,486	8.4%	22,069	19.8%	155	0.4%
Farming, Forestry & Fishing	15,606	1.9%	4,738	4.3%	914	2.6%
Service	50,646	6.3%	7,167	6.4%	846	2.4%
No Occupation *	517,329	64.3%	69,716	62.6%	23,693	67.8%
Total	804,416	100.0%	111,398	100.0%	34,921	100.0%

Source INS 1996 (Table 31) * includes homemakers, students, unemployed, retired persons and others no reporting an occupation.

(Alarcón 2000: 11)

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