Authors: Alok Aggarwal, Orna Berry*, Martin Kenney*, Stefanie Ann Lenway, and Valerie Taylor

Chapter 4: Corporate Strategies for Software Globalization

4.1 Introduction

The previous chapter examined the provision of software production and services for the global market from a national perspective. This chapter examines the same issue from the perspective of the firms involved. Our interest is in how firms use low-wage environments to undertake software work for their global operations. The interest here is not in the relocation of work from companies in a high-cost nation such as Germany or Japan to firms in another high-cost nation such as the United States or the United Kingdom even though this type of relocation is common. This chapter also omits work sent to Canada which does have somewhat lower wage rates than the United States and is the beneficiary of what some have termed near-shoring from the United States. Also excluded from this presentation are the operations of multinational or domestic firms that service the local economy of a low-wage nation. In most cases, these are relatively small operations except in the case of China whose domestic consumption of software is increasing rapidly.

This chapter does not debate the reasons firms offshore to nations with significantly lower wages; it simply accepts the fact that the wages are significantly lower. (An analysis of the various reasons firms send work offshore is presented in Chapter 1.) In addition to reducing costs, a company's decision to offshore is often dependent upon two dimensions. The first dimension involves its strategic decision regarding the kind of human capital that it would be able to access when it goes offshore. Put differently, it is an uncontroversial observation that if the nation where work is sent did not offer the proper skill set in its workers, firms would not relocate work to that environment. The second dimension is cost. It is uncontroversial to state that, given the right skill set,[1] a sufficiently low cost of labor, and work that can be done remotely, firms will find it attractive to locate to that environment even if there is no market in that locale.[2]

A decision to offshore software work may come about in a variety of ways and may take a variety of forms. The decision to offshore work has traditionally been made by the manager with responsibility for a project, including profit and loss responsibility. In cases where the contract involves strategic operations, critical company proprietary information, or very large budgets, for example, the decision is often made at a higher level in the organization, sometimes as high as the CIO, CFO, or CEO. In certain cases, the real reason for offshoring might be simply that competitors have already done it or the board of directors is demanding an offshoring initiative to save money. Rarely are the answers so simple, but there are numerous anecdotes about how an executive team in the United States will demand that the overseas operation achieve a certain headcount reduction by a clearly

[1] This chapter focuses on the availability of technical personnel as the attraction for offshoring. It is important to add that capable managers are also extremely important. As Parthasarathy (2005) points out, the executive management team is critical for the success of an offshore subsidiary.

[2] For example, Nike produces athletic shoes in a large number of nations where there are few, if any, customers for its shoes.

*O. Berry and M. Kenney took a leadership position in the writing of Chapter 4.

unrealistic date. The responsible executives will achieve the headcount goal regardless of the economic justification. In other words, rationales for action vary. Moreover, similar firms often have different recipes for using offshore resources. One basic decision a company that has decided to offshore must make is whether to undertake the work in its own offshore premises or outsource it.

This chapter considers five kinds of firms that are involved with software production or software services that are provided by one or more developing nations.[3]

1. Packaged software firms headquartered in developed nations that make and sell software as a product, for example, Adobe, Microsoft, and Oracle.
2. Software service vendors headquartered in developed nations. These companies may also provide packaged software, though not all of them do so. Examples include IBM, Accenture, and EDS.
3. Internal software operations in firms headquartered in developed nations that have software operations but are not part of the software industry. This encompasses all the companies producing non-IT goods and services. (The group is eclectic and enormous. The importance of this category is that software is now at the heart of value creation in nearly every firm. This is true of financial firms, such as Citibank and HSBC, and manufacturing firms, such as General Motors and Siemens. Each of these companies has a large staff writing software. To illustrate, it is estimated that by 2010, 40 percent of the value of an automobile will be in its electronics of which embedded software will become an increasingly important component. In 2002, it was estimated that the typical luxury automobile had 105 microprocessors. up from 70 in 1998 (Tsai 2004).)
4. Software-intensive, high-technology startups based in developed nations. (This category, though small in numbers of jobs, is important because these firms provide many of the jobs of the future. For these firms, frequently there is no job displacement at all. Rather it is the location of the future employment growth that is in question.)
5. Offshore IT service providers headquartered in developing nations that provide services for firms in the developed nations. As was discussed in Chapter 3, firms providing software services have emerged in a number of countries, though the largest by far are located in India.

This classification of firms is only heuristic. The global Fortune 1000 firms have complicated webs of relationships which might include newly built facilities, facilities they acquired, contractors from developed nations (e.g., IBM and Accenture), and contractors from developing nations (e.g., Infosys (India), I.T. United (China), and Softtek (Mexico). Some product firms outsource certain activities to contract R&D firms and even form joint ventures. There are also intermediate solutions such as the build-operate-transfer option, which lies in between building one's own facility and outsourcing. The tasks being

[3] We do not use the term captive in this chapter, even though it is used elsewhere in this report. In keeping with the literature on international business, we use the term subsidiary. It is more accurate and does not suffer from the bias reflected in the term captive. The categories are not divided on the basis of which firms are subsidiaries because #1, #2, #3, and #4 are all subsidiaries. Only the developing nation firms' operations are not subsidiaries. The categories developed in this chapter are for the purposes of understanding the impact of globalization on software professionals and thus they may not be useful for other purposes. For example, if one was merely interested in globalization, it might be that the packaged software firms should be combined with software services firms. Or, alternatively, software and software services might be combined. The separation of small start-ups from large software and software services firms is justified only because of the importance they have for the high-technology economy. For other purposes, this separation might not be proper.

undertaken vary widely and include activities such as low-level software support, product testing, product development, and research and development. The options and permutations are numerous, and the case studies in this section are merely overviews, thus they cannot do full justice to the breadth and scope of the software and software service operations of these firms.

For each category, the chapter gives a general discussion of the outsourcing issues faced by a specific kind of firm, followed by several case studies to illustrate the types of operations the firm carries out in developing nations and why those particular countries were chosen. These case studies are intended to be illustrative but not exhaustive. The particular cases were selected in order to provide a balance across sizes of companies and do not constitute a random selection upon which generalizations should be based.

4.2 Offshoring Firms

Large, Established, Developed-Nation Software Firms

Because of the somewhat different dynamics of the packaged software firms and the software services providers, we discuss them separately despite the fact that there is significant overlap between these two categories of firms. For example, Oracle and Cadence, which are usually considered packaged software providers, have large consulting arms to assist with the installation and operation of their software. IBM sold $15 billion in software in 2004, yet it is today more of a software services firm (with revenues of $46 billion in its global services unit). Accenture is a massive consulting firm that provides a variety of services, including software services. Thus the line between the two categories is somewhat difficult to draw, but it is nevertheless a worthwhile distinction because a pure packaged software firm such as Adobe or Microsoft hires programmers almost exclusively, while a firm such as SAP, IBM, or Oracle also hires consultants and analysts who are not necessarily working on products but are providing services.

Packaged Software Firms

The packaged software firms are what most people think of when they think of software. As a general rule, the largest and most successful packaged software firms in the world are headquartered in the United States (the notable exception is SAP in Germany). Successful packaged software firms can be very profitable because they only need to write an application a single time (although perhaps in several variations) and then reap their revenues from the sales of many copies. One reason for establishing offshore facilities is to localize the package for particular language groups. For example, Ireland has a large industry that specializes in localizing products from US software firms for the European markets (O'Riain 2004). Localization work characterizes a significant portion of the work by the R&D laboratories of packaged software firms in various nations. This type of work, though important for the global economy, is not of particular interest here.

There are, of course, other motivations for package software firms to locate in developing countries. The most frequently given reason is access to the talented labor force working in these lower-cost locations.[4] One important motivation behind offshoring for these package

4 The decision to move to a location for lower cost is a complex one. Lower cost includes not only wages but also the lower cost of benefits including health care. It also includes issues such as reduced concerns about discipline problems, substance abuse in the workplace, and governmental regulations concerning harassment, racial policies, etc. that are part of the protections commonly expected in the developed nations. This chapter does not place a judgement upon these policies. Quite naturally, in each nation, there are different regulations and standards that channel business activities and create various costs and benefits.

software producers is that their packages are constantly increasing in size and complexity, driving the cost of writing the software, testing, and debugging it ever higher. Whichever of these causes is the most significant, what is certain is that nearly all major packaged software firms are establishing offshore facilities in lower-cost environments, ranging from Eastern Europe and Russia to India and China. In the following case studies of Adobe and SAP, we examine this new geography of the software industry.

ADOBE

On account of its Acrobat program, Adobe has a wide global footprint. Its software has applications in digital imaging, design, and document technologies. The firm does its product development in the United States, Canada, Germany, Japan, and India. In India, Adobe has its largest physical office space outside of the United States, and the Indian operation is growing more rapidly than any other location.

In 1997, Adobe established a sales office in New Delhi, India, to market its products. In 1998, it established an R&D center in New Delhi (Noida) to utilize the low-cost R&D talent available in the country. By 2005, Adobe had 3,800 employees worldwide and approximately 500 (13 percent) were located in India. Adobe has invested $10 million in India but plans to increase that to $50 million over the next two years as the R&D center grows. Adobe was perhaps the first international software company to develop a full-fledged product in India, Page Maker 7 (Rediff 2005). The Indian center has filed 25 patents in the last four years, an indication of the sophistication of the work it is undertaking.

In 2005, Adobe acquired Macromedia, another Silicon Valley firm. Rather than consolidate Macromedia's Bangalore research operation into its own research operation in New Delhi, it is retaining and expanding the Bangalore facility which in April 2005 had 150 workers and was expected to grow to 250 by year-end 2005 (Verma 2005).

> Adobe's Indian R&D center works on Adobe Acrobat desktop applications and server-based products as well as products related to digital imaging and video. It develops components for almost the entire range of Adobe's product line. Products it has worked on include PageMaker, FrameMaker, Postscript, Photoshop Album Starter Edition, and the Acrobat Reader on Unix and alternate platforms.

From the managerial perspective, the Indian operation is becoming increasingly integrated into Adobe, as is evidenced by the fact that Naresh Gupta, who managed the Indian operation since its inception, is being relocated to the San Jose headquarters where he will join the executive management team (Rediff 2005).

There can be little doubt that India has become Adobe's low-cost development center. To date, Adobe has not established development centers in other low-cost countries. In 2002, there were articles in the press stating that Adobe might abandon sales in China because of concerns over software piracy; this was quickly denied by Adobe spokespersons, but the company has not moved to open a development center there (Sim 2002). There are indications that Adobe's Indian operations will continue to grow at least through 2007. If the last four years are any indication, the percentage of the company's employees located in India is likely to increase (given that the total global headcount is growing slowly).

SAP LABORATORIES

SAP, established in Walldorf, Germany, is one of the world's largest software vendors with operations throughout the world. SAP Laboratories is its R&D arm and has units in nine locations worldwide: Walldorf, Germany; Palo Alto, California, United States; Bangalore, India; Tokyo, Japan; Sophia Antipolis, France; Sofia, Bulgaria; Montreal, Canada; Tel Aviv, Israel; Shanghai, China; and (most recently, in 2005, with about 50 employees) Budapest, Hungary. The role of SAP Labs is to distribute global development efforts, enable SAP to access the world's best IT experts, support local and global markets, develop first-class

solutions, and drive innovation and competitive advantage for SAP, its customers, and partners.

Most of the laboratories are relatively small. For example, SAP's fourth largest lab worldwide is in Israel and it employs 500 people (it also has another, smaller R&D operation in Israel located within a firm that it acquired), while Sofia, Bulgaria employs only 200 programmers (SAP 2005). Each laboratory has its own specialties. The Shanghai laboratory has focused on localization work, but is slated to grow to 1,500 engineers by 2009 and is expected eventually to do more than just localization (People's Daily Online 2004). In China, SAP is cooperating with the Chinese Linux supplier Red Flag Software to develop corporate applications for Linux (Bishop 2005).

> The India SAP Laboratory was established in 1996 and has grown to be the largest lab outside Germany with 2,000 employees today, and employment expected to reach 3,000 by 2006. According to SAP AG executive board member Shai Agassi, "Indian developers had contributed substantially to the global success of the NetWeaver, the first appli-structure platform for enterprises across the verticals. The SAP Labs India team is one of our most important development teams for NetWeaver worldwide" (Indo-Asian News Service 2005). Even though the Indian operations for the global economy are categorized as research and development, many of the employees are in the services and consulting operations (Barlas 2004).
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> SAP has a global R&D and operations strategy with its various laboratories specializing in different areas of software development. The plans for employment growth for both India and China are aggressive. If current plans are realized, India and China will become even greater portions of SAP's total global headcount. Given their economic growth, these countries will also become sizable markets for SAP.

Conclusion

The large package software firms are building increasingly global operations. In many cases, their offshore operations are for localization work for the domestic market. However, particularly in the case of India, but also in Russia, the work is for their worldwide software packages. Locating in low-wage countries enables these firms to have access to lower-cost programmers, many of whom are comparable in skill levels to the workers in the developed nations. This is not the only benefit. Having operations in other time zones can speed up production by facilitating round-the-clock production. These opportunities are encouraging the rapid expansion of employment by major packaged software firms in India and other lower-cost nations.

Offshoring will have a complicated effect on the packaged software firms and developed nations. First, it might, and likely will, put employment pressure on software firms to decrease employment in the developed nations. Alternatively, the lower cost and faster production could allow the development of new features in old software and could contribute to the production of lower-priced software products, thereby increasing usage that could result in higher revenues and greater hiring. If the trends as described in these case studies continue for the packaged software firms, elements of both of these scenarios may occur.

Software Services Providers

Software service firms have been among the fastest growing firms in the IT sector, and in general they are far larger than the packaged software firms. This section confines discussion to the software service activities of these firms, but it is important to remember that firms coming from the software service side (such as IBM or Hewlett Packard) and from the service side (such as Accenture) are converging. In the case of IBM, this has been achieved both through hiring and its recent acquisition of the Indian service firm Daksh

(with its approximately 6,000 employees). For service providers, software and various other software-based services (i.e., anything done on a computer) may be converging. The software services firms are basically in what might be called a headcount business; they grow by hiring more workers. Thus they tend to have more employees than most of the packaged software firms.

IBM

Established in 1911, IBM has been the global leader in computer hardware and software products and services. In this section, we focus on three different IBM activities, namely, software products, software services, and research and development. It is important to understand IBM's scope and scale. In 2004, it had annual revenue of approximately $96 billion. Global headcount at the end of 2004 was expected to be more than 330,000 employees, excluding employees gained from acquisitions and strategic outsourcing contracts (IBM 2004). The company's geography of revenue growth is shifting dramatically. In Brazil, China, India, and Russia, IBM's annual revenue growth from 2003 to 2004 was 25 percent (though from a small base), while growth in the developed nations was on the order of 4 percent. Between 2002 and 2004, IBM increased its workforce in these four nations by 30 percent (Palmisano 2005).

As of 2005, IBM's Software Group had revenues of $15 billion and contributed one third of IBM's profit. In the Asia-Pacific region, this group employed 5,000 people, including sales and marketing. In India and China, IBM's software development laboratories employed 1,500 in each country (Smith 2005).[5] Richard Smith, the vice president of the Asia-Pacific region for IBM Software, stated that "the Chinese market is internally focused. In India, a lot of the software development activity is mixed - it is focused internally as well as on exports." As an example of the contributions of offshore centers, "a significant chunk of the code for its AIX version of the Unix operating system was developed in India." (Smith 2005)

> IBM is already well advanced in using global software development teams. Hayward (1997) described a global application development team it created that uses two shifts. The first one is a small group of 25 people in Seattle that would set a daily work specification for a particular application and assign it to offshore teams of 31 programmers each in India, China, Latvia, and Belarus (a former Soviet republic). The offshore team in each location would write code to those specifications during their daytime work hours. The code would then be sent back to Seattle where it would be reviewed and tested. In principle, this process should not only lower labor cost but also accelerate production.[6]

Software development at IBM is now a global process with the offshore low-cost nations growing rapidly to meet increasing demand. In the illustration by Hayward, the Seattle team was clearly the dominant team. However, given the increasing capabilities in developing nations, this hierarchical division of labor may no longer be as distinct in the future.

> IBM Global Services is the largest service provider in the world with revenues in excess of $46 billion and 175,000 employees spread across 160 nations as of 2004. The services it provides include application development, data storage, infrastructure management, networking, technical support, business consulting, and outsourcing

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[5] According to the IBM (2005) website, its China Software Development Laboratory employed 2,000 engineers.

[6] There continues to be debate regarding the success of such follow-the-sun strategies. Carmel (1999) argues that these global development projects are difficult to manage and often are unsuccessful. On time-shifting, see Carmel and Tjia (2005).

services. At the end of 2004, IBM employed 23,000 people in India, and an internal planning document stated that, by the end of 2005, this would increase to 38,000; the bulk of these employees were in Global Services. India now has more IBM employees than any nation except the United States (Hamm 2005).

IBM Global Services is active in providing services to domestic Indian and Chinese firms. For example, in March 2004, it signed a ten-year IT outsourcing deal for $700 million with Bharti Tele-Ventures Ltd., India's leading telecom company that included the transfer of Bharti's IT-related assets (including workers) to IBM. Not only did IBM acquire a new customer; it also purchased more skilled employees to expand its Indian operations. In 2004, IBM also purchased a leading Indian business process outsourcing firm, Daksh, which though not an IT firm, had 6,000 employees. This acquisition illustrates how the IT and non-IT services are blurring for the providers. For this reason, the discussion in this section incorporates an overview of IBM's entire range of offshoring service operations not only the software services.

India is becoming IBM's central delivery center for services. However, like all of the multinational service firms, IBM has also established facilities in a number of other lower-cost nations, including China. In China, IBM Global Services has three centers, including one opened in Dalian in 2005 with 600 workers. The Dalian center is expected to grow rapidly with its main purpose to serve the Asia Pacific market (ZDNet 2005). IBM Global Services also has a service center in Mexico.

In August 2005, IBM announced that it was establishing an IT services research center in Bangalore as an extension of its India Research Laboratory located in New Delhi with an initial staff of 10 researchers. According to P. Gopalakrishnan, the director of IBM's India Research Lab, it would look "at how technology can improve the capabilities and efficiency of delivery. This would include the whole spectrum of services from infrastructure management, application maintenance, BTO to BPO services." (CyberMedia News 2005). If this pattern continues, India may become the hub not only for doing offshore work but also for developing ways to automate service delivery using software.

India has clearly become a core location for IBM to provide offshore software services, and with the establishment of a research laboratory there to develop methodologies for the automation of service provision, it appears as though India may become IBM's global center of excellence for these functions. However, all of the multinational software service providers have a global footprint so that they can offer their customers a wide variety of services in many different languages. IBM is likely to continue expanding its workforce in software and other services in lower-wage nations, while growth in the developed nations is expected to be slow.

With eight laboratories around the world (three in the United States and one each in Switzerland, China, India, Israel, and Japan), IBM Research employs approximately 3,050 researchers. The company has steadily increased its R&D expenditures outside the United States, from 28% in 1993 to close to 60% in 2003. In the 1990s, IBM opened three new research labs in Austin (1995), China (1995), and India (1998). For the research laboratories, access to the most creative individuals is the greatest priority, but it is also true that the research centers in China and India have lower operational costs. The main point of these research centers is to attract local talent and to conduct some of the research on problems that are relevant to the local environment using global-class research.

There appear to be some differences in emphasis between the Chinese and Indian laboratories. The India Research Laboratory (IRL) has about 100 researchers and focuses on areas critical to expanding India's technology infrastructure so, while IRL researchers work on some local issues such as text mining and speech recognition for Indian languages,

they also work on more general research problems in the areas of bioinformatics, natural language processing, grid computing, and autonomic computing. The IBM China Research Laboratory (CRL) also has approximately 100 researchers. It has been working on Text-To-Speech systems and can now provide language support for Chinese, Taiwanese Chinese, Cantonese, Korean, Japanese, and French. It has also been working on IBM's Websphere Translation Server that provides machine translation between English and Chinese. In this sense, the research profile in the Chinese laboratory is more localized.

All IBM research laboratories actively cultivate relationships with local academic institutions. For example, the India research lab is located on the Indian Institute of Technology (IIT), Delhi, campus where it has access to a vast pool of talent. In Israel, IBM has built strong relationships with Haifa University and Technion. The R&D laboratories in India and China are still quite small; however, there appears to be a commitment to increase their size rapidly. Their missions are different: in the case of China, much of their work will continue to be on localization and the Chinese language, while the Indian laboratory is more likely to undertake work directly applicable to global business needs.

As the largest software/software services firm in the world in both revenue and headcount, IBM has the most sophisticated global footprint of any firm. Not only is it increasing its employment in developing nations in the more mundane and routine aspects of service delivery, it is also increasing employment in software product development and research and development. In the process, IBM's global posture is changing from being heavily weighted toward the developed nations to a more equal weighting globally.

SIEMENS BUSINESS SERVICES

Siemens Business Services (SBS) is a Siemens subsidiary that has a global practice in performing software and other outsourced work. It employs approximately 36,000 workers and derives substantial revenue from installing, customizing, and maintaining SAP software in businesses. Its 2004 revenues of 4.8 billion Euros were roughly divided between Germany (48 percent), the rest of Europe (39 percent), the United States (8 percent), and the rest of the world (5 percent) (Siemens Business Services 2004). SBS has been under significant cost pressure and has instituted layoffs to bring its costs under control (Blau 2005). SBS, like many other large service firms, has been globalizing its service delivery operations and, in the process, has downsized its domestic workforce. Of SBS's 36,100 global employees, only 15,100 are now located in Germany, and 4,000 are located in its rapidly growing Indian subsidiary.

SBS has developed a business strategy that uses a matrix of vertical industry knowledge and sets of general competencies to serve its customers. One aspect of the matrix is the industry expertise (vertical knowledge) or competency centers that are scattered in different countries, for example, the paper and pulp vertical is located in Finland (Hallez 2004). The other part of the matrix is the general activities, located in offshore sites in Canada, Ireland, and Turkey, and they handle stabilized processes. India has two roles: it functions as a back office operation for finance and accounting, and it does general software programming and service and applications development for SAP programs. SBS uses Russia for very labor-intensive and repetitive back office and software application development (Hallez 2004).

> Siemens also operates its Siemens Information System Laboratory (SISL) in Pune, India.[7] SISL has been involved in the development of an atmospheric disturbance model for Boeing flight simulators, engine and auto throttle control simulation, modeling and simulation of Weibul clutter, and GPS and INS error modeling for measurement simulation. It has also designed a control system for wind shear

[7] This section draws heavily upon Express Computer (2002).

control on the Boeing 767, a control system for the flight management system for the Boeing 747, and primary flight control system software as well as executing the development of Kalman filters for GPS and INS, integrated with GPS in feed-forward and feed-back configurations. SISL has been able to use Indian engineers to design sophisticated software for developing-nation customers.

SBS and other parts of Siemens are interesting because, in contrast to US firms, they place a strong emphasis on nearshoring facilities to Eastern Europe, Russia, and Turkey. Nevertheless, SBS India is the location with the largest non-German headcount, and it continues to grow rapidly.

Conclusions About Developed Nation Software Services Firms

Software services is in most respects a headcount and labor-cost business. The multinational software services firms have been experiencing increasing pressure on costs due to competition from developing-nation producers, particularly the Indian service giants (as described later in this chapter). This has forced the multinationals to secure lower-cost offshore labor. Both IBM and SBS are typical of other service firms such as EDS, ACS, and Accenture in that they operate globally, but only in the last five years have they found it necessary to build significant operations in developing nations to decrease their labor costs. Today, the larger firms such as IBM and Accenture are rapidly increasing their headcount in a number of developing nations, particularly India. At the same time, these firms are holding steady on their developed-nation headcount or gradually drawing it down. Given the ferocious competition in software services, there is little likelihood that prices will increase substantially. This suggests that, for the large multinationals, the offshoring of services will continue to increase in both absolute numbers and percentages of the global workforce.

Software Operations in Non-Software Firms

Today, virtually every firm in every industry sector is dependent on software. These needs range from routine software for personal computers and small servers to more complicated and customized software for complex and proprietary systems. All of these systems require customization, maintenance, or updating on a regular basis. IT systems have become an increasingly significant expenditure for businesses in developed countries, and firms are actively trying to control these costs. One way to lower them is to offshore the work to nations with lower labor costs.

It is difficult to even estimate the amount of software work that is offshored. Businesses do not provide this information in their reports. If work is transferred to an overseas subsidiary, this is an internal transfer and may remain unannounced and difficult to trace. It is more clear who does the work. If it is not an overseas subsidiary of the company, then it is likely to be one of two other kinds of firms. The service might be supplied by a large service firm from a developed nation such as IBM, CapGemini, SBS, or Accenture (as discussed in the previous section). Alternatively, the work might be outsourced to a firm from a developing nation such as TCS or Infosys (India), Luxoft (Russia), or Softtek (Mexico) (as discussed later). When a multinational company does the software work for its developed-nation facilities itself in one of its developing-nation locations, it is likely that this is not the only work done at that location. For example, as of April 2005, Dell Computers employed approximately 10,000 people in India in a variety of tasks, one of which was to produce software for Dell's internal operations. The overseas operations undertake many tasks, only one of which is software production. Having a mélange of activities can provide the scale needed to make establishing an overseas subsidiary more attractive since the software work may not have been of a sufficient scale to justify a subsidiary.

AGILENT TECHNOLOGIES INC. (ATI)[8]

In the technology sector, ATI is a good example of how a firm normally considered a hardware firm also undertakes considerable amounts of software-related work. ATI develops tools and technologies that sense, measure, interpret, and communicate data. The company operates in four business areas: test and measurement, automated test, semiconductor products, and life sciences and chemical analysis. ATI, which was separated from Hewlett Packard in 1999, established its first Indian offshoring operation in 2001. By 2005, it had offices in over thirty countries. Manufacturing was located in the United States, China, Germany, Japan, Malaysia, Singapore, Australia, and the United Kingdom. ATI Laboratories are located in California; Mizonokuchi, Japan; South Queensferry, Scotland; and Beijing, China.

> The dot-com crash had a severe effect on ATI. At the end of 2003, revenue was $6.1 billion, down from $9 billion in 2000,[9] and the number of employees had been pared from 40,000 in 2000 to 29,000 in 2003. In addition to eliminating headcount in the developed nations, ATI decided to establish an offshoring center in India. It already was outsourcing some software work to India. Although the company established a facility in India, it also decided to outsource maintenance and technical work (largely programming) to outside vendors, while retaining strategic control.
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> ATI introduced what it terms the *hybrid model*, where outsourcing service providers are required to operate out of its offices. This has proved to be advantageous because it mitigates the perceived security risk of having separate leased lines from non-ATI locations feeding into the VPN (virtual private network). It also allows ATI to induce competition among outsourcers and minimizes transition and operational costs, and it facilitates cross-functional communication between outsourcers and the firm.

Work transfer has not been simple. For example, in early 2002 Agilent established a communications software engineering group in India to automate some software test suites. When the project encountered release delays, there was friction between the US and Indian engineers. This was exacerbated by the dot-com crash which resulted in large US layoffs. These difficulties slowed the transfer of additional work, and, over a period of 18 months, the Indian team experienced a greater than 70 percent attrition rate. Despite these difficulties, the software test suite project has expanded to include the development of new modules and maintenance and defect correction for the entire product in India.

ATI India began with simple projects. For example, the first technical project was data entry related to engineering services. Other initial tasks assigned to India were similarly simple such as CAD support for engineering and quality assurance. Rather rapidly, however, the work became more sophisticated in both the technical and administrative areas. For example, only three years later, Indian engineers were designing application-specific integrated circuits. The Indian engineers took on more and more R&D work in wireless solution systems, OSS, and billing software for telecom service providers. Employment has grown at 20 percent per year, and total employment in India reached 1,250 in March 2005.

ATI's Indian operation is typical of those established by high-technology firms. It uses both offshore outsourcing and developing-nation subsidiaries. ATI has established operations and R&D laboratories in a number of nations, but India has become its largest and most important center. Though it does the more mundane software testing and

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[8] The material in this case study is taken from Dossani and Manwani (2005).

[9] These figures exclude the company's healthcare business, sold to Philips in 2001.

maintenance, the Indian operation also does more challenging work, for example, developing software that is embedded into ATI's core telecommunications and wireless test equipment products. ATI is an example of a process that is underway in many high-technology and other industrial firms whose core products are becoming more complicated and more software-intensive.

CITICORP

There is relatively little information available about offshoring of business or software services in financial firms. What is well known is that the large money-center banks, insurance firms, and financial firms are among the largest IT users in the world. To support their operations, they have large internal staffs and many software service vendors. One of the world leaders in using offshore facilities for global operations is Citicorp. It uses outsourcing both on-shore and offshore and was one of the first firms to establish a substantial software service subsidiary in India.[10]

> In 1984, Citibank established its Indian software subsidiary, Citibank Overseas Software Limited (COSL). COSL wrote software in India for Citibank's global operations and particularly its effort to computerize its worldwide operations (Arthreye 2003). By the time the global computerization was completed in 1989, COSL had developed a robust banking solution and had approximately 500 employees (Bitsaa nd). COSL used other domestic companies such as Silverline and Nucleus Software for coding, while it handled the development of the architectural components itself. In 1992, while COSL was being converted into a proprietary subsidiary, two executives convinced 150 employees to follow them to form Citicorp Information Technology Industries Limited (CITIL) which was funded by Citicorp's venture capital arm. CITIL did not sell to Citicorp but rather became a merchant software firm. In 2000, CITIL was renamed I-flex. As of 2005, I-flex had 5,500 employees worldwide and over 500 customers. In August 2005, Oracle purchased a 40 percent stake in I-flex for $900 million.

The remaining part of COSL continued to work for CitiGroup. Then in 2001, COSL was merged with another arm of Citibank, India (known as Global Support Unit (GSU)) to form OrbiTech Solutions Ltd. which developed a suite of banking products. In 2002, OrbiTech merged with Polaris Software Laboratories (Udani), and, by 2005, Polaris had approximately 6,000 employees, working mainly in the financial arena.

> Citicorp pioneered the use of India to lower its cost of software production. From Citibank's initial investment in India, it spun off CITIL and COSL and apparently today does not have large in-house software operations in India. In addition to the software operations, Citibank also had a large service operation that did everything from transaction processing to customer-focused call centers. In 1999, this was spun off as e-Serve and listed on the Bombay Stock Exchange. In 2004, Citi delisted e-Serve and brought it back in-house. As of 2005, e-Serve employed more than 10,000 workers in India. In terms of software services, Citibank was the financial industry's pioneer in using India and has been very important in training Indians in software development for the global market.
>
> Since Citicorp's pioneering establishment of a wholly-owned software services subsidiary in India, many other banks and financial institutions, including Deutsche Bank (Deutsche Software), Bank of America, Barclays, ING, and JP Morgan Chase, have established facilities in India to provide software services support for their

[10] For an excellent account of Citicorp's early Indian operations that was drawn upon heavily for this account, see Arthreye (2003).

global operations. Regardless of the ownership configuration, there is ample evidence that the relative amount of software service offshoring by financial institutions to India and possibly other locations will continue to grow. For example, insurance firms, which thus far have been more conservative than banks, have recently begun offshoring their IT operations.

Conclusion

It is difficult to be certain that offshoring will lead to a decline in the number of software service employees in the internal IT operations of firms outside the software industry, but it does seem possible. At ATI, there were lay-offs in the IT sector; however, the losses came in the context of massive lay-offs because of the dot-com crash. In the current recovery throughout the IT sector, existing firm headcount in the United States appears to be stagnant. In other sectors, there is very little data available. For example, in financial services, it is unknown whether the increasing headcount in developing nations such as India has had any impact on employment in the developed nations. The most that can be said is that non-IT firms are increasing their IT and engineering-related employment in developing nations, and this trend is underway across many different industries, including manufacturing firms such as Caterpillar and Nissan (Kenney and Dossani 2006).

Software-Intensive, High-technology Startups

For small startups, offshoring is often a difficult decision, although recently a number of firms in the United States have been established with the express purpose of leveraging lower-cost engineers offshore. For smaller firms, an offshore facility can be demanding on management time. This is especially true because in India hiring and retaining highly skilled individuals is difficult. In developing nations, particularly China (but also India), the protection of intellectual property, which is usually the only asset that a technology startup has, can be difficult. Despite these obstacles and risks, under pressure from their venture capital backers and due to the need to conserve funds, there is ample anecdotal information suggesting that small startups are establishing subsidiaries abroad, particularly in India, to lower the cost and speed software development.

There is a wide variety of models for utilizing offshore skills, and the following case studies are intended only as examples of what high technology startups are doing abroad. These case studies are by no means exhaustive, and whether they are even representative of current practice is uncertain. However, all of these cases indicate that engineers in lower-wage nations can be an important resource for entrepreneurial firms.

HELLOSOFT

Hellosoft is a private company established in Silicon Valley in 2000 and funded by Venrock Associates, Sofinnova Ventures, Acer Technology Ventures, and JumpStartup Venture. It is a growing provider of high-performance communications intellectual property for Internet telephony (VoIP) and wireless devices. The founders are Indian-Americans who had entrepreneurial experience in US startups, and the company was established with the express purpose of using low-cost Indian engineering talent to create the intellectual property that would be marketed by the US headquarters team. By plan, nearly all of Hellosoft's research and development is done in Hyderabad, India, where the company employs over 100 digital signal processing engineers (Hellosoft 2005). Marketing and sales operate out of the company's San Jose headquarters.

The Hyderabad center develops software in areas such as 3G wireless, 802.16 (a broadband technology), and EDGE (advanced data rates for GSM evolution). It has already had significant research success, and, in July 2005, Hellosoft raised another $16 million from venture capitalists which will be invested in marketing and further research and development.

Hellosoft's business plan is based on leveraging low-cost engineering talent, and the US headquarters operates largely as an interface with the market and customers. Nearly all the growth in technical employment will occur in India. Should Hellosoft be successful, the other beneficiaries will be venture capital firms that may garner significant capital gains and further relationships with other Silicon Valley service firms that assisted in the establishment of the firm.

NETSCALER[11]

Netscaler was founded in 1998 to redesign a specific piece of infrastructure, *the load balancer*, used in regulating Internet traffic flow. Netscaler aimed to reduce the set-up and tear-down time for each backend server connection. After Netscaler developed a product to demonstrate its more efficient way to handle Internet traffic, the company needed to add other features in order to attract customers who were unsure about moving from legacy products to new hardware that did not have industry backing. Netscaler understood that, as long as it had the ability to see inside a connection, it could offer other on-the-fly services. To create this ability, Netscaler hired an Indian firm known as NodeInfoTech to help develop an on-the-fly SSL encryption engine (NodeInfoTech 2005). With the aid of NodeInfoTech, Netscaler introduced an extension to its product, allowing the backend servers to send unencrypted data to the Netscaler product that encrypted it and forwarded it to the client over a secure connection.

> The success with NodeInfoTech convinced Netscaler to establish an Indian subsidiary, Netscaler India. To staff the new operation, Netscaler hired many of the developers from NodeInfoTech (Tillman and Blasgen 2005). In 2004, Netscaler India employed approximately 60 engineers to develop other features such as on-the-fly compression, virtual private networks (VPNs), and integrated cache, and it planned to double the number of Indian employees in 2005 (Hindu Businessline 2004). Netscaler had grown to 200 total employees by 2005 when it was purchased for $300 million by Citrix Systems who retained both the Silicon Valley and Indian operations.

The reason Netscaler formed an Indian subsidiary was to allow the company to increase the types of work it could do and develop tighter engineering integration (Tillman and Blasgen 2005). Netscaler's CEO, B.V. Jagadeesh, found that "[Indian] employees of similar skills are as efficient as they are here. The only handicap they have against their counterparts in the US is that they are not directly exposed to customers and customer challenges as India is not a destination market yet. When Indian companies start to buy our products, even that gap will be reduced pretty dramatically." (as quoted in Tillman and Blasgen 2005).

> Netscaler continues to both offshore to its subsidiary and outsource to vendors lower-level engineering support. With the aid of both the internal Indian and US engineering teams, Netscaler can provide all levels of support 24 hours a day. Since the low-level support is fully outsourced, it is hard to learn much more about its operation.
>
> At Netscaler, technical writing is done by in-house technical writers because it is necessary for the writers to work closely with the engineers to provide good documentation. Netscaler originally employed a single technical writer in the United States, but in 2003, as the staff in India grew, a technical writer was hired there. The company's main reason for dividing up the writing was that the writer had to

[11] This section draws heavily on a case study done by Joshua I. Tillman and Nicholas W. Blasgen (2005).

work with the engineers in order to correctly document the various product specifications. This allowed Netscaler to divide documentation writing between the two development sites, and the lower wages in India allowed a net reduction in the costs of producing documentation.

As a part of Citrix, it seems likely that Netscaler's future growth will be divided between the United States and India. The exact division is not yet clear, but cost pressures indicate that Indians will become an ever greater portion of the entire workforce.

KETERA[12]

Ketera is a venture capital-financed firm established in 2000 to help firms cut purchasing costs, streamline procurement processes, and achieve higher performance from suppliers without the expense and overhead of traditional software applications. The company provides its software as a service. To lower costs, Ketera made a strategic decision to use India for all functional areas in the company. In its first phase of offshoring in 2002 and 2003, it contracted three Indian firms to provide software development, client services, customer support, and IT support. In April 2004, the company decided to create a wholly-owned subsidiary in India and to transition from all outsource to mostly in-house offshore operation. In 2005, Ketera has a wholly-owned subsidiary in Bangalore employing about 75 people. The company still outsources a small portion of work to a legacy provider and contracts with new providers for special needs.

Why did Ketera set up a subsidiary? In 2004, the company was offshore outsourcing some software development of its core service product, customer support, IT support, and some other functions. However, the company decided that the engineers at the outsourcing firms were not as productive and quality-oriented as Ketera desired. This problem seemed to be due to compensation and attrition issues, and to engineers with no motivation to innovate. There were also difficulties in the United States, where there were too few US managers to handle the Indian engineers, resulting in significant communication gaps. These issues prompted Ketera to establish its Indian subsidiary. Their first Indian hire was a general manager who had experience working in both a Silicon Valley start-up and in India.

The software-related functions offshored internally were software development, operations IT, marketing, and customer support, and portions of product management. In 2005 there was discussion of whether to move certain back office functions and telemarketing to India. According to one report, the center was tapped to be the product engineering and development site for the company's entire suite of *spend management solutions* (Times News Network 2004).

Shah (2005) believes that as the Indian teams mature, they will be able to perform more sophisticated work and that other functions could be at least partly offshored. Maturation is occurring quickly, and Ketera is already creating a new technology prototype in Bangalore.

Conclusion

An increasing number of US technology startups are utilizing lower-cost workers in developing nations. These case studies indicate that, although startups may initially use outsourcing as a strategy, they often soon opt to establish a subsidiary for a variety of reasons, including concerns about intellectual property protection, workforce control, and management efficiency. According to Shah (2005), the minimum staff size for an offshored operation is about 10 people. If this is accurate, then it may be possible for many more small firms to establish subsidiaries in developing nations. Unfortunately, data on the scale and scope of offshoring by startups is unavailable.

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[12] The source for the discussion of Ketera is Shah (2005).

It is tempting to view this offshoring as an unmitigated loss of jobs for US workers. However, the reality is more complicated. Lowering the cost of undertaking a startup means that the barriers to entry are lowered, and this is likely to encourage greater entrepreneurship in the United States. The jobs created by this entrepreneurship should be counted against those lost to offshoring. For example, Rakesh Singh, Netscaler's General Manager of Asia Operations, was quoted as saying, "The cost savings through outsourcing have helped us become more competitive and experience rapid growth as a company. As a result, we have a lot more employees in the US today than we did when we set up the India operations" (Tillman and Blasgen 2005). So, correctly estimating the employment effect of offshoring in the case of startups is difficult when one takes into consideration jobs created as well as jobs lost.

Offshore IT Service Providers

The availability of capable software programmers in developing nations provided an opportunity for entrepreneurs and existing firms to hire them and offer their services on the global market. As discussed in Chapter 3, it was in India where this practice first began in a significant way. Initially, in the early 1980s, because telecommunications links were not so sophisticated, the Indian programmers were moved to the US customer's premises. This practice was profitable and gradually expanded and evolved as both customers and providers became more comfortable.[13] This level of comfort and the lower cost that could be offered through remote provision of services led to a shift wherein a major portion of the contract work was completed in the offshore offices of the contractor.

Indian firms were the pioneers in providing the offshore outsourcing of software production and services. As Dossani (2006) shows in his case study of India, but in a lesson that can be generalized to firms in other nations, the real explosion of outsourcing came during the dot-com boom of the late 1990s when there was great concern about a shortage of programmers. US firms, in particular, were concerned about the Y2K problem and sought low-cost assistance in preparing their IT systems. These developments created an environment where major corporations were willing to experiment with overseas vendors, and a sufficient number of these experiments were satisfactory. The result was that offshore vendors, particularly Indian firms, were validated as candidates for software projects. These projects also allowed offshore vendors, again particularly Indian firms, to grow rapidly in headcount, experience, and financial resources so that they could undertake ever larger and more complicated projects.

TATA CONSULTANCY SERVICES[14]

Tata Consultancy Services (TCS), the largest and oldest Indian software services provider, is an excellent example of the growth of Indian vendors (see Table1). TCS was established in 1968 to service the in-house data processing requirements of the Tata Group and, in 1969, offered electronic data processing (EDP) services to outside clients. In 1970, it became the exclusive Indian licensee to sell and maintain mainframe computers built by the American firm, Burroughs. In an effort to encourage the development of an Indian computer industry, the government enacted the Foreign Exchange Regulation Act of 1973, forbidding

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[13] Obviously, comfort is a subjective term that refers a person's faith that another person(s) will respond in certain predictable ways or that a set of agreed upon tasks will be discharged according to a set of expected criteria. Cultural, social, economic, legal and other practices and beliefs impact our comfort with a relationship. Comfort is increased through repeated successful interactions. As levels of trust increase due to positive interactions, the client becomes more willing to escalate its commitment.

[14] This case study draws heavily upon Dossani and Kenney (2004).

foreign firms from operating fully-owned subsidiaries. A number of foreign firms established joint ventures, and the Indian industry grew gradually. During this period, all of these firms including TCS, sold and maintained computers and software systems made overseas by their joint venture partner and offered electronic data processing services to local clients.

TCS's overseas experience in providing software-related services began in 1974 when TCS was asked by Burroughs to install systems at US-based clients. Burroughs was attracted by the combination of software engineering talent and the English language skills that it had found in the TCS workforce. This was the beginning of the body-shopping business which entailed the dispatch of Indian programmers to the sites of overseas clients. Typically, these assignments lasted for a few months at a time. During this period, Indian firms were basically labor recruiters.

Table 4-1 TCS Revenues, Number of Employees and Percent of Revenues Derived from Outside to India, 1991-2005

Year	Annual Revenues (in $million)	Total Employees	Revenue Derived from Abroad, %
1990	28.1	2,300	70.8
1991	45	2,600	75.6
1992	52.3	4,761	80
1993	55.9	6,450	80.7
1994	64	5,589	79.2
1995	90.1	6,071	80.5
1996	123.9	7,864	81.9
1997	169	9,929	84.2
1998	241.8	11,176	88.2
1999	357.8	12,770	89.8
2000	417.9	15,044	86.1
2001	616.2	17,607	91.3
2002	792.1	20,459	92.7
2003	1,000	24,168	
2004	1,560	30,100	
2005	2,240	45,700	

Source: Compilation by Rafiq Dossani and Martin Kenney

As the software industry changed and Burroughs continued to lose market share, TCS developed a growing competence in conversion work, that is, converting clients' existing Burroughs' systems to work on IBM hardware. To further its growth, in 1979, TCS opened an office in New York, the first overseas office by an Indian software firm. Entering the 1980s, TCS remained the largest Indian software services firm. In 1980, the Indian software

industry exports were $4 million, shared by 21 firms of which TCS and a sister firm, Tata Infotech, accounted for 63 percent. By 1984, the number of firms increased to 35 and export revenues reached $25.3 million.

When, in 1985, TI persuaded the government to supply it with scarce satellite bandwidth, Indian firms such as TCS also demanded telecommunications access. But it was the acceptance of UNIX as a programming standard in the 1980s that made offshore work for clients feasible. Again, TCS pioneered the remote project management model as it came to be called. In 1988, only 10% of TCS's work was done in India, but this rose to 37% in 2005. The industry shift to UNIX and workstations also benefited Indian firms since they could secure work converting installed applications into Unix-compatible programs. Again TCS was a leader, but soon other Indian competitors such as HCL, Infosys, Satyam, and Wipro emerged.

> The type of work TCS performed changed substantially in the 1990s. Conversion work tapered off once most corporations completed the adoption of the common Unix platform. This work was replaced with writing applications programs, a more profitable activity. TCS eagerly sought higher value-added work such as systems integration and focused considerable effort by the end of the decade into bidding for larger projects, that is, those that required from 20 to 150 people-years. The largest industry serviced by TCS continues to be financial services. Today, 72 percent of its revenues continue to be in application development and maintenance, while body shopping still provides over 60 percent of its revenue (Mahalingam 2005).

By 1991, TCS had grown to 2,300 employees and had revenues of $28 million. During this period, the company pioneered the establishment of India-based, client-specific offshore development centers (ODCs) which enabled firms such as TCS to undertake large, turnkey projects that combined Indian-based and overseas staff (the latter often supplying critical industry expertise otherwise unavailable in India). Y2K was a bonanza for TCS and the other Indian firms. At the end of the fiscal year 2000, TCS had 15,000 employees and revenues of $428 million. To accelerate its growth, in 2001, TCS acquired CMC, an Indian government-owned firm with 2,500 employees. Rather than slow down after 2000, the rapid improvement in telecommunications capabilities combined with serious pressure on the bottom lines of firms in the developing nations expanded the opportunities for TCS which grew to over 20,000 employees in 2003. TCS began offering new services such as real time database management, quality assurance, and web services.

By 2005, TCS had grown to over 45,000 employees and was continuing to grow at approximately 25 percent per year. As TCS continues its efforts to overtake firms such as IBM and Accenture, it is establishing a global network of operations facilities, not only marketing, customer liaison, or concentrations of dispatched personnel. In 2005, the company had development centers in Europe, Latin America, and Japan, although most of its employees continued to be located in India.

TCS and its major Indian competitors have had a significant cost advantage over their developed-nation rivals. Until very recently, however, they did not have either scale or a sufficiently global footprint to compete against the IBMs and Accentures. This is changing as the Indian firms experience annual growth rates in excess of 25 percent and have significantly better profitability than their US-based competitors (Hira and Hira 2005). The marketplace dynamic may change as the rivals from developed nations increase the percentage of their workforce located in lower-cost environments. Regardless of the outcome, firms such as TCS have successfully forced firms from developed nations to dramatically increase the portion of their global workforce located in developing nations, and thereby have shifted the geography of software service provision.

SOFTTEK

Indian firms, due to their size and sophistication, have rightfully received the bulk of the attention from those considering offshoring. However, there are firms in other developing nations that are also providing software services to developed nations. One noteworthy example is Softtek, a privately-owned Mexican firm based in Monterrey with development centers in Monterrey, Aguascalientes, and Mexico City, two others in Brazil, and one in Spain. Like the large Indian firms, Softtek operates certified Six Sigma programs and has reached a CMM 5 rating (Softtek 2005b). The company was established in 1982 to employ graduates of Mexico's best technical university, the Tecnologico de Monterrey, to provide IT consulting services to Mexican firms and later to firms in other parts of Latin America. It entered the US market in 1997 with the business strategy of providing a near-shore alternative. In recent years, Softtek has grown from 2,000 employees in 2000 to approximately 3,400 in 2005 (Lopez 2005; Softtek 2005a). With about $135 million in revenue, it is growing at 30 percent per year, although it still is only about one-tenth the size of providers in the large developed nations or India.

Softtek's value proposition is based on the fact that its software development centers are near-shore, and thus operate synchronically with its customers. Because its employees are more highly paid than those in the Asian developing nations, Softtek had to develop a somewhat different model than Indian vendors.[15] Their business strategy is not to displace offshore vendors, but rather to capture a portion of the total offshore spending. What Mexico offers is an opportunity to diversify risk which is important for highly interactive processes that could benefit from running at the same time. To further their advantage, Softtek even adopted the US vacation calendar for their US-focused operations. In addition, the United States and Mexico share similar cultural and commercial environments. Proximity facilitates the logistics of arranging face-to-face meetings. This limits the need for Softtek engineers to be stationed onsite, thus lowering costs and helping to make Softtek competitive with the lower-cost Indian or Chinese competitors (Lopez 2005). Travel is simplified because, when it is necessary to visit, as a Mexican firm, employees can use NAFTA visas. In general, Softtek works on fixed-price contracts, not the time-and-materials contracting that is typical of body-shopping.

Despite the opportunities, Mexico's growth in the IT area has been limited. Softtek is the largest independent Mexican software services offshoring firm serving the global market, although there are other smaller firms. Only recently has the Mexican government recognized the opportunity in software services offshoring and formed an organization (Prosoft) to improve Mexico's position by funding training projects. Even five years ago, few Mexican universities outside of the Technologico de Monterrey were providing well-trained graduates for this industry. This has changed as Mexican universities and students have recognized the career potential in IT. To improve the preparation of Mexican IT workers, Softtek and the other Mexican IT vendors are interacting with a number of Mexican universities to improve IT training (Lopez 2005).

Softtek's experience demonstrates that it is not only the Indian majors that are finding opportunities to provide software services to developed nations. Yet, its status as one of the largest Latin American software services firms indicates the lead the Indian firms have built. This case study also shows that high-level CMM qualification is not confined to Indian firms. Most importantly, it demonstrates the entrepreneurial opportunities available in any developing nation that has a reservoir of technically trained personnel.

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[15] An IT graduate from a Mexican university starts at between $15,000-18,000 per year as opposed to an Indian graduate that starts at $6,000 per year.

Conclusion

Software services firms from a number of the developing nations are players in the global economy. They have not yet become significant players in the packaged software industry, and given the propensity for the large international players to buy promising software startups wherever they may be located, it could be difficult for packaged software firms from developing nations to capture significant global market share. The large Indian firms, such as TCS, Infosys, Wipro, Satyam, and HCL, are at this time the global leaders. However, in China, Mexico, and Russia, there are smaller but also rapidly growing software service firms that employ between 1,000 and 5,000 workers. Currently, the firms from other nations are not large enough to compete with either the developed-nation multinationals or the large Indian firms. These medium-sized firms in other geographies can reduce country risk for customers, although it is also possible that some of them will be acquired. The larger multinationals and Indian firms are also establishing facilities in other geographies, particularly Eastern Europe and, more recently, Mexico.

4.3 Overall Conclusion

The variety of case studies in this chapter illustrates the breadth of the phenomenon of software and software services offshoring. The reasons for offshoring vary by firm and particular recipient nation, and often decisions are made for a complicated amalgam of reasons. In the case of the elite R&D laboratories, the desire to tap into the most talented individuals, wherever they might be in the world, is clearly the foremost motivation. Particularly in the case of China, but also increasingly India, the growing local markets are attractive and a reason for siting software facilities locally. Labor costs are a primary motivation for much of the offshoring being undertaken by the firms examined.

There can be little doubt that offshoring is still small in comparison to how large it is likely to become. The case studies in these chapters are firms that can be considered early adopters; the followers have only recently begun to investigate the opportunities for offshoring. As the case of ATI showed, particularly in the subsidiaries of Western firms, it is likely that more sophisticated work will be relocated during the coming decade. Firms are becoming increasingly willing to entrust core activities to their offshore subsidiaries.

Whereas some believed that a certain size was necessary prior to offshoring, the case studies of startups showed that this is not true. US startups are establishing offshore subsidiaries even before their headcount reaches 50 people, and for some firms, their entire business plan is built on the premise of using lower-cost offshore IT professionals. This suggests that employment growth in the United States might be constrained. However, the availability of low-cost technical talent also can lower the barrier to entry for entrepreneurship, and this may encourage greater entrepreneurship and, as a result, wealth and job creation in the United States.

Every firm in this admittedly small sample is pursuing a global strategy for R&D and IT provisioning. It is entirely possible that this will become the norm for nearly every firm in the developed nations. The labor-cost arbitrage factor is and will remain significant and all executives, in large and small firms, are considering the most economical footprint for their IT operations.

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