

The Evolving Indian Offshore Services Environment: Greater Breadth, Depth, and Scope

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Introduction

India's emergence as an increasingly significant economic actor on the world scene is unique because its impact is based on the export of non-physical goods, such as software and an array of other activities that are somewhat imprecisely grouped in the catch-all category called "services." Unusually for those used to equating the export of services with the export of highly trained consultants and investment bankers, India's services exports are almost entirely in the form of datastreams – be they the voices of telephone operators answering customers' queries, data from a form entered on a computer, sophisticated integrated circuit designs or software. Robert Reich (1991) is identified with the term "symbolic analysis" and its deepening in the course of the progress of advanced economies; this work is related to the manipulation of symbols especially those on a computer screen and this is the true character of Indian service exports.

John Seely Brown and Paul Duguid (2000) emphasize the danger of lifting these symbols out of their context and physical medium, but this digitization is increasingly the norm. When this has happened, the symbols can be manipulated by persons anywhere in the world where there are individuals capable of understanding these digital representations. Stated differently, India's value-added contribution to the global economy is almost entirely through the export medium of telecommunications and the shipment of humans to do computer-mediated work on-site.

India is, therefore, important: it is the harbinger of a world within which developed nations will no longer have an automatic lock on services that have, at least, some components that are dependent upon information and communication technologies (borrowing from the NASSCOM term, but extending it we term these ICT-enabled).

The growth of the Indian service provision to the global economy has been exponential, compounding in terms of revenue at nearly 30 percent per annum since 2000 (Nasscom, 2004, p.26, 63; Nasscom, 2006, p. 47). This expansion has been remarkable because it has occurred very rapidly along three vectors. The first is in the workforce, which has grown from roughly 232,000 in 2000 to 922,000 in 2005 – a compounded annual growth rate of 32% (Nasscom, 2006, p.145). The second vector is a movement up the value ladder in each activity area, and this, in many ways, is more significant than simple quantitative growth. So, for example, where an Indian firm may have begun by entering data from a scanned medical insurance billing record, it then moved to the higher value-added activities such as coding the various procedures for reimbursement – an activity that requires trained coders and, for the most sophisticated bills, even a medical doctor. In addition, the Indian firm may offer billing error and fraud detection and may even build sophisticated data-mining software tools to assist in this process. The third vector is the expansion of service offerings fulfilled from India to new business areas. For example, TCS has established an airplane interior development laboratory where it will design airplane interiors for its customers.

This paper explores the implications of each of these three vectors, but at the outset we believe that they suggest a radical thought. Namely, potentially any ICT-enabled work could conceivably

be done in India or any other location having the proper talent and infrastructure. Of course, the richness and depth of the talent pool are critical for the establishment of a dynamic ecosystem, rather than a disconnected branch operation. This suggests a profound fluidization of the location of work. Note, however, that we will qualify our definitions of talent substantially beyond most of the current discussion which focuses on engineering capability (ACM 2006; National Academies Press 2006).

This is a radical concept because most current thinking places India at the low-end of the value-chain, or, perhaps, in the mid-range in software programming (MGI 2006; Dossani and Kenney 2007a). Even in 2005, the most incisive analyses suggested a division of labor within the context of high growth rates: the advanced countries would do the more sophisticated work of understanding customer requirements and responding with the conceptualization of the elite technologies, products and services. The developing countries would focus on 'fulfillment', i.e., providing the labor-intensive pieces of the supply-chain such as programming, operating the call-centers, entering data and the like. What is now apparently emerging is quite different and raises the challenge to the advanced countries to a completely different level.

Figures 1, 2, 3 and 4 stylistically depict the rapid evolution of Indian services ecosystem in graphical form. What these figures show is that the Indian ecosystem has evolved from a quite simple one in 1995 to a sophisticated complex one in 2006. Truthfully, this ecosystem has evolved on Internet time and it is the Internet, i.e., the evolution of ICT, that made India's vertiginous growth possible.

Figures 1, 2, 3 and 4 about here

In 1995, the Indian firms were clustered in the IT services area, and the majority of their workers were being body-shopped to the U.S. and Europe (Heeks 1996; D'Costa 2003). A few MNCs such as British Air were doing back office travel work, CitiCorp was doing software development and some back office work, and General Electric Capital was doing various back office tasks. Further, TI and HP had small technical operations in Bangalore. By 2000 the Indian IT services industry was growing rapidly particularly on the basis of Y2K work. Also, MNCs such as IBM, Oracle, and SAP were establishing their Indian operations. The call centers had begun to grow, though BPO was still limited. The turn to India was, in many respects, driven by the shortage of programmers in the U.S. that was created by the Dot.com Bubble and the Y2K panic. The positive experience with Indian programmers combined with the recession in the aftermath of the collapse of the Dot.com Bubble to convince U.S. corporate executives of the savings with good quality that could be derived from offshoring (Dossani and Kenney 2007b). The initial surge of investment after 2000 was by MNCs that already had a presence in India, and by Indian entrepreneurs that understood how the Internet and a massive expansion of the global telecommunications systems created an opportunity to provide business services, particularly call center services to overseas customers. What is most remarkable is how quickly services offshoring spread from the pioneering firms, most of which had prior experience serving the Indian market, to the general population of firms around the world whose only experience might have been with Indian IT services vendors. The expansion in this initial phase was largely, though not completely, confined to labor cost arbitrage that used Indian college graduates to do standardized work. The early exceptions to this general emphasis on low-level work did occur at

about this time as firms like General Electric Capital India Services (GECIS) were doing some sophisticated actuarial work employing Indian Ph.D.s, while TI and Motorola's operations were also undertaking some higher-end design work. This is not surprising because most of the MNC operations were at that time in the startup phase, but the ambitions on the part of U.S. executives for India were enormous as exemplified by statements from such corporate leaders as Jack Welch, Michael Dell, and Carly Fiorina that touted the advantages of low-cost, well-trained, and extremely highly motivated young Indian college graduates.

The experiences of the firms that increased their involvement after 2000 were, overall, successful. In the initial period, their intent was to take advantage of low labor cost in a thriving global economy. That they would find the talent to do more than low-end work was not envisaged. For example, SAP in 2000 was struggling to quickly deliver its new CRM application. It found, unexpectedly, that it was able to do 40% of the work in India and that the work done spanned the value-chain. In the words of its general manager for Indian operations, George Kniese, "We then discovered that India had a winning combination of cost, domain knowledge, scale, productivity and creativity."

The period since 2004 has seen a rapid evolution in the quality of work (See Figures 3 & 4). Apart from the discovery that experience with a local environment brings, there was the realization that it was possible to do work requiring high levels of global coordination in India (though not always managed from India). This required experimentation with operating models, as we discuss later, but it also required that the talent to coordinate be present in India. This was found in the returning expatriates, who played a key role.

Role of NRIs

An important added dimension to the Indian ecosystem was introduced after 2000 by the increasing availability of non-resident Indians, i.e., Indians that had emigrated and now lived abroad, deciding to work in India. Although their number is unavailable and is probably not very large as a percentage of the work force, their impact has been significant.

The first discussions of Non-Resident Indians, whether seen positively or negatively, was couched in terms of a "brain drain" (Sen, 1973; Bhagwati, 1984). Even in the late 1990s, scholars evaluating the movement of highly qualified personnel from India to foreign nations saw this as a net loss (Krishna and Khadria, 1997). However, during the Dot.com Bubble at the end of the 1990s, certain scholars revised the assessment of the Brain Drain, which many had viewed as a negative, as a Brain Gain, i.e., positive, on the basis of their belief that these overseas nationals reinvested and transferred skills learned abroad to their home nations. The primary academic expositor of this revisionist position was AnnaLee Saxenian (2006) who attributes Taiwan's economic success to the relationships built between Taiwan and Silicon Valley).¹ In this section, we put the NRI phenomenon into perspective recognizing its

¹ The historical evidence for Saxenian's position is dubious. For example, in the case of Taiwan the role of Japan in providing technical assistance in the earliest period of Taiwanese take-off is not mentioned. The linkage with Silicon Valley comes in the mid to late 1980s when the PC emerges, and Taiwan is able to use the capabilities it learned in consumer electronics to provide low-end assembly to U.S. PC firms. Since she focuses only on Taiwan, and she does not consider the counterexample Korea, which develops at roughly the same pace, but has very few nationals in

significance particularly recently without giving it a deus ex machina role that Saxenian attributes to it.

The leading Indian software services firms, such as TCS, Infosys, Wipro, HCL, and Satyam, were not established by NRIs, though some of the founders had received degrees in the U.S. (India was, of course, not unique in having sent many students to the U.S. Pakistan and Bangladesh also sent many to the U.S. for higher education) A few of the early MNCs, such as Hewlett Packard, had NRIs in prominent positions within the firm, but the population was generally too small to wield significant influence. This suggests that in the early phase the NRIs had only a limited effect on business (they were however becoming important as examples of what Indians could do abroad when freed from the fetters of the Indian bureaucracy).

Further, there is no evidence that the employees of these Indian service vendors that were dispatched abroad returned home to establish startups. Most stayed in the developed countries, probably for economic reasons, or returned home and continued to work for the same employers that had dispatched them. As Siwek and Furchgott-Roth (1993) noted, “For 1986-7, 58.5% of IIT graduates in computer science and engineering migrated. . . [The result of this they believed would be] that certain programming activities will continue to leave the U.S. to some extent [of course, at that time the vast majority of Indian programmers were dispatched abroad and worked on the customer’s premises]. These activities are more likely to emphasize maintenance rather than basic software design and development.”

The true significance of the NRIs is recent, and can be roughly dated from the collapse of the Internet Bubble, but even more important from the GROWTH of opportunities in India.² From our interviews with managers, which very often were NRIs, we feel that the importance of the NRIs is their familiarity with U.S. and particularly, Silicon Valley, management styles, which they are importing into what previously was the hierarchical Indian management style. As Ravi Krishna, the founder of a Bangalore startup, Sonoa Networks, notes, “The returning NRIs brought with them the sense of execution ethics and accountability that prevails in the US marketplace.” In our interviews with MNC managers and startup executives, it was this execution ethic and deep understanding of how to organize high performance product-oriented firms that has turbocharged the movement to higher-end work. Within the MNCs and also the Indian startups intent upon selling into the global market, NRI managers are particularly important because they have developed global-class management skills while managing abroad. The ability to attract them to India by paying either U.S. salaries or domestic Indian salaries (approximately 60% of U.S. salaries for high-level managers) means that seasoned global-class managers are available to manage MNC operations and startups aiming to penetrate the global market.

Silicon Valley to draw upon. Methodologically, by relying upon interviews with individuals that built the ties between Silicon Valley and Taiwan, her sample was biased to the result she desired.

² The important counterfactual to consider is what if there had been very few opportunities in India because there was little offshoring growth. Would these professionals have returned home and could they have found gainful employment. So, in our thinking, it was the boom in opportunities that attracted them and thus was the critical factor, not simply the U.S. downturn. There have been previous economic downturns such as the one in 1990-1993 that had NO discernable impact on the return of Indians to India and an upwelling of economic growth.

The availability of global-class managerial talent to lead these new operations means that they are not retarded because of a need to train domestic talent for a global role.³ In our Indian interviews, we met a number of managers who had career paths that included U.S. education and successful careers at U.S. high technology firms and startups. They either were returning to India permanently or, at a minimum, returning for extended periods. Their role can be conceptualized as roughly analogous to the pre World War Two German army, which during peacetime consisted almost entirely of highly trained and motivated officers and non-commissioned officers. When the raw recruits were called up, it was battle-tested veteran leaders that effectively guided them. The returned NRIs appear to be performing exactly this function in India. Over time some of these raw recruits will also become experienced leaders creating a pool of home-grown leaders to work alongside the NRIs.

The role of internationally experienced Indian professional managers has played an important role as a cadre that can effectively manage the interface between the Indian subsidiary and the MNC headquarters. Their role especially in jumpstarting the growth of the MNC and particularly Silicon Valley subsidiaries in the last five years cannot be overestimated as they form crucial liaison links with the headquarters. They were and are vital in convincing headquarters that their Indian subsidiaries can undertake higher value-added projects and that full responsibility for certain projects can be invested in the Indian subsidiary. They perform a similar role as key persons in the binational startups discussed below. As Venkat Panchapakesan, manager of Yahoo India's operations noted, "Prior to 2003, we focused on product extension work. But, around 2002 and 2003, we noticed that we could recruit engineers returning to India after significant work experience in the US. Their availability allowed us to shift from product extension work to taking on components of a project in its entirety."

Entrepreneurship

Judging a nation's entrepreneurial propensities or activities is difficult as can be seen by the 2004 Global Entrepreneurship Monitor rankings that rated Poland above Israel and Canada far above Finland. Peru, Uganda, Ecuador, and Jordan were the global leaders! India and China, the two newest economic giants, were not even measured. For this reason, we do not enter the debate about whether Indians are entrepreneurial (an odd debate anyway, when one considers that the U.S. has hotbeds of entrepreneurship, and there are many other locations where there appears to be minimal entrepreneurship). This section has more modest goals. First, we describe the dimensions of Indian technology-based entrepreneurship and assess its potential to grow. Second, we summarize the status of the entrepreneurial ecosystem with particular attention to the VC industry.

In Figure Five we provide a schematic that divides the startup operations in India by whether they are meant to serve the domestic or foreign market and by the location of the startups headquarters. The number of startups in each of the three quadrants is growing dramatically. The Quadrant One startups are the ones that were established in U.S. particularly Silicon Valley, but for various reasons, especially cost, establish an Indian subsidiary. The exact division of labor

³ There is anecdotal evidence that in China there is a relative dearth of global-class management talent, and this may be retarding the development of MNC operations, and possibly, startups aiming at the global market rather than domestic markets.

between Silicon Valley varies by firm. In some cases, the division is between lower and higher value-added work, but this makes it difficult to retain the best Indian engineers because they share the universal engineer's motivation to be involved in interesting cutting-edge products. So one of the key issues faced by these firms is how to partition the projects so as to motivate the Indian engineers or, alternatively, which projects to assign to the Indian team. Each of these requires a leap of faith by the U.S. headquarters staff.

Figure Five about here

The traditional belief is that the Indian subsidiary does lower value-added work than is done in Silicon Valley. From one perspective, this is correct in the sense that the top executives still are concentrated in the U.S. However, our interviews suggest that this is too simplistic. For example, Insilica's Silicon Valley headquarters has approximately 15 employees including the C-level executives (all of whom are NRIs), marketing, sales, and operations, the functional heads of imaging and the ASIC SOC groups, and a couple of engineers to support program management for customers. The rest of the firm is located abroad. The Quadrant One firms are part of a growing tendency for Silicon Valley startups to establish an Indian subsidiary very early in their life-cycle or even to have an Indian operation as an integral part of their business plan.

Quadrant Two startups, from their inception, have essentially all of their engineering and product development in India. Admittedly, the line between Quadrants One and Two firms can blur. For example, the business model for Arada Systems, a startup aiming to provide software solutions around IEEE 802.11 Wifi solutions to the telecommunications, industrial, outdoor and automotive markets, planned to have all of the development in India and only a thin staff of three persons in the U.S., though this did expand rapidly to nine persons. The plan was to continue increasing the size of the Indian team, which would do all the development. Another firm, TutorVista, which was conceived and launched in India, offers online tutoring to students in developing nations using Indian and Filipino teachers. The firm's venture capital came from U.S. firms such as Westbridge Capital (now Sequoia Capital). Tutorvista's operations are entirely located in India, but its market is abroad. One of the most successful of the firms entirely based in India but supplying the world market is I-Flex, which was first an in-house software subsidiary of Citicorp, but was later spunout to be an independent firm. I-flex produces banking software programs that are sold globally. From this brief discussion, it is clear that Quadrant Two is a polyglot category including firms that were conceived abroad, but have their entire operation in India, and firms conceived in India with their entire operation in India, except usually a few marketing executives, abroad. It was our distinct impression that the number of Quadrant Two firms is expanding rapidly.

In Quadrant 4, there are two types of firms. One group, 4a, are the increasing number of startups whose strategy has been to use growing Indian markets to establish their products prior to advancing into global markets. One apparently successful example of this is Tejas Networks, which designs telecommunications optical switches (actual manufacturing is handled by a contract assembler). Established in May 2000 in Bangalore, it has grown to 300 employees with 85 percent of its revenue coming from India (the expectation is to grow by 100 employees next year and to double revenues). All of the founders were in India and the firm does not yet have a sales office in the U.S. However, Tejas plans to dramatically grow its foreign sales in the next

few years, and make a stock offering on the Indian market. The rapid growth in the Indian telecommunications and particularly wireless market offers Indian firms an opportunity to reach significant scale prior to entering the international market, so it is possible that the Tejas strategy of using the burgeoning Indian market might be repeated by other firms.

In Quadrant 4b there are the startups for the Indian market. This is roughly analogous to the many successful Chinese startups that have listed on the U.S. and other markets. There are a variety of business models here. A number of these business models are simple translations from the U.S. such as travel, auction, job listing, etc. sites. While not very original, these can be good investments for venture capitalists. There are also startups serving the burgeoning local cell phone market through offering applications such as ring tone downloads. As was the case with China, the rapid increase in wealth is creating a massive relatively underserved market with enormous pent-up demand for services. This is also creating a large underserved market that does not speak English, or, in certain areas, even Hindi and other local languages. Here there are opportunities for voice recognition/translation software. For local and international venture capitalists, this offers numerous investment opportunities that require small capital investments.

India has some significant advantages for startups, and the most important of these is labor cost (though as mentioned earlier in certain sectors the burgeoning domestic market is very important). In the case of Tejas Networks, our respondent suggested that building an equivalent telecommunications equipment firm in Silicon Valley would have cost between \$100-150 million, whereas Tejas, which is now on the verge of cashflow positive, will have cost between \$30-50 million – a dramatic difference that permits greater risk-taking by venture capitalists. In another case, which is a software/ASIC design firm, the cost comparison for their firm, which has 50 engineers in India, was an average salary of \$180,000 per year in Silicon Valley or a burn rate of \$9 million per year, versus an average cost of \$40,000 per year in Bangalore or a burn rate of \$2 million per year. All of these firms draw upon returning Indian engineering managers because of their experience and knowledge of how the industry operates. When comparing the Indian engineers versus Silicon Valley engineers, many believed there were differences with the Silicon Valley team being superior, but not sufficiently better to justify the cost differential. The point being that there were significant cost advantages to operating in India, but this is PREDICATED upon there being a skilled and capable work force in India that can be supplemented with trained, “battle-hardened” managers with deep experience and understanding of the U.S. and, in the case of technology fields, the Silicon Valley management system.

One assumption regarding the startups aiming at the global market is that their operations are divided between India and the U.S., usually Silicon Valley. However, in our small, though admittedly biased toward elite firms, sample we found two firms Telsima and Insilica that had operations in Europe, also. For example, Telsima, a startup established in 2004 to develop WiMAX based broadband wireless access software for data-intensive and mobility applications, has its main development center in Bangalore, but also employs 35 persons in Trzin-Ljubljana, Slovenia where they purchased a firm with personnel that had sophisticated radio frequency experience. In another case, Insilica purchased a Flextronics semiconductor design group located in Slovenia that does system on a chip development and is now integrated with the Silicon Valley and Indian operations. Another similar example was Athena Semiconductors, which was recently purchased by Broadcom. Athena was headquartered in Fremont, California with a 40-

engineer design team in Bangalore, India and another 23 engineers in Athens, Greece. In these firms, the Silicon Valley headquarters continues to be responsible for overall coordination; however, the Indian operations also interact directly with the European branches. The point here is that there are cases in which the Indian operations are key links in a global knowledge network. Of course, working in such environments leads to important learning on the part of the Indian managers.

The role of US venture capital in the startups is significant. While the interaction between the venture capitalist overseas and the Indian teams is not as frequent as would happen were they in the same location – typical interactions are limited to quarterly board meetings, the venture capitalists have been able to help find markets, key consultants and acquisitions in other countries. In this, they go far beyond the role played by domestic venture capital firms, whose role for the global-class startups continues to be relatively minor.

In conclusion, when considering the three Quadrants together, we can make the following tentative observations: First, understanding the entrepreneurial environment is difficult because of its complexity, but many new firms with a wide variety of missions are being formed. Second, an ecosystem for supporting entrepreneurship is being built. Third, the availability of returning NRIs from high-level management positions, often, in U.S. startups, is providing Indian startups and the Indian subsidiaries of U.S. startups seasoned professional managers. Fourth, it is possible to build near global-class or global-class startups in India.⁴ Fifth, there is every reason to expect a continuing and accelerating pace of startup formation, and it is possible that in the next two years there will be some attractive exits either through public listing or M&A. Should these exits occur, they will have a powerful positive affect on the pace of startup formation. The ecosystem for entrepreneurial startups is rapidly maturing and this should increase the rate of startup formation and the willingness of venture capitalists to invest.

The Indian Services Firms

The changes in the work in the Indian service firms typifies the evolution of the entire Indian services ecosystem. The evolution of the established firms has been stunning in terms of size, breadth of offerings, and depth in verticals. The other change is in the number of new firms that are entering the market with specific skills in high value-added activities (the discussion of these new firms is connected to the entrepreneurship discussion above). The new firms are important in increasing the spectrum of activities being offered, and these firms are entering the market with specific domain expertise or skills that are not easily imitable.

Classifying the large Indian software services providers as software service providers is increasingly imprecise, because these firms are evolving to include other engineering services and business process service provision. The common thread here is that all engineering services are about using software be it in integrated circuit design, the engineering of products, or providing back office services.

⁴ We use the term “near global-class” simply because we were unable to undertake a detailed evaluation of the technology these firms are developing, but we are certain that these firms are developing technology for the global market, and thus are in competition with firms in Silicon Valley and Israel.

The last five years have seen a quantum jump in the ability of the Indian software services firms to undertake large complicated projects. Only a decade ago, Indian firms were largely confined to low-level coding and programming (Dossani 2006). More recently, Indian firms have proven capable of undertaking larger projects and portions of the software services value chain that are higher value-added (see Figure 6 for a depiction of the movement of Indian firms to higher value-added functions in software services). The first dimension of undertaking larger projects is having sufficient numbers of employees. Whereas, at the end of fiscal year 1999, i.e., March 2000, the largest Indian service provider TCS had 17,000 employees and Infosys and Wipro had approximately 10,000 each, in March 2006 TCS had 63,000 while Wipro had 54,000 and Infosys had 45,000. As of September 2006, TCS had 78,000, Infosys had increased to 66,000 and Wipro had 61,000, and each of the firms had ambitious hiring plans. Though still smaller than IBM with its global employment of approximately 330,000 (of which approximately 140,000 are in IBM Global Services) or Accenture with 140,000 employees, the Indian service firms are increasingly able to undertake all but the very largest outsourcing contracts.

Figure 6 about here

As Figure 5 indicates, Indian firms are ultimately interested in capturing the highest end work such as R&D services and system integration. There are already indications that some of the service firms are having success particularly in the “D” portion of R&D. For example, consider Figure 7, which depicts the services that one large Indian software services firm provides to customers. According to our interviews, in the semiconductor chip design field, only three years ago the Indian vendor’s work was largely confined to the two lower value-added steps of Verification and Physical Design and Production and Silicon Production Engineering. In the last three years, overseas customers have contracted with them to provide the higher value-added areas of digital/analog design and even the architecture area (see Figure 7). The benefit for the Indian vendor is that it can receive improved rates for the project AND it allows its Indian employees to develop new capabilities, which satisfies their desire to improve their skills thereby aiding retention. When one considers that all of these service firms are striving for the same goal, namely moving up value-added ladders in whatever product areas they are in, the second dimension of changes in the depth of value-added can be understood.

Figure 7 about here

Finally, the large Indian firms are broadening their business bases by offering ever more services. For example, in 2006 TCS announced that it had contracted with Boeing to work closely with its customers to design the interiors of new aircraft they had purchased. This contract for \$30-50 million led to TCS establishing a “laboratory” in Chennai for the design of aircraft interiors (Kurup 2006). Though just an example, it is illustrative of the ability of these firms to broaden their business bases and presumably to increase their value addition.

The Indian firms are remarkable in that they have developed superb process skills. The Indian industry to prove itself had to adopt various global standards for process excellence, whether they were the CMM standards for software process maturity that placed enormous emphasis on creating standardized documentation or various ISO standards. In the business process area, the influence of the General Electric’s six-sigma program is pervasive. The importance of these

programs is that Indian vendors carefully examined their service production process and standardized them, but as important were constantly experimenting with methodologies for improving them. This created a drive to create metrics for measuring efficiency and quality. There is an uncanny resemblance to the way in which the Japanese adopted the Deming/Juran Total Quality Control ethic after World War Two. It is unsure what the QC practice and ethic is within the U.S. competitors such as IBM Global Services, Accenture, EDS, etc., but what is clear is that quality deficiencies will not be tolerated by customers, if, on average, the Indian vendors can deliver certifiably better quality.

The large Indian firms have, as a consequence of their improved quality of work, become desirable employers. S. Ramadorai, CEO of TCS, believes that the Indian operations of some of the global service firms are not yet doing their highest levels of value-added work in India, perhaps due to issues of managerial control. Since the Indian service providers do not suffer from this difficulty, he believes they are more desirable employers. Our observation is that for the service-focused MNCs, the Indian service providers are considered as desirable companies to recruit employees. At some of the less well-managed MNC's, there are tensions between their Indian subsidiaries and the parent operation, because the subsidiary feels that it is competing with the Indian service providers for certain business activities. Here, the MNC headquarters has not effectively integrated its Indian subsidiary into its worldwide operations, and thus it has no clear conception of its place in the firm. The result of this lack of clarity and sense of mission is that the most ambitious top performers move to other firms and even direct competitors.

If the large Indian vendors are expanding, there are also a number of smaller more recently formed firms that have been established particularly in what some term "knowledge process outsourcing." Regardless of the term used, these firms, though smaller, target particular industries or activities and build specialties in them. There are a large number of these, some merely boutique shops and then others like EvaluateServe and Marketics Technologies that are showing dramatic growth. The example of Marketics is instructive. Marketics is a datamining firm with approximately 400 employees as of November 2006. In the U.S. the datamining industry for consumer products is highly fragmented with small specialized firms usually staffed by highly credentialed researchers. Marketics has approached datamining using a Smithian division of labor model, whereby the more routine work such as data preparation and preliminary analysis is done by less highly credentialed employees, and the more highly trained employees are used only for the most sophisticated portions of the work engagement. EvaluateServe provides the services of highly skilled personnel in a number of different fields ranging from equity research to datamining and patent preparation. EvaluateServe is also growing rapidly (approximately 50% CAGR since 2004) and its headcount is at 1,500. Though these firms are far smaller in terms of employment than the more general firms, they are growing very rapidly, and it seems safe to say that more firms will emerge as Indian entrepreneurs discover new niches in which part of a service production process permits offshoring and offshore outsourcing.

MNCs in India

Nearly every Global 500 firm and many smaller firms now have either a direct presence in India through subsidiaries or through work that it has outsourced to an Indian services vendor or a developed nation service vendor that delivers, at least, part of the service from India. The largest

of these firms, such as Citicorp have multiple Indian operations that can include contracts with Indian outsourcers both in IT and BPO, contracts with MNC outsourcers like IBM and Accenture that have an Indian component in the delivery model, and then have one or more Indian offshoring subsidiaries. It may be that even headquarters does not fully understand the scale and depth of their operations in India. When one includes the fact that these firms are acquiring and divesting operations constantly, their offshoring to India is even more complicated. This section does not address this problem, but does note that a lack of clarity in defining what should be outsourced and what should be retained internally could have numerous adverse effects including the loss of IP, institutional knowledge, and internal capabilities. It can also result in adverse effects on the firm's Indian operations. The focus of this paper is the technology sector; however, the activities of other MNCs in the financial, insurance, travel, automotive, and health care sector are also quite significant.

The rapid growth of MNC Indian subsidiaries in terms of sheer numbers of employees, their breadth, and their level of value-added has also been remarkable. In Table MNC EMPLOYEES, it can be seen that the rate of expansion of Indian employment in these firms has been remarkable. The largest of these, IBM, plans to have over 60,000 Indian employees by the end of 2006 and 100,000 by 2010. IBM is not alone as every U.S. IT firm scrambles to establish and expand their Indian operation (s). The MNC subsidiaries can be divided into two groups: First, subsidiaries whose sole role is to work for the parent, i.e., Yahoo!, Google, Cisco, General Motors, HSBC, Citicorp, etc. Second, subsidiaries of MNCs that are service providers, i.e., their business is supplying outsourced services, e.g., IBM, Accenture, HP, EDS, Convergys, etc. Of course, many of these are also transferring their internal work such as HR and finance to their Indian subsidiaries. This section shows that both MNC groups are experiencing growth in size, spectrum of activities, and the quality of work they are undertaking.

Table One about here

The MNCs are interesting because they are pioneers in understanding how to do high value-added work in India and in implementing the business models that make this possible. Company A is a typical example of such an effort. As noted above, in 2000, they discovered and developed the depth of Indian capabilities in the programming function (see Figure 8). By 2003, India was established as a global development center, meaning that it was eligible to take product ownership while possessing the skills to contribute to projects across the board. As of 2006, only Europe, U.S., and Middle East also had this status. India currently is the global center of excellence for oil and gas, steel, and telecommunications verticals.

Figure 8 about here

The key to Company A's success has been relentless experimentation in order to discover the operating model that would enable value-added work to be done in India. Initially, the project managers were based in Europe while the engineers were based in India and other locations. This 'hub and spoke' approach did not work well due to the need for engineers within a project component to coordinate with engineers in the same component but located elsewhere. Firm A then experimented with an approach of every engineering team in India having its manager located in India. That manager was required to coordinate with managers globally, but the

engineers did not have to. This significantly reduced the number of coordination points and enabled more sophisticated work to be done out of India.

The case of Agilent Technologies India is instructive. It was established in 2001 to undertake both back office and engineering services (see Figure 9). Its initial engineering services work was simple data entry. However, the operation rapidly matured and began doing CAD support the next year. The next task it undertook was QA for product development. In 2003, Electronic Design Automation software development commenced in India. Success in these areas convinced management to add an ASIC design center in India, only the fourth one that Agilent operated globally (Dossani and Manwani, 2005). In April 2006, Agilent announced that it had purchased 10 acres of land in the Delhi area to build its own campus. Employment growth was very rapid, as it had no employees prior to November 2001, and by November 2004 had 1,200 employees with plans to increase to 2,000 by 2006. Agilent India is growing rapidly in three ways: first, its engineering capabilities are growing rapidly. Second, it is undertaking more of its global back office operations in India. Finally, the Indian market for its test and measurement equipment is expanding rapidly.

Figure 9 about here

As Amit Seth shows in his case study of Yahoo! India for this conference, Yahoo! has rapidly expanded its Indian operation (see Figure 10). In 2003 Yahoo! established its Indian Development Center (IDC) and hired 150 engineers. It has grown to nearly 1,000 employees in December 2006. But, from our perspective, what is more interesting is how its work has evolved. Initially, the IDC operated entirely as a back office for Yahoo! Palo Alto. In general, the work transferred to India was low value-added and mundane. The result was unacceptably high rates of attrition that were sapping the cost savings. To address this problem, in 2004 Yahoo! moved first-level project management to India, a step that gave the IDC more ownership, but created conflicts with Palo Alto-based managers. The solution to this was the movement of complete responsibility for major activities such as datamining to India. Now the Indian functional manager reported directly to a SVP in Palo Alto. With the increasing success of the Indian operation, functional responsibility not only for datamining, but also for mobile applications and iPod broadcasting was moved to the IDC.

Figure 10 about here

One should not overemphasize the success factors, of course, no matter how significant they are in improving India's capabilities to execute high value-added work. While the achievements of the last few years are stunning because of the change in the quality of work, there are still obstacles to doing more of the highest quality work in India. The absence of detailed market knowledge and interaction with the most sophisticated customers in the world handicaps the ability of Indian engineers to work in many areas.

As the manager of a large MNC noted, in a statement that was repeatedly echoed in several firms, "It is easy to do cutting-edge work in India and to manage large projects. The difficulty is

in launching products from India, especially the last stage between putting it all together and going live. There is also a gap in capability in conceptualizing projects from India.”

A final dimension is that it takes time to build sophisticated capabilities in-house. As the graphs of Agilent, Yahoo and Company A show, it takes two to three years before high-end work can be done in-house. This is probably due to a combination of building the firm’s work ethic in a new environment, concerns about lack of control, and the changing maturity of Indian engineers.

Global MNC Management Models

Developing the proper models for managing internal global development teams has been a topic that has occupied managers and students of international business. This section does not try to break new ground in this area, but rather aims to review some of the models with which firms we visited in India are experimenting. Prior to beginning this discussion, it is important to note that, with only very few exceptions, the preponderance of the MNC work in India is for export, and not for exploiting the still small, though rapidly growing, Indian market. Further, the models discussed here are all drawn from case studies in the technology sector, and thus may not be easily generalizable to other sectors.

The initial motivation when a firm enters India is to access lower-cost labor. This motivation is unlikely to change completely as long as India is a cost-effective environment. As a result, the Indian operation is likely to undertake much mundane service work for the MNC. The discussion of management models below refers to the efforts to also transfer higher value-added work to the Indian subsidiaries that are showing an ability and even desire to undertake higher level work.

This invariably means that the first model is of the Indian operation as a subsidiary meant to undertake low-level mundane work that the home country employees find repetitive and uninteresting. This is understandable from two perspectives: First, U.S. employees are often willing and even eager to shift such work. Second, for management, the risks are low. As in an experiment, if the work is of acceptable quality, then managers will more comfortably shift other higher level tasks that require more discretion and capabilities. Not surprisingly, the Indian managers and employees soon find such work uninteresting, and attrition rates can be challenging. Whether an operation whose sole activity is such mundane works is sustainable is unclear, but there can be no doubt that such work still occupies a preponderance of the work done in India, and for many MNCs this allocation of global responsibilities is likely to remain. The difficulty that will arise in terms of staffing will be that the most capable Indian personnel will not be satisfied with such arrangements and so turnover will be an issue.

There are other business models that are being explored. Each of these has advantages and drawbacks. The most commonly discussed model is the follow-the-sun (FTS) model that takes advantage of the time differentials between the U.S. and India. Effectively using the FTS model is not as simple as it may sound. Initially, many believed that one site would work on the problem and then simply upload it to be worked on at the other site. When everything was working smoothly the model seemed flawless. However, when there were problems with the

other team's work that required discussion, everything stopped until the team on the other side of the world explained the problems. If there were numerous difficulties, soon each team would blame the other, and the project might be so impeded that the FST model was actually slower and more expensive than simply doing the entire project in the high-cost environment.

The FST solution to this problem was to partition the work. For example, the coding would be done in the U.S. and testing would be done overnight in India. Or, in data entry or even datamining applications, the data is processed in India after the end of the U.S. working day, and it is then ready for use in the U.S. the next morning. Here there is a clear partition in the work and responsibilities are well-known. In some cases, the Indian employees are doing low-end routine work such as data entry or software test and debugging. But, in other cases, such as the datamining area, the work can be quite sophisticated. So, the FST model can offer significant savings in time and costs.

A variant on the FST model is the Division of Labor model (DOL). In DOL, a project is broken into various components that are largely modular, meaning that work on the components can proceed with only limited interaction between the two (or more) groups. Often when the melding of these parallel efforts occurs, for example, in chip design it may be necessary to bring everyone together at one location for extended periods of time to undertake the final tuning and problem-solving. Another problem with this approach is that certain functions that are common with each component such as testing and QA must now be replicated at each location or else there may be considerable delays in reverting to a single location that houses the common function.

A model that is increasingly being adopted by technology firms is what might be termed a Total Responsibility model (TR). The TR model transfers the entire responsibility for a business unit or functional activity to India. Initially, this is often for a smaller peripheral project and, almost always, at least, initially the responsible manager is an NRI who has had experience in Silicon Valley or other overseas location. Often, the NRI is hired overseas and transferred to India either on a long-term assignment or permanently. These persons have the credibility, contacts, and execution ethic of the home country firm or, at least, embody the ethos and have the ability to execute in ways that headquarters expects.

For many of the firms we studied this has become the dominant model for organizing the liaison between the U.S. and Indian operations. Moreover, significant responsibility is being transferred. For example, Adobe India has full product responsibility for PageMaker and FrameMaker. At Broadcom, total responsibility for developing ASIC designs for certain products is vested in the Indian operation. At Yahoo! the IDC is the global center of excellence for datamining and thus has primary responsibility for this function.

Another sophisticated model being created is that of Company A that builds large software programs and has multiple development centers around the world. It might be termed the Matrix model (Ma). Company A developed a model wherein no product it developed could be done in less than two Centers, i. e., the product managers had to use more than one location, thereby forcing them to see Company A as a whole and not simply consider how to aggrandize their local Center. However, since the product is modular, they had a second rule, which was that a component could only be done in two centers, thereby controlling the lower-level managers

coordination problems. The idea was that managers could be burdened with complexity and the higher one went in the managerial hierarchy the more complexity there would be. Finally, for the individual programmer their immediate supervisor must be local and preferably, two levels of supervisors were local. The objective of this was to give the programmers immediate feedback and supervision. The Ma model appears to be quite complex, but is a method for overcoming localism and forces interaction and cooperation across the firm's global development centers.

These models for managing the Indian operations may not be that different from those developed by MNCs to manage other mental labor abroad. However, there is one enormous difference between the operations in India and other nations – namely the scale of the Indian operations. As Table One suggests, the Indian operations are very often the largest operations that these MNCs have outside their home nation. Just their size means that properly managing them has direct implications for the success of the firm. Ineffective or incompetent integration with the global operations will be extremely costly. By their sheer size, improvement in their operation and extracting more value from the Indian operation may be the most important international business management challenge these firms face.

The Indian Ecosystems

Economic ecosystems exist and have existed in many nations. Our particular interest here is in two different but interrelated ecosystems, the first for offshore services provision and the second for entrepreneurship. The entrepreneurial ecosystem of interest is what the Global Entrepreneurship Monitor terms “high-opportunity entrepreneurship,” to distinguish it from small-scale startups often in the informal retail, agricultural, or manufacturing that have little chance of growing to be significant firms. The two ecosystems discussed here do intersect as services offshoring provided a space in which the entrepreneurial ecosystem could grow.

The ecosystem for service provision is much larger than the one for entrepreneurship as it encompasses the large established Indian firms, the MNCs, and the entrepreneurial startups. It also includes the central government through the medium of the Software and Technology Parks of India (STPI); the lobbying arm of the industry, NASSCOM; university and research institutions; and a plethora of facilitating organizations such as real estate developers, lawyers, talent search organizations, training agencies, facilities management firms etc.; all of whom ease the establishment and operation of global service provision. Though the main reason for this ecosystem's existence is to supply existing firms, new startups can also draw upon it. The rapidly expanding entrepreneurial ecosystem certainly benefited and, perhaps, would not have been possible with the service provision ecosystem that predated it.

The Ecosystem for Service Provision

In addition to the ecosystem to support entrepreneurship, India has developed an ecosystem that supports long-distance service provision. In an uncanny resemblance to China's development into the “global factory,” India may be becoming the global office – and the term “office” is used in the expansive definition, i.e., non-physical work in all its dimensions. Today, office work is predicated upon computers linked to a network – much of such work if divided into its

constituent parts can be undertaken remotely. The implications of this statement are enormous, as office work is the largest portion of the overall employment in developed nations.

The service providers in India are diverse in terms of industry segment, business model, and size. For example, even while many financial service firms use Indian service providers, they are also establishing Indian subsidiaries. For example, JP Morgan Chase plans to have 9,000 employees in India by the end of 2007, Bank of America employs 1,500 employees in two different Indian cities, Deutsche Bank has plans to increase the size of its Indian operations to 2,000 by the end of 2007, and Credit Suisse announced that it was establishing a subsidiary with 1,500 persons in India. In the case of Deutsche Bank, part of their Indian operation will be research staff. Goldman Sachs and Morgan Stanley, the elite investment banks, already have significant research employment in India. In effect, the world's largest banks now find it necessary to have an Indian subsidiary. The side effect of the establishment of operations by so many banks is the development of an ecosystem replete with a labor force experienced at handling financial back office functions.

The ability to transfer IT-enabled work to anywhere in the world that has the appropriate infrastructure makes India iconic but not unique. Other nations including the Philippines, Mexico, Hungary, Poland, and China, to name only the most prominent are also destinations for this IT enabled work. Having said this, India is clearly the center for this offshoring and has the richest and most sophisticated infrastructure to support the transfer of this work. What is happening is that relatively sophisticated global divisions of labor are being developed through which combinations of offshore and nearshore service support can be given. The sophistication of the telecommunications networks allows real-time intercontinental synchronization enabling the establishment of global networks for service provision.

Another development is that the Indian operations of the MNC firms are receiving global mandates for the provision of certain services or products. For example, Bangalore is the headquarters for Hewlett-Packard GlobalSoft, which is a globally focused software development and IT services company. HP is also considering divesting its business process outsourcing (BPO) business, H-P Global eBusiness Operations, also headquartered in India with around 6,000 employees providing financial and other services. For many MNCs, India is the first developing nation to receive global product mandates. We have already noted the cases of SAP Labs India, which employs over 3,000 persons, is now the largest SAP laboratory outside of Germany and is developing itself as a global center of excellence for certain functions; and of Adobe India, which now has global responsibility for PageMaker and Framemaker software.

Ecosystem for Entrepreneurship

There is an ecosystem for entrepreneurship emerging in India, especially in Bangalore and a few other cities such as the New Delhi National Capital Region, Chennai, Hyderabad, and Mumbai. The critical factors in this entrepreneurial ecosystem are NRIs that have returned either to manage startups or to join established MNC firms such as Intel, Cisco, Broadcom, Yahoo!, Google, etc. that have entrepreneurial roots in Silicon Valley, in particular. These returnees have contacts in the U.S. that can be used to mobilize resources. There are many ways these contacts might operate, for example, their contacts in Silicon Valley might develop a business concept

based on low-cost Indian engineering, and then contact the returnees to establish and manage the Indian operation. The returnee is responsible for organizing and recruiting for the offshore delivery operation. In this case, the returnee would be a critical member of the startup team. Of course, the NRIs often have important managerial positions in the U.S. subsidiaries in India. Such positions provide important insight into new business opportunities, and so they would be well suited to leaving to establish their own firms. They could then build their sales and marketing teams in the U.S. (the Israeli model). The NRIs are particularly well suited to establishing global-class operations in India.

The MNC subsidiaries also are promoting Indians to positions of responsibility in which they learn global-class management and R&D skills that could later be used to start new firms. In the case of Israel, the MNCs were important training grounds for managers. We have shown that increasingly sophisticated work is being undertaken in the Indian subsidiaries, and this is particularly significant in cases where the management of entire business units or products has been delegated to the Indian subsidiary. Thus a cadre of Indian managers that have the capability of establishing and managing a startup is also being established. So the first requisite for creating an entrepreneurial ecosystem: high-quality entrepreneurs and a labor market replete with skilled managers already exists.

Until recently, there were few global class venture capitalists deeply knowledgeable about technology markets operating in India. This is rapidly changing as major Silicon Valley venture capital firms have established Indian operations. In addition, there are an increasing number of domestic venture capital firms, although these have yet to become important actors.⁵ Moreover, the Indian government is relaxing the various regulations that inhibit the operation of VC firms. There seems little doubt that if Indian entrepreneurs can create firms that have successful exits either through listing on global or Indian markets or merger and acquisition, there will be more investment. There already have been some successful exits on the Indian markets, such as Sasken, a fabless semiconductor contract services firm, and a few on the U.S. exchanges such as Exl, which is a BPO firm. Merger and acquisition has also led to successful exits. For example, IBM acquired the BPO startup Daksh in 2004 for \$160 million and an older Indian IT infrastructure maintenance firm, Network Solutions, for an undisclosed price, EDS acquired the BPO startup Mphasis for \$380 million, and R.R. Donnelly purchased the high-end BPO firm Office Tiger for \$250 million. There have been successful exits and there are likely to be many more as the Indian economy grows and some of the recent startups such as Tejas Networks mature. The previous successes and the large number of recent startups suggest that an entrepreneurial ecosystem is being established in India, and particularly, in Bangalore.

The role of Indian universities (discussed in greater detail in the next section) in the development of this ecosystem is mixed. There can be no doubt that the typical Indian university graduate makes an excellent worker, and the graduates from the elite universities and Indian institutes are as good as any in the world. In terms of research, the elite Indian institutions are improving, but they are not yet on a par with Tier One U.S. universities in terms of publications. All of the top institutions have established incubators and/or S&T parks, which do have some startups. However, thus far there have not been any global-class startups established by Indian professors

⁵ For a history of the development of the Indian venture capital industry, see Dossani and Kenney (2002). A recent update of the Indian venture capital environment is in Dossani and Desai (2006).

or students. Whether this will change in the short-term is doubtful. At this point, the most important contribution of the Indian higher education system to the entrepreneurial ecosystem is a high-quality graduate that can be hired by industry or accepted at the best foreign universities for advanced education.

Observations about the Educational System

A system in which there is a rise of 32% per annum in the workforce might be expected to strain access to the best engineers and India is facing such a strain. Attrition appears to average 12% p.a. and salaries have risen by 15% in the past year. The salary gap between the fresh engineer in India, who earns about \$5,000 a year on average, and his developed country counterpart is still substantial, but the gap narrows quickly to less than 2:1 at senior levels.

Despite a generally rising quality of output from the engineering schools, due in part to increased private provision, the average quality of engineer appears to have fallen. This is because demand has increased more than supply, forcing firms to dip deeper down in the talent scale in order to obtain the numbers they need. IBM India, for example, sorts through 60,000 resumes a month, interviews 10,000 and recruits 1,000. Infosys reports that it receives 1.2 million job applications a year.

Firms operating in India are managing these issues in various ways. First, many, particularly the larger firms, have in-house training systems. The large firms further rely on their reputation as good employers offering growth and interesting work. Others try and orient graduates to their particular requirements. Texas Instruments India, for example, has partnered with over 500 Indian college campuses, supplying DSP kits and other course material.

Indian universities and research institutes have done an excellent job of providing a well-qualified work force capable of creating value in the global economy after significant, but not exorbitant, post-education training. Among the best young persons, firms operating in India must compete with their desire to go abroad for further education. The question for India is where to invest its limited dollars – K-12 or higher education? There is a strong argument for India making a concerted effort to improve its postgraduate educational system, but this will require significant investment in improving the research capabilities of its universities; something that will be quite difficult given the shockingly low professorial salaries in public and private universities, which is already attracting some of the best professors to private industry. For a nation entering the global economy on the basis of its citizens' ability to provide mental work, investment in improving the educational system at all levels is and will continue to be of critical importance.

Conclusion

Behind the published figures of the exponential growth of Indian service provision to the global economy lies growth in three dimensions. First is a continuing of the already-known ability of the ecosystem to support rapid growth in numbers. Second, and perhaps more significant, is the movement up the value-chain. Third is the expansion beyond the traditional domains of finance and telecommunications service provision to new areas such as chip design and aerospace.

These different dimensions of advancement are enabled by the following changes in the environment: new management approaches that appear to be able to circumvent erstwhile barriers of interactivity; the return of NRIs who are providing advanced and creative project conceptualization and implementation skills; the involvement of both sophisticated venture capital located in Silicon Valley (and elsewhere) and established firms in pioneering multi-country coordination from India; and the leveraging of some sophisticated local markets, particularly in wireless telecommunications.

These changes are not independent, rather they are mutually interdependent creating a positive feedback loop. This interdependence reinforces growth on the three dimensions mentioned previously. For example, the confidence to experiment with new business models is undoubtedly bolstered by the presence of NRIs; so, too, is the willingness of Silicon Valley venture capitalists to invest in India increased by the NRI presence. That said, India's rise, though iconic, is not entirely unique. Other nations, notably in Eastern Europe and Asia, are also destinations for sophisticated work, though those in Eastern Europe/Ireland are mainly regional centers. The Philippines appears to be developing a complementary relationship to India. What has occurred in India is that it has managed to place itself at the center of global movement to offshore services and, for the reasons mentioned earlier has spawned the richest ecosystem to support such work.

The future is difficult to predict, but if the past is prologue, then the future of the Indian ecosystem for services provision and for entrepreneurship is very promising indeed. There can be no doubt that India is challenging the traditional view that it is not possible to do highly sophisticated work in India and deliver it remotely. In this way, India is challenging, and, quite possibly has already debunked, the concept of a global division of labor based on stages of development. We suggest that India is pioneering a new model of development based upon mental labor, rather than physical labor.

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