ECONOMIC DEVELOPMENT STRATEGIES AND MACRO- AND MICRO-LEVEL HUMAN RESOURCE POLICIES: THE CASE OF INDIA'S "OUTSOURCING" INDUSTRY

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Abstract

This detailed case study of India's "outsourcing" industry illustrates the challenges in linking macro and micro human resource policies with an economic development strategy based on export-oriented services. The rapid expansion in the outsourcing of services to India has raised the possibility that this sector will be a key engine of India's economic growth. Based on extensive field research carried out over a four-year period, the authors of this study argue that four interrelated human resource policy challenges threaten the outsourcing industry's growth: two "macro" problems (current skill shortages and the inability of the country to produce higher levels of skills for the long-term growth and sustainability of the industry), and two micro problems (very high levels of employee turnover and rapidly increasing employee costs). The authors evaluate current policy responses and suggest options.

The growth in the "outsourcing" of a variety of low- and high-skill service sector jobs from the United States to India has stimulated debate in the United States. Critics of such outsourcing argue that it may harm the American middle class and seriously undermine the economic future of the country (see Blinder 2007; Greider 2007; Gomory and Baumol 2001). Proponents argue that such outsourcing will increase profits, expand exports, raise dividends, and result in greater economic efficiency (for example, Greene 2005). No such ambiguity is present when this phenomenon is viewed from an Indian perspective, where the "outsourcing industry" has come to be viewed as the "primary engine of the country's development over the next few decades, contributing broadly to GDP growth, employment growth, and poverty alleviation" (Srinivasan 2006:204). India's reputation as the business process outsourcing capital of the world raises the question of whether an economic development strategy based on export-oriented *services* (EOS) is a viable option for developing countries, in contrast to the low-cost, labor-intensive export-oriented *industrialization* (EOI) strategy that has been the hallmark of Asian development (World Bank 1993).

Many have highlighted the linkage between successful EOI strategies and appropriate labor policies (see Amsden 1989; Deyo 1987, 1989; Kuruvilla 1996a). In this paper, we focus on the linkage between an export-oriented services strategy (EOS) and national human resource policies (particularly skills development policies). Specifically, the policy question we investigate is whether existing work force skills and national human resource policies in India will support or retard the development of this sector, given that the quality of human resources is a critical factor in determining comparative advantage (for example, Wood 1994; Godfrey 1997). Thus, although we focus on India, this issue has relevance for the many developing countries (for example, Hungary, the Philippines, Malaysia, the Czech Republic, China, and Brazil) that seek to emulate India's success in developing service sector "outsourcing" strategies.

Although the availability of the world's largest pool of low-cost, English-speaking, scientifically trained "manpower" has been India's major source of competitive advantage and success in outsourcing, the industry now faces critical labor shortages. Further, we argue that both near-term and long-term growth prospects of the Indian outsourcing industry hinge crucially on its ability to overcome a series of interrelated macro (national-level) and micro (firm-level)

human resource policy challenges. The macro challenges include current skills shortages and a deficit in the production of high-end skills essential to the long-term sustainability of the industry, and the micro HR policy problems are the extremely high labor turnover and rapidly mounting human resource costs. We use the skills equilibria framework (Finegold and Soskice 1988) to evaluate current efforts to solve these problems and to suggest policy solutions. A key implication of our analysis is that there is an urgent need to reexamine the current roles and policies followed by the government, the industry association, and firms if the outsourcing sector is to be a vital engine of India's development.

Methodology

Since the purpose of our research was to identify the changes in and development of a brand new, growing industry, we relied on a variety of methods to gain understanding. Our primary source of "perspective" was 79 interviews spread over the 2004–2007 period. These interviews, conducted in an unstructured format, averaged about 2 hours in length, though some took as much as half a day and others lasted only an hour. Interviewees included outsourcing industry managers (both operational and HR) and other experts (professors, journalists, and critics). We used a snowball sampling method, obtaining interviews not just with a pre-set list of persons, but also with others suggested to us by the interviewees themselves as persons who might have different perspectives on the sector or different experiences managing human resources in their firms. Most of our informants were from larger firms (large firms dominate in terms of industry revenues), and to that extent there is a large firm bias in our sample.

Together with interview data, we use data from the first author's observation of four workplaces in the business processing outsourcing (BPO) segment of the industry in 2004. Typically these observation sessions lasted roughly half a shift. In two cases the work flow was observed, giving us a sense of the complexity of the work involved in the typical low-end business process firm. The observation of the work process confirmed the conclusion of much prior research (for example, Batt et al. 2005; Remesh 2004) that low-end BPO and call center work is typically "Tayloristic" in character. In the other two cases, the observation focused on the training of new hires, particularly in the "accent neutralization" of call center operations.

Observation of these processes was also buttressed by short interviews with the trainers. In addition, in each of these firms, we examined firm-level human resource information (particularly the demographic profile of employees, HR cost structures, HR policies, and turnover data).

Through a system of open and axial coding (Strauss and Corbin 1990) of the interview data, we identified the important problems facing the sector. When in doubt about the importance of certain problems, we went back to selected interviewees in 2005 and 2006 (although some of them had changed their jobs during that period). Since much of the study's focus is on firm-level HR problems and issues, the second author spent two months "embedded" in the human resource department of one of the three leading outsourcing firms in 2007. As a "participant observer," the second author was able to study personnel policies and practices in some depth. Based on interviews with HR managers attending the annual HR Summit for the industry in July 2007, we believe that although this firm's policies were those of a leader and trendsetter, they have some generalizability—as suggested, for example, by the similarity of measures employed to combat turnover.

Our understanding of the problems facing the industry was considerably enhanced by close perusal of "trade magazines." While the most important trade journal was *DataQuest*, a number of internet-based sources are also widely used by outsourcing industry employees. These include daily technology news websites like *Wired* as well as dedicated information technology (IT), telecommunications (Telecom), and BPO news resources like *InfotechOnline* and a number of blogs (for example, TCP BPO is a blog specifically catering to BPO workers in India). In addition, most leading newspapers in India now have an "InfoTech" section dedicated to industry news.

To get a sense of the contours of the outsourcing industry, we relied on data from NASSCOM (the National Association of Software and Services Companies). NASSCOM functions as the trade body and chamber of commerce of the industry, and is the *only* comprehensive source of industry data, which are collected via membership surveys and through special studies done by NASSCOM in partnership with consulting firms such as McKinsey (for example, the NASSCOM-McKinsey reports) and Hewitt (for example, the NASSCOM-Hewitt rewards study). NASSCOM's data regarding industry growth and exports are generally consistent with data from CMIE (the Center for Monitoring the Indian Economy).

Although one should be appropriately skeptical of industry data provided by any industry association, NASSCOM's research wing has established a reputation for publishing authentic and credible data (Joshi 2002). Because of the level of detail provided by NASSCOM's data, which allows for analyses of trends over time, most academicians and observers prefer NASSCOM over other sources, such as the Department of Electronics, the Reserve Bank of India, and the CMIE. Tharakan, van Beveren, and Van Ourti (2005) cross-checked the accuracy of NASSCOM data with data from 51 national IT associations, 45 national statistical offices, and 9 international data sources and concluded that the NASSCOM statistics were comparable, but more comprehensive. Most managers interviewed by Arora and Asundi (1999) regarded NASSCOM figures as accurate and credible. Adding to their credibility is the fact, as noted by Joseph and Harilal (2001:16), that they are compiled from firm-level data and that "there is hardly any software or BPO company in Indian which employs more than 20 professionals that is not a member of NASSCOM." Hence in this paper, the various figures on industry size and growth presented were assembled by us from a variety of NASSCOM reports and studies.

Companies in the industry belong to NASSCOM for a variety of reasons, mostly having to do with the ability to network (both domestically and with the international software community), to lobby the government, and to gain access to the variety of services that NASSCOM offers its members. These services include research on software technologies and market intelligence services (including new emerging opportunity areas), training in industry best practices, knowledge about quality and security standards/minimum requirements, access to the National Skills Registry, and subscription to weekly and biweekly publications (like *HR Connect, Communique,* and *BPO Newsline*) as well as annual reports (like the Strategic Review). NASSCOM also organizes seminars, human resource summits, technical conferences, case study presentations, industry-specific sessions, training and mentoring workshops, leadership forums, and other events, based on industry trends and member needs. In addition, NASSCOM plays the role of "strategic advisor" to member companies by mentoring them on world-class management practices. Thus, there is a strong incentive for most firms in the sector to become members of NASSCOM, and its 1,200 members constitute 95% of the revenues of the industry and include both Indian and multinational firms. Hence, it is a representative organization.

NASSCOM is also influential (a relevant issue in this paper, especially when, in the last section, we discuss policy options). Although its initial charter was to lobby and obtain

concessions from the government on tax matters, NASSCOM's biggest achievement is that it has at least managed (through a variety of methods) to put various issues on a slow-moving government's policy agenda. It has successfully lobbied for industry-friendly policies such as zero tariff protection, strong intellectual property and data protection laws, stepped-up deregulation of the telecom market, the creation of software technology parks, and private sector participation in the education system (all of which have helped the growth of the industry). Moreover, unlike other chambers of commerce, NASSCOM has a voice in the creation of government policy, since it now has representatives in various committees within government departments, including the Ministry of Information Technology, Ministry of Commerce, Ministry of Finance, Department of Telecommunication, Ministry of Human Resources Development, Ministry of Labor, and Ministry of External Affairs. A final indication of its influence is the consulting services it provides to state governments to advise them with regard to telecom infrastructure, physical infrastructure, and IT orientation. Thus, NASSCOM plays a central role in representing the industry's interests in the political arena, providing a portfolio of relevant services to its members and consulting services to state governments.

The Indian Outsourcing Industry

NASSCOM refers to the "outsourcing" industry as the IT-ITES industry (Information Technology–Information Technology Enabled Services). The IT-ITES industry is subdivided into four *segments:* IT Services and Software (henceforth called the software segment), ITES–Business Process Outsourcing (henceforth called the business processing segment or BPO), Hardware (which is relatively small, and domestically focused, and therefore ignored in this paper) and Engineering Services, R&D, and Software Products (a newly created segment henceforth called R&D). Note, however, that the lines between some of these segments are increasingly becoming blurred as a result of the changing nature of "outsourcing" work as well as industry consolidation.

Origins of the Software and Business Process Outsourcing Segments

Prior research has identified a number of catalysts that have influenced the growth of the software segment. (There is much debate about the relative importance of each of these catalysts; for differing views, see Srinivasan 2006; Arora and Athreya 2002; Saxenian 2002; Dossani 2006; Dossani and Kenney 2003; and Nilakant 2006.) The catalysts include the general liberalization of the Indian economy; government policies favorable to software and telecommunications; entrepreneurial Indian firms (such as TCS, Wipro, and Infosys) that exploited the opportunity in the 1980s and 1990s to export highly trained engineers to the United States to do programming work for U.S. firms (a practice known as "body shopping"); the Y2K crisis, which popularized India's reputation in software; the Indian diaspora in Silicon Valley; and, finally, India's large pool of low-cost, skilled, English-speaking software professionals. The reputation developed by India's software segment by the 1990s, in turn, was a key catalyst in the development of the BPO segment in the late 1990s and early 2000s, along with the availability of telecommunications bandwidth at lower prices, technological developments such as the ability to digitize documents, a growing opposition to "body shopping practices" in the United States, and global competition that forced U.S. firms to look for cheaper locations to locate low-end business processing work. The pioneering efforts of large MNC's such as GE, American Express, and British Airways in setting up outsourcing operations in India to capitalize on the huge salary cost differentials between similarly trained employees in India and the United States paved the way for more firms to emulate their practices (Dossani 2006).

Industry Size and Growth

The "outsourcing" sector is currently valued at $47.8 billion (2006–2007) and is projected to grow to $150 billion by 2012. Table 1, which provides both value and growth data, shows that while the whole industry has grown steadily, the growth rates of the different segments vary. Although the software segment grew by 33% in 2006–2007, the annual average growth rate during the 2000–2007 period was only about 28%, compared to the BPO segment's explosive annual average growth rate of 53% during the same period. And while the software segment has accounted for the lion's share of total industry revenue—50% in 2006–2007,

compared with 20% for the BPO segment—projections based on current (2007) growth rates show the BPO segment overtaking the software segment by 2012. The relatively new R&D segment grew at 30–35% per year between 2005 and 2007, albeit from a small base.

{{**Table 1 about here.**}}

Table 2 indicates the *significance* of the outsourcing industry to India's economic development. While the overall contribution of the outsourcing industry to India's GDP is still relatively small, accounting for only 5.4% of GDP in 2006–2007, projections[1] suggest a figure of 12.3% by 2012. This is remarkable considering that the agricultural sector (India's largest sector, employing about 60% of its population) currently (2007) accounts for only 18.5% of the country's GDP (Ministry of External Affairs, Government of India).[2] The significance of the industry is better revealed by its contribution to export earnings. It accounted for more than 25% of India's export earnings in 2006–2007. (The software segment was responsible for 58% of the industry's export earnings contribution, while the BPO segment accounted for 27%.) The industry's contribution to employment is modest in a country as large as India, but significant in absolute terms. The number of people directly employed by the industry stood at about 1.6 million in 2006–2007 (projected to be 5 million by 2012), and indirect employment includes about 1.2 million jobs in ancillary services such as transport, catering, construction, security, and housekeeping (NASSCOM 2005).

{{**Table 2 about here.**}}

The dramatic growth rate of the industry, its relatively large contribution to export earnings, and the potential for significant contributions to GDP as worldwide demand for outsourcing increases (see Blinder 2007 for some estimates of the number of U.S. service sector jobs prone to outsourcing)[3] have placed this industry in a good position to become India's most important "development engine."[4]

Industry Composition and Structure: The Variety of Work Outsourced

Software Services Segment

The software services segment can now be divided into three different "service lines." (Table 3 reports value, growth, and revenue statistics for each service line.) Each service line comprises both a large and stable "low-end" market—the "bread and butter" of most firms—and a small but growing "high-end" market. The largest service line, *Project-Oriented Services,* accounts for 56% of total segment revenues, and is dominated by the low-end customized application and maintenance of software for client firms, which has been the mainstay since the early 1990s. Of late, there has been growth in "higher-end," higher–value-added services such as system integration (where growth rates averaged 40% in the last two years) and IT and Network consulting (see Table 3), evidence that the industry is "moving up the value chain." An area of growth of particular importance here is consulting in enterprise application integration, which is key to designing global value chains and building effective e-business infrastructures. These high–value-added services (which require good postgraduate skills) have propelled Indian firms such as Infosys to establish consulting units in the United States to compete with global leaders such as Accenture and IBM.

Table 3 about here.

The second service line, *IT Outsourcing,* which accounts for 33% of the segment's revenues, differs from Project-Oriented Services in that it focuses on standard IT services for all clients (not customized for any single client) and encompasses both "low-end" activities such as applications outsourcing (which is the largest activity) and high-end services such as network infrastructure management. Typical examples of such work are cases in which Western client companies (for example, Bell-South) outsource the entire gamut of IT applications to Indian firms.

The *Support and Training* service line is more heavily dominated by the "low-end" operations of software support, such as software support to a domestic U.S. consumer. However, there is also a high-end activity here—the export of IT education and training services. A notable example is Educomp Datamatics, which has developed its Smart Classroom for U.S. schools.[5]

In sum, the composition of work done in the software segment is slowly but surely changing from low-end work to increasingly high-end work, with the high-end work evidencing faster growth (see the last column of Table 3). This change has brought about a transformation in the business strategies of Indian firms, which are moving from simple off-shore outsourcing of

some elements of IT to a more evolved "sophisticated global delivery model." Hence, on the one hand we see more and more IT services being sent offshore to India (the offshore percentage of software revenues increased from 43% in 2000 to 71% in 2005), and on the other hand Indian firms are providing higher–value-added services onsite (that is, in the United States), evidenced by the opening of consultation locations in the United States. Infosys, for example, has a 1:3 onshore-offshore ratio, so that for its 9,000 U.S.-based employees hired to serve as an interface to the U.S. clients, there are 27,000 offshore employees.

Thus, the Indian software segment is becoming more skill-intensive, consistent with Krishnan and Dayasindhu's (2004) suggestion that the industry must develop "new layers" of competitive advantage, given the increasing competition in software services from China, Hungary, Argentina, Latvia, Malaysia, Estonia, Slovenia, and Romania (Nairn 2004). However, this movement requires that the country produce the skills required. As we will demonstrate in the next section, the Indian university system has little or no capacity to produce the skills required at the top of the software value chain (in particular, the skills of system architects, researchers, and visionaries), and even skills lower down the chain, such as the global domain knowledge needed by business managers, are already in short supply (interview, Narayan).

The Business Process Outsourcing (BPO) Segment

The reasons for India's dominant position in the global market for business process outsourcing—a 48–50% market share in 2004 (NASSCOM 2005)—are reflected in the advice and recommendations corporations turn to when forming their offshore location strategies. The most heavily used resource of this kind is a comprehensive evaluation tool developed by the consulting firm AT Kearney. AT Kearney's analysis indicates that India has a clear lead over its major competitors, particularly with regard to cost and the quantity and quality of skills. India's score on the index is a 7.12, compared to scores ranging from 5.33 to 5.61 for the other BPO competitors (China, Malaysia, the Czech Republic, Singapore, the Philippines, Canada, Chile, and Poland).[6] India's cost advantage vis-à-vis the United States is demonstrated by a comparison of call center costs between the two countries (Table 4).

{{**Table 4 about here.**}}

The BPO segment, growing at an annual average rate of over 50% since 1999, saw employment rise from 50,000 in 1999–2000 to 415,000 by mid-2006. Rather like the software segment, the BPO segment is characterized by a large "low-end" section and a discernible and growing "high-end" outsourcing market that involves very advanced skills (of which many are in short supply). However, there is greater variability in "service lines" in the BPO segment than in software. The mushrooming of newer service lines on almost a weekly basis makes it difficult for us to categorize them. Table 5 lists descriptions of the basic service lines for which we have data for 2005; below, we describe the many new categories that are emerging.

{{**Table 5 about here.**}}

Customer care (call centers) and support services for a number of different industries comprise the largest service line, accounting for close to 40% of the industry's employee base and a third of its revenues. Typical examples include the outsourcing of Delta Air Lines' worldwide reservation center to the Indian firm Wipro-Spectramind (now Wipro BPO) and Amazon's outsourcing of its customer service to Daksh (a firm now owned by IBM). The finance and accounting service line includes the standard business processes of transaction management, general accounting, treasury and risk management back office work, statutory reporting, and compliance work, while the payment services line includes a variety of billing services, insurance claims processing, and tax processing. The HR outsourcing service line is experiencing rapid growth (this typically comprises payroll and benefits administration, travel and expense processing, talent management services, and employee communication services). In addition, there is a growing "medical and legal transcription" service line.

New service lines have emerged in fields such as finance (analysis of economic data, business intelligence management of foreign commodity accounts, and lower-end services such as home loan processing, mortgage services, and debt collection and recovery), medicine (creating medical education databases, doctors' desk reference guides, and notes on drug efficacy; more recently, reading and analyzing patient X-rays), printing (pre-publication of scientific journals), and remote education (such as providing math tutorials to U.S. schoolchildren), leading to new service line categories known as Financial Process Outsourcing (FPO) and Knowledge Process Outsourcing (KPO).

Thus, like the software segment, the BPO segment is "moving up the value chain," but more rapidly. At the low end of BPO, revenues are tightly and linearly linked to manpower

employed.[7] However, at the FPO and KPO level, it is high skills, not numbers of employees, that matter. The difference in complexity between regular BPO jobs and the jobs in the KPO family can be seen in the differences in billing rates of BPO firms. Whereas billing rates for traditional HR outsourcing average about $15 per hour, the average for a wide range of KPO activities is about $45 per hour and rising, as shown in Table 6.

{{**Table 6 about here.**}}

Engineering Services, R&D, and Software Products (the R&D Segment)

This newly created segment (originally part of BPO) represents very high-end services that have the greatest potential for growth, according to industry analysts. Here too the variety is great and does not neatly fit into NASSCOM's categories. But some of these jobs require doctoral-level skills or advanced master's-level skills. Table 7 shows a limited subset of the varieties of work done in this segment, and we discuss selected examples in more detail below.

{{**Table 7 about here.**}}

In engineering services, a particularly important line, India had 15% of the worldwide market share in 200__, according to a study by Booz, Allen, and Hamilton (see NASSCOM 2006). Worldwide outsourcing of engineering services is currently worth $15 billion. The study suggests that India accounts for 28% of the world's engineering services outsourcing talent in low-cost countries (Russia and China are the closest competitors with 11% and 10%, respectively). Engineering services span several industries ("verticals" in industry parlance), including aerospace, automotive, telecomm, utilities, industrial construction, pharmaceuticals, medical engineering, consumer electronics, and industrial chemicals. Aviation and aerospace accounts for a particularly large portion of engineering services outsourcing activities and is growing rapidly. For example, Wipro employs 450 engineers in its aerospace engineering services outsourcing and plans to double that in the next few years. Sathyam computers has created a new subsidiary, Sathyam Aerospace, to focus on providing engineering services to the global commercial aviation aerospace and defense markets. Further, many engineering MNCs (for example, Siemens, Snecma Aerospace, Samsung, Philips, Delphi, Daimler, and Bosch) have established engineering research and development centers in India.

In software, there is growth in the R&D-oriented field of embedded software and systems (which grew by 44% in 2005–2006). Large electronics producers such as Samsung, Texas Instruments, Motorola, and Intel source some of their embedded system requirements from India, and a growing number of them established software design centers in India in 2005–2006. As of 2007, over 900 engineers were working at Motorola's Global Software Group (GSG) at Bangalore and Hyderabad, creating cutting-edge technological solutions for wireless products and providing embedded solutions and services for 3G phones. There is also growth in the research-intensive area of software product development (the highest end of the software value chain). Several successful software products have been designed, developed, and marketed by firms located in India; indeed, a few have achieved global success (for example, Talisma Corporation's "E-CRM" suite, Infosys's "Finnacle" for the financial and banking industries, Iflex's "flexcube" for the internet banking industry, Tally Solutions' "tallyees 6.3" accounting and financial management package, and Cranes' "SYSTAT" statistical analysis package).

Apart from engineering services and software, R&D outsourcing is growing particularly in two industries: life sciences and finance. In the life sciences industry, the work pertains primarily to medical research, drug discovery, drug testing, clinical trials, and development of search tools to search genomic databases. The U.S. Department of Labor estimates that at least 36,000 jobs in this industry will move to India over the next few years. In the financial services industry, very high-skill jobs in equity research, data modeling, and actuarial analytics have already "moved" from Wall Street to Bangalore! (For more detail on the finance industry, see Grote and Taube 2004.)

Changing Industry Structures

The rapid pace of change in the nature of jobs being outsourced to India has transformed industry structure. On the one hand, there is *consolidation within* both the software and BPO segments. In the software segment, although there are over 3,000 different IT firms, the structure is pyramidal, with five very large firms (> $1 billion in revenues), about 70 medium-sized firms (> $25 million in revenues), and a large number of "bottom feeders."[8] The top 20 firms accounted for 48% of revenues in 2003–2004 (up from 46% in 2002–2003). In the BPO

segment there were more than 400 firms in India in 2006, but 10 large firms dominated the industry.[9] Consolidation is also eroding the distinction between "captives" (BPO firms owned by U.S. client firms such as Dell, EDS, and HP that service only their owners) and "third-party firms" (both Indian-owned and foreign-owned firms providing BPO services to any client, and normally servicing a large number of clients simultaneously).

In addition, there is *cross-segment consolidation*, blurring the boundaries between the segments. The nature of the work being outsourced has provided an opportunity for increased synergy between software support and services and BPOs. All the major software firms have started or acquired their own BPO units; for example, Wipro started Wipro Spectramind, Infosys started Progeon, TCS bought Phoenix, and IBM recently acquired one of the largest third-party firms, DAKSH, leading to the emergence of true "outsourcing" multinationals. Infosys, for example, integrates both software and BPO work and is widely diversified, with operations in engineering (engineering design), aerospace (airframe design, seating), automobiles, heavy engineering, banking and finance (transaction processing systems, trading software), healthcare (creation of a national health record system), logistics (software for supply chain management, transportation), manufacturing (logistical systems for fishermen), and several other fields.

In sum, the software segment, the BPO segment, and the R&D segment in the outsourcing industry are experiencing rapid growth in terms of volume, but also show evidence of "moving up the value chain." These developments have revealed many skill shortages (giving rise to a number of firm-level problems), which raise the question of whether the country can generate the higher–order skills required to sustain the headlong growth and transformation of this industry.

Macro and Micro Human Resource Challenges

We argue, on the basis of our field investigations, that four critical and interlinked human resource challenges threaten the near-term and long-term prospects of this industry. Two problems are "macro" in nature, that is, requiring government-level policy interventions. The first macro HR problem is a shortage of skilled human resources, and the second, perhaps more critical problem is the difficulties India's advanced education and training infrastructure will face

as it is tasked with producing the high-skilled manpower the industry will need, given its current trajectory toward more knowledge- and research-intensive work. Policymakers acknowledge and are trying to address the first problem but have not yet seriously confronted the second.

The "micro" human resource problems, themselves interrelated, are also linked to the macro ones, but they require mostly firm-level solutions. The first problem is high average turnover rates, which in 2007 were about 20% in the software segment and 50–60% in the business process outsourcing segment. These high rates are partly related to the macro problem of skills shortages, but are also a function of poorly developed firm-level human resource strategies. The second and closely related problem is rapidly rising human resource costs in the BPO industry—particularly at the low end, where low costs are a source of competitive advantage. Cost increases are a function of turnover, to be sure, but as we will demonstrate, solutions will also require some macro policy interventions. Although the problems of turnover and skill shortages are increasingly attracting business press coverage, this is the first comprehensive study of all of the HR problems facing the industry.

Shortage in Supply of Skilled Labor

A key source of competitive advantage for the software segment in India has been the availability of low-cost skilled "software engineers," and for the BPO segment, well-educated, English-speaking "manpower." This large HR "pipeline" has been prized by clients and has contributed to Indian firms' reputation for being able to "ramp up quickly" (interview, Varadarajan). However, there are critical labor shortages in both segments. These shortages were apparent during the first phase of our fieldwork in 2004, but are more widely recognized now. The head of NASSCOM in 2006 suggested that in the next two years India could lose potential off-shoring work worth billions due to critical talent shortages (NASSCOM 2006).

Software segment. About 562,000 software professionals were employed in 2007 (NASSCOM 2007). This is a steep rise from the 398,000 software professionals employed in 2006 and the 297,000 employed in 2005. Demand for software professionals is growing steadily. For example, the top three software firms hired more than 72,000 in FY 2006–2007. Infosys alone recruited over 25,000 in 2006 (Long 2006). However, estimates of future demand

vary widely. In 2006, NASSCOM suggested that annual demand for software professionals would outstrip supply by a margin of 70,000 in 2007–2008 and 235,000 by 2009–2010. Analysis and projections by Dataquest (a trade journal) suggested a more dire picture, with a shortfall of 300,000 predicted for FY 2006–2007 itself. Our interviews with managers in the industry present a compelling picture of current shortages, but a more nuanced view regarding where the shortages are occurring.

At the time of our interviews, the managers reported shortages of programmers with "common" software skills (for example, proficiency in Java, C++, ERP, SAP, and J2EE), as well as shortages of application developers and database engineers, but they cited a more severe shortage of workers with more "specialized" skills (for example, data warehousing experts, Citrix-certified enterprise administrators, Sun-certified system administrators, check point security administrators, Cisco-certified network professionals, Microsoft-certified systems administrators, certified information systems security professionals, and Red Hat–certified professionals). Managers also reported shortages of workers with "managerial" skills (for example, systems administrators, project managers, and coordinators/managers of teams of software professionals across various countries). Also, further up the software value chain, consultants who can advise clients about their technology needs were reported to be in short supply. Finally, our interviewees reported a great need for researchers, architects, and visionaries of the kind for whom the job market is truly international and who therefore tend to gravitate abroad. As one researcher told us, "Tenure at a U.S. university trumps pay" (interview, Venkatratnam). The shortage, in the views of the managers we talked with, appears to be more critical at the middle and upper management levels and in high-skill categories.

If the extent of the labor shortage in the software segment is difficult to pin down, so is the supply. Although the business press and popular press tout the production of 350,000 engineers annually (a figure that has been cited in numerous reports; for example, see U.S. Department of Education 2006), our figures, based on triangulated data from the Institute of Applied Manpower Research, the All India Council for Technical Education, and NASSCOM, suggest that there was an estimated annual supply of 180,000 entry-level software professionals (see Table 8), sufficient to meet current demand, consistent with our interviews with HR managers who argued that the shortages were in specific skills at higher levels. (Compared to

the previously published estimates, ours are closer to estimates found in a January 2008 study by Gereffi, Wadhwa, Rissing, and Ong.)

{{**Table 8 about here.**}}

Other trends have been increasing turnover and declining average tenure: the percentage of employees with less than two years of experience increased from 19% in 2003 to 33% in 2004 (NASSCOM 2005). In 2003, 77% of the organizations met their recruiting needs through "lateral" hires (NASSCOM 2004). Further, 32% of the 25,000 hires planned by Infosys in FY 2006–2007 were lateral hires. As a result, every software firm has reported increases in turnover in recent years (ranging from 15% to 20%), leading to a high degree of "poaching" at middle management levels in the software segment.

The BPO segment. This fast-growing segment employed about 415,000 people in 2005–2006. Estimating future demand in this industry is problematic, given the rapid growth rates (50% per year, on average), the increasing interest in outsourcing in the West, and the expansion of India's outsourcing "footprint."[10] A NASSCOM-McKinsey study projected a stock of 1 million jobs by 2008–2009, while a NASSCOM-KPMG study forecast a stock of 1.41 million by 2009. To the extent that past growth is an indication of future growth (at least over the next three years), the above estimates seem reasonable. After taking into account the current available pool, the annual intake, productivity improvements, and current rates of turnover, the KPMG study estimates a shortage of 262,000 people by 2009.[11]

We are aware of no readily available data, published or unpublished, regarding the supply of English-speaking graduates (who are particularly important for customer service jobs) to the BPO segment. Two problems make accurate forecasting difficult here. The first problem is the absence of good statistics regarding the output of graduates generally,[12] and the second, more critical problem is the difficulty in estimating the number of English speakers available for the BPO call centers. Most human resource managers we talked with expected a much greater shortfall than that estimated by NASSCOM,[13] probably due to differential estimates of available English-speaking graduates. Table 9, which shows our own estimates of HR supply for the low-end BPO segment, suggests that in 2005 there was a pool of 250,000 graduates who were potentially available for work. If we allow for various "unaccountables," we obtain a more conservative estimate of between 150,000 and 200,000. But not all of these graduates are capable of being hired. And given that the annual intake into the BPO segment is about 120,000

and growing, a shortage of 262,000 bodies (that is, of hirable workers, quality aside) by 2008–2009 is a certainty. The high turnover rates (discussed below) are not entirely a function of current shortages, however.

{{**Table 9 about here.**}}

Beyond the shortage of English-speaking workers, our interview subjects highlighted shortages in "industry-ready," "industry-relevant" manpower, that is, a scarcity of professionals who are equipped with the necessary "domain" knowledge to cater to specific "verticals" (industry segments) such as banking, insurance, telecom, retail, and manufacturing (Mitra 2004). Also remarked were shortages in the supply of foreign language skills, notably in French, Spanish, Mandarin, German, and Italian, that make it difficult for Indian BPOs to expand their presence in European and Asian markets (Indian BPOs derive 82% of their business from the United States and United Kingdom).

As of this writing (July 2008), there are relatively few current shortages in the R&D segment. The financial segment's need for skilled researchers and data analysts is being met via the country's large number of master's-level graduates in mathematics and economics. In the life sciences, there are no shortages, as science postgraduates are available currently. Neither are shortages reported in engineering services, although the rapid growth in that arena will force it to compete with the software segment for engineers, and with traditional manufacturing, which is also growing. In software R&D, there are, as noted, desperate shortages of visionaries. However, given the growth in the R&D services, more skilled scientists and researchers will be needed quickly, and the Indian education system cannot in the near term increase its output of scientists and engineers (we discuss this in greater detail farther below).

High Turnover

The industry is facing high rates of turnover, ranging from approximately 20% in the software segment to about 50–60% in the BPO segment. In the case of the software segment, average turnover was about 20% during the boom years of the Y2K crisis (1999–2000), but subsided to "normal levels" in 2001–2002 in conjunction with the slump in the U.S. economy (the bursting of the dot-com bubble). While a range of 6–9% turnover in the top 10 firms was

considered "normal" until 2002 (interview, Limaye), in July 2003 average turnover began increasing in these firms, reaching 22% by 2004, as Indian software firms stepped up their hiring. Wipro reported a turnover rate of 17% in 2004, and Infosys reported that turnover increased from 7.9% in 2003 to 10.5% in 2004 and 11% in 2005. Average turnover in the top 10 software firms was over 20% in FY 2006–2007.

Attrition in the software segment varies by specialty and level. While most of the HR managers we interviewed felt that the turnover situation is under control as long as the attrition rates are high at the entry level and not at the middle and senior levels, the entry and expansion of large MNCs such as IBM, Oracle, and Accenture into India have resulted in considerable "poaching" of developers, project managers, and high-level executives. Currently (as of Month Year), attrition at the junior and middle management level is close to 25%.

While we are unaware of any systematic studies of turnover in the software segment, our sense is that a primary cause of attrition—more important than pay and benefits—is the lack of opportunities to work on cutting-edge technology. This is a young, very well-educated work force with high average earnings (see Table 10). A 2004 survey showed the average age of software professionals to be about 28 years; 76% were male, 50% had more than three years' tenure, and 81% had graduate degrees (69% were engineers, 17% had graduate qualifications in engineering, cost accounting, chartered accounting, or business, and 14% were diploma holders or graduates in other social science fields) (NASSCOM 2005).

{{**Table 10 about here.**}}

The BPO segment. Turnover estimates range more widely for the business process outsourcing segment than for the software segment. Most reports of BPO turnover quote numbers in the neighborhood of 30–40%. Commercial and popular reporting tends to focus on the extremes, that is, turnover as low as 12% and as high as 90%. One large BPO company "said high staff turnover rates had forced it to replace 90 per cent of the 14,340 employees in its largely call center-focused BPO business in the last year" (McCue 2005:1). A 2004 study of turnover in 7 large "third-party" call centers, which we consider more representative, showed average turnover of 30%, with a range from 12% to 62% (Remesh 2004). In general, turnover is lower in "captive" BPOs than in third-party BPOs. We found turnover rates in five captive firms to be between 15–20%, although even some captives reported rates as high as 30%.

There is job-based variation in turnover as well. Average turnover in "voice-based processes" is 45–50%, while in "non-voice" operations it is 15–20% (Remesh 2004). Further, "infant mortality" (turnover in the first 45 days of employment after training) in voice-based processes is about 20% (interview, Varadarajan).

Causes of turnover. Although there have been no systematic published studies regarding the causes of turnover in the outsourcing industry, our findings, based on interviews with HR managers[14] who shared the results of "exit interviews" with us, suggest that there is remarkable consistency in the causes of turnover across firms. Most HR managers we spoke to agreed, for example, that 50% of employees who leave a firm exit the industry completely, while 50% move to another company. Most HR managers also seemed to identify as the main causes of turnover the four we list below, although there was some difference of opinion across companies about the relative importance of each cause.

This consistency across HR managers' responses is not surprising, given that most firms are experiencing high turnover and that BPO jobs and work force characteristics are similar across BPO firms. The problem is so acute, yet diffused, that some companies are satisfied if they just succeed in maintaining a turnover rate of 20%, since this is below the industry average (interview, Ramesh). Even at conferences that bring industry HR managers together—the HR Summit, for example, which the second author attended in July 2007—the focus of the discussion is not on addressing the underlying causes of turnover, but on the generation of people practices to alleviate the problem (we discuss these below). The same focus is apparent in *HR Connect,* an online magazine for HR managers in the industry. Below, we examine the primary reasons for turnover identified by HR managers.

Job-related reasons. An important issue is dissatisfaction with the immediate supervisor (the "lousy boss syndrome"). Because of the BPO segment's youth (it is just __ years old), the youth of its new hires (most of whom are 19–27), and its high turnover, promotion of young people with only 6 months of BPO experience to positions in which they supervise teams of 10–15 people is not uncommon. Relatively little time is spent training these people to be effective supervisors. These managers do not have the required experience to manage teams of young people who themselves do not have a history of work experience, and who bring a variety of expectations and aspirations with them when they enter the industry. HR managers refer to this

as the "managerial bandwidth" problem and liken it to the problem of trying to create a 10-year-old scotch in 2 years (interview, Limaye).

A second key job-related problem lies in the nature of the work itself. There is considerable agreement in international research (Batt et al. 2006; Deery et al. 2004) that call center jobs are organized in a "Tayloristic" fashion: they are highly repetitive, with tightly regulated lunch and restroom breaks, targets in terms of number of calls to be made, and intensive monitoring of employee activity. Indian call centers apparently fit this description (Remesh 2004). Decrying the electronic surveillance at work, a BPO worker said, "We're treated as bonded labor" (Nadeem 2006:16). These workers, who are sometimes pejoratively called "techno-coolies,"[15] must cope with considerable stress on the job (see D'Cruz and Noronha 2006 for an elaboration). These workplace conditions and others—especially the night shift schedules required to provide service to U.S. clients during North American daylight hours—have resulted in an outbreak of what the industry calls BOSS (burn-out stress syndrome), an important cause of turnover. In response to the growing number of employees seeking counseling services and psychological help, more and more organizations (including trade unions) are offering such help. The Young Professional Collective in Mumbai, for example, is organized by a well-known labor lawyer and staffed by well-known labor activists.

Finally, there are limited avenues for career advancement in a BPO firm (although the labor shortage to some extent alleviates this problem). This lack of opportunity is borne out both by our own research and by previous studies. Batt et al.'s (2005) survey of 60 call centers revealed that over the period of the study, 15% of the existing stock of employees at that time were promoted to higher positions within the call centers, but only 1% were promoted to upper management levels beyond the call center sections of the organizations. Our research suggests a more nuanced picture: captive call centers are able to provide more promotions to higher levels than "third-party" call centers, because the market stability they enjoy fosters longer career paths than in third-party call centers.

Demographic profile of workers. Another important reason for turnover is the demographic profile of workers, raising the question of whether the industry is targeting the appropriate labor market segment. Most young people who work in call centers are marking time, with the goal of earning a good salary for a couple of years before continuing their education. Second, call center employees are disproportionately women, many of whom leave

once they get married. The demographic picture of a substantial cross-section of workers in a large third-party BPO is particularly instructive. Remesh's (2004) survey of 277 workers suggested that 75% of BPO workers were graduates of convent schools (private schools that are relatively expensive, typically run by the Catholic or Protestant churches, and noted for their superior and English-based education); furthermore, 94% of their fathers and 63% of their mothers, many of them working for the government, were also graduates of such schools. Members of this slice of the Indian middle class aspire to higher-level professional and government jobs, and are only temporarily attracted to the higher BPO salaries (the average BPO and call center salary of Rs. 10,000 per month in 2005 represents about 2.5 times what a graduate could earn in, for example, civil engineering).

Psycho-social factors. A number of "psycho-social" factors affect turnover. For upper middle-class students, working on the night shift is an alienating experience. They are not able to meet their friends in the evenings or to see their family regularly. By the time they get home, other family members have gone to work. This "distancing" is new for these young people. In other cases, middle-class parents of BPO employees disapprove of the work, complicating their children's feelings toward it. Pradhan and Abraham (2005) suggested that "the new working habits and patterns of living, that is, working late into the night, the pub culture, the consumerism, are in complete contrast to ways of living together, value systems, traditions and beliefs still nurtured by the middle class" (p. 4). Other parents disapprove because they feel that their children are lured by easy money and will forgo the chance to pursue higher education. Yet others worry about their daughters' reputation.[16]

Further, Pradhan and Abraham (2005) have argued that having to adopt a different name and persona during work hours—an Indian girl named Anjali might become Angie at night, for example, and assume an American accent when speaking to American customers—can induce identity confusion and lead to "multiple personality disorder," cultural self-alienation, and a sense of "dissonance." (See D'Cruz and Noronha 2006 for an argument regarding how the assumed name helps people deal with some workplace issues.)

The factors described above are not the only ones responsible for high turnover, but they are the major reasons identified by the human resource managers we spoke to. As remarked earlier, although these respondents were from diverse firms in the BPO segment and their

comments did show some cross-firm variation, the level of their agreement on the main outlines of the explanation for high turnover was remarkable.

Increasing Human Resource Costs

Low cost has been a key advantage for India's outsourcing industry. Table 11 compares costs in the United States and India for a number of jobs in both the software and BPO segments in 2002–2003. A triangulation of data from various sources indicates that the cost of software and BPO employees in India was about 15–20% of that in the United States. Rising costs are not a significant issue in the high–value-added portions of either software or BPO work, where the competitive advantage is based more on skills. In software, cost increases have been incremental and steady, by and large (one notable exception being a 17–20% average increase in 2004). Until recently, these higher-end jobs tended to be filled on a "just-in-time" basis—that is, hiring took place only when a company obtained a contract for a project—but the industry has now shifted to "recruiting for the bench," building up a stock of workers with skills that are in short supply, to be called on when needed. It is at the lower ends of both segments that the rise in costs threatens the industry's growth.

{{**Table 11 about here.**}}

Our research shows that about 45% of the average BPO organization's costs are accounted for by employee expenses, 35% by telecom and bandwidth fees, and the remaining 20% by other costs, such as administration and marketing. The largest of those categories, employee costs, has three critical components, all of which have been increasing: salaries; recruitment and training; and employee transportation to and from work.

Salary costs have been increasing as a consequence of the tight labor market and high turnover in this segment. Our research on larger BPO firms suggests average total salary cost increases in the range of 14–15% per year over the 2003–2007 period, consistent with the estimate of 12.5% by GE Capital International Services (GECIS), a leading BPO firm. The increase in compensation costs, however, has been almost perfectly offset by a decline in bandwidth costs. Between 2001 and 2005, average bandwidth prices fell by approximately 20%

per annum.[17] Although bandwidth costs are expected to decline further, telecom costs have increased (largely as a result of the explosive growth of the BPO industry).

However, it is the increase in the other two components of employee costs that is the problem. The second component consists of recruitment and training costs (including training time). Given a declining recruitment conversion factor that, as of 2007, averaged only about 4% (only 4 out of every 100 interviewed could be hired), firms have had to cast larger and larger nets, and the associated costs (advertising, recruiters' travel to other cities and university campuses) increased by over 25% between 2004 and 2006, according to the managers we spoke to. As for training, it has grown more costly in almost every respect, driven, in large part, by shortages of trainers. In the call center industry, it takes about 14 weeks of training before an employee is ready to work in a job servicing the U.S. market. There are three types of training. The first type includes communication, grammar, vocabulary, pronunciation, and "accent neutralization." The objective of such training is to ensure that communication is "free of first language influence that impedes comprehension, often referred to as 'Indianisms' in industry parlance" (Ramachandran 2006:1). To quote a training manager,

"The industry uses standard formats when it comes to modules on accent and culture training. After rigorous training in neutralizing accents, voice modulation, moderating the rate of speech, intonation and so on, call center associates step into their new personas. That's where an Alok transforms into an Alex. (InfotechOnline 2006:2)

The second type of training, which overlaps with the first to a large extent, is training in the client country's culture (loosely defined, and focused on certain icons such as baseball); in a number of "soft skills" (ability to build rapport by using the appropriate tone, for example); and in comprehension skills (understanding the customer's query, providing appropriate solutions, and understanding different U.S. accents). Both of these components, according to a communications coach within a BPO, "help call center agents 'zap the gap' and earn credibility" (Ramachandran 2006:1).

The final type of training is in technical and project-specific skills. This training is particular to the project or industry the employee is associated with (for example, financial products).

As the recruitment conversion factors decline, training time increases. Shortages in training staff, especially in staff who can deliver instruction in "culture" and accent neutralization, contribute to increasing salary costs. Arguably, these costs would decrease if the activities could be outsourced, but the HR managers we interviewed in this industry said they were not satisfied with the quality of labor market intermediaries (firms that would recruit, train, and supply staff).

The final component of employee costs concerns employee transportation to and from work (a cost that in other countries would be borne by the taxpayer in the form of efficient public transportation systems). Given the absence of effective and safe public transportation, especially at night (which is when call center employees work to service the U.S. market by day), BPO companies provide transportation to their workplaces (most are located on the outskirts of major metropolitan areas). Safety concerns are so important (especially the safety of female employees, who comprise about 50% of the work force) that even if the most economical route for a van carrying six employees might be to drop off a female person last, she must be dropped off before at least one male colleague. Training and discipline of drivers is also important. To keep a check on security, a BPO company called EXL, based in New Delhi, installs radio systems with which drivers can report back to the base station every 5 kilometers. Further, at least once a week, EXL checks each company shuttle at a random time and place in the city (Aggarwal 2003). The cost of managing a large transport operation is high. Our estimates, based on interviews with HR managers, suggest that transportation costs account for as much as 10% of employee costs. Most BPO companies have a full-time vice president to oversee transport operations. For example, in 2004, EXL had a work force of 2,600 and a fleet of 150 vehicles from 7 different vendors to cover about 440,000 person kilometers each day. The expenses per employee of this operation worked out to about Rs. 2,500 per month, which is approximately a quarter of the average monthly wage. The industry average was much higher, at about Rs. 3,500 per month in 2004 (interview, Vijayabhasker).

Thus far, increases in human resource costs have been partially offset by declining bandwidth costs. And costs are not relevant for the smaller part of the segment that is engaged in higher-value-added activity. However, since low-cost customer care work still constitutes the bulk of the industry, public policy initiatives that could result in better urban transportation

systems or produce more English-speaking graduates could significantly reduce HR costs and help maintain the industry's competitive edge.

Developing Long-Term High-Skill Human Resource Capability

Of the four problems, this is perhaps the most critical one, given the "upward" trajectory of the outsourcing industry. We argue that India's postgraduate education and research system cannot yet generate high-level skills of the kind that are required for growth in the high end of the industry, particularly the software and R&D segments. Several indicators support this argument.

First, government spending on research and development is considerably lower in India (0.0843% of the country's GDP in 2007) than in some competing countries (2.8% of South Korea's GDP, for example). In fact, government spending on higher education as a proportion of GDP fell from 1% in 1971, to 0.8% in 1981, to 0.6% in 1991; in 2001, it was 0.4% (Mahadevan 2006). Further, the proportion of expenditure on higher education to total expenditure on education declined from an average of 15% in the 1980s to 10% in the 1990s (Kapur and Mehta 2004). The lack of focus on research is reflected in patent data. Table 12 shows the movement in utility patents filed in the United States by a number of countries between 1980 and 2005. While Korea increased its share from 0.03% of all patents in 1980 to 4.24% in 2005, India showed only a modest increase, from 0.021% to 0.37%. This is also considerably lower than the increase posted by China. Within India itself, more foreigners than Indians have been filing patents: in 2003–2004, foreigners obtained 1,400 patents, Indians 1,200. India also ranks very low on the technology achievement index (0.21, compared to the United States' 0.73, in 200__), and has one of the lowest numbers of research and development personnel per capita (World Bank 2001).

{{**Table 12 about here.**}}

Second, India is not appreciably increasing its production of doctorates in scientific fields (critical for the future of the outsourcing industry). The total number of doctorates in science produced in India has been stagnant (from 3,861 in 1996 to 3,896 in 2000). What is even more worrisome is that the proportion of doctorates in science out of total doctorates has been steadily

decreasing (from 50% in 1974 to 38% in 2002), while the shares of doctorates in arts and business have increased. Nor has the supply base of potential doctoral students been growing; on the contrary, there has been a long-term decline in the proportion of students who are studying science in college, which fell from 31% in 1950 to 20% in 1990 (University Grants Commission 2007). Further, the number of engineering and technology Ph.D.s received in India is low (298 in 1997)—indeed, substantially lower even than the number of Ph.D.s in engineering and technology received by Indian citizens studying in the United States. Clearly, few Indians wishing to undertake scientific research choose to do so in the doctorate programs of Indian universities. Most of them instead prefer either to enter educational institutions outside India, where they can more easily work on cutting-edge research, or to join industry research staffs, where they are paid a higher salary than they could obtain if—taking the other main potential career path open to them in India—they chose to become research assistants or associates (whose pay is low because it is capped by the University Grants Commission).

Third, the poor quality of doctoral education in India has been a long-standing problem (Chatterjea 2007). The India Science Report published in 2005 found that 14–15% of doctorates in science were not employable after their studies, in spite of the rapidly increasing demand for researchers. Chatterjea and Moulik (2007) argued that although doctoral education in colonial India produced a number of world-renowned scholars, doctoral education since independence (with a few notable exceptions) has been hampered by poor faculty quality, a lack of resources, poor leadership, and severe infrastructure problems.

It is not hard to find concrete evidence that India's advanced education system suffers (with a few notable exceptions) from quality problems. For example, in 2007, not a single Indian university was among either the world's 300 top-ranked universities (as compiled by the Institute for Higher Education at Shanghai Jiao Tong University) or the top 10 universities in Asia (despite the few "islands of excellence" such as the Indian Institute of Technologies [IIT]). India occupied the 33rd position among all countries in terms of research quality (the United States ranked 1st, China 19th, and South Korea 21st).

It is therefore not surprising that India does not fare well in terms of the quality of its research either. Over the 1998–2005 period, India's *share* of all papers published in journals listed by the Science Citation Index did increase by 14% (from 1.57 to 1.79), but China's increased 93% (from 1.90 to 3.68), and Brazil's, 44%. Further, even in the best institutions,

citations per faculty member are low; at the IITs, for example, the 5-year citation count per faculty member has been 2 or 3, compared to 45 at MIT and 52 in Stanford's engineering department (Hearne 1999). Thus, advanced educational institutions in India have historically done little basic research, and such research as they have done has not spawned business, as has happened in Silicon Valley. As one professor noted, "We don't have an entrepreneurial culture, nor have we a well-developed research infrastructure" (interview, Parthasarathy).

The poor quality of advanced education is further reflected in engineering (which is critical to the nation's economic development). Although there has been an increase in the number of privately run engineering colleges in many Indian states, which has contributed to the increasing output of engineers (Puliyenthuruthel 2006), the All India Council of Technical Education has eliminated about 22,722 seats at 300 engineering colleges because the colleges lacked faculty, courses, and infrastructure. Of course, the country's first-tier and second-tier engineering institutions, such as the IITs and the Regional Engineering Colleges, are world-famous for their student quality, but it is the third-tier engineering colleges that produce 88% of engineering undergraduates, 66% of engineering postgraduates, and 82% of engineering faculty (Cairncross 2006). Some of these colleges have neither electricity nor access to computers, suffer from a shortage of faculty, use textbooks that are decades old, emphasize rote learning, and base grading exclusively on test scores (Sullivan 2007).

A key issue is the shortage of faculty. If engineering colleges have increased in number, engineering Ph.D.s have not, raising the question of where the faculty in these new colleges are coming from. Even in the best institutions, such as the IITs, there are critical shortages. Several departments at IIT Delhi are facing a 40% shortage in faculty, the problem being most acute in computer science, chemical engineering, and electrical engineering (Sinha 2002). The other IITs (IIT Kanpur, IIT Kharagpur, IIT Bombay, IIT Madras, IIT Guwahati, and IIT Roorkee) are facing similar shortages in faculty, between 20% and 35%. For example, Sinha noted that when IIT Delhi advertised faculty vacancies in its chemical engineering department, 120 applications were received, of which 18 were selected for a final interview—but not one of the interviewees was deemed qualified for the positions. The faculty shortage is even more acute outside the engineering arena: in 2006, at non-engineering departments in regular public and government-aided colleges in ten Indian states, more than 22,500 vacancies for lecturers went unfilled for lack of applications.

It is not our intention to recapitulate the considerable prior literature that has highlighted problems facing India's higher education system in general (see Chatterjea and Moulik 2007). But even our selective review makes it quite clear that the country's higher education system may not be equal to turning out highly educated engineers and researchers either in the numbers or of the quality required to meet the future needs of a growing outsourcing sector.

Summary

The HR problems we have discussed do not uniformly affect the different segments of the outsourcing industry. Skill shortages affect both software and BPO segments. The problem of high turnover is particularly severe for the BPO segment, less so for the software segment, and, at least as of this writing, non-existent for the R&D segment. The problem of rapidly increasing HR costs affects primarily the BPO segment. India's difficulties in generating high-level skills affect all three segments, but especially the software and R&D segments. The varying severity of these problems across the different segments makes it difficult to determine precisely how they are affecting the growth of the *whole* outsourcing industry. In addition, the high growth rate of the industry in general makes addressing these problems less urgent from the standpoint of policymakers and firms.

However, industry leaders have increasingly been complaining about lost business opportunities. The high turnover has led to increased "poaching." Some clients have moved India-based call centers to the Philippines and China. Some software outsourcing opportunities have been lost to Romania, Hungary, and Estonia. Perhaps most compelling as a sign that skill shortages are affecting business is the frequently heard complaint about the quality of new recruits. One manager in a well-known Wall Street firm that has its own software support unit in India told us that "we are really scraping the bottom of the barrel now and are hiring engineers from third and fourth tier schools who have very little engineering knowledge at all" (interview, Rajan). Another manager told us in June 2007 that in his opinion, one should expect to see the growth of the Indian industry begin to decline, given the declining quality; "The boom is bust," he said (interview, Krishnakumar). On the other hand, India still remains the dominant

destination for a variety of outsourcing work that requires English-speaking ability. Thus, the current high growth rates mask to some degree the immediate effects of underlying skills shortages, but the long-term sustainability of the industry is surely in question if some of the macro problems are not resolved.

Addressing Macro and Micro HR Problems

The combined problems of skill mismatches, skill shortages, and hindrances to long-term skill development are not unique to the Indian outsourcing industry. Such problems typically arise when a new industry develops, or when there is a change in development strategy. For example, high turnover was a key problem in the early development of the Japanese silk industry (Taira 1970), the Japanese automobile industry, (Cusumano 1985; Okayama 1986), and the U.S. automobile industry (Sward 1968). Similarly, Singapore, Korea, Taiwan, and Malaysia experienced skill shortages and skill mismatches when they transitioned from a low-cost labor-intensive EOI strategy to a higher–value-added EOI strategy (Green et al. 1999; Kuruvilla, Erickson, and Hwang 2002).

Solutions to such problems have differed depending on the institutional context. In the silk industry in Japan, firms introduced the concept of lifetime employment to solve the high turnover problem (Taira 1970). In the Japanese auto industry, employers took a long-term view to solve skill shortages, high turnover, and labor management relations by developing an internal labor market involving lifetime employment, firm-specific broad-based training, and enterprise unionism—institutions that are now well established as distinguishing features of the Japanese industrial relations system. In the case of the U.S. automobile industry, Henry Ford's response to labor strife, absenteeism, and turnover was to introduce the 5-dollar day; subsequently, Sward (1968) wrote, "the company's labor turnover dropped by 90% [and] absenteeism from 10% to 1/3rd of 1 percent" (p. 56). To minimize skill mismatches and optimize long-term skill development upon transition to a new industrialization strategy, Singapore adopted a concerted national effort that involved multiple actors, encompassing multiple institutions, at national, university, and firm levels through a variety of policy mechanisms, include taxation (Kuruvilla, Erickson, and Hwang 2002). Singapore's approach and, more recently, Malaysia's are consistent

with Singh and Zammit's (2000) argument that avoiding skill mismatches and upgrading skills for economic development require a concerted multi-level national effort, with multiple mechanisms and policies that involve multiple actors. Solving both macro and micro HR problems in India's outsourcing industry—problems requiring different policy interventions by different actors—implies, similarly, a concerted, or well-integrated, national effort.

Finegold and Soskice's skills equilibrium framework can be used to translate Singh and Zammit's (2000) perspective into more concrete policy advice, and to evaluate the current approaches in India. Finegold and Soskice (1988) argued that moving from one level of skill equilibria to another (avoiding skill mismatches, in other words) requires that different actors in the system take concerted and reinforcing action. For example, individuals must be willing to invest in appropriate education and training, firms must be motivated to develop and retain employees, and governments must be motivated to ensure that there are no skill shortages. Three categories of institutional and market-based conditions are prerequisites for forcing this kind of action: conditions that force actors to take a long-term outlook to ensure that institutions counter pressures from capital markets to focus on the short-term; factors that encourage inter-firm cooperation within a competitive environment; and either an export orientation or exposure to international competition.

In the Indian case, the market prerequisite, exposure to international competition, is clearly met in the case of the outsourcing industry, since it is internationally focused. Table 13 summarizes what the actors have recently been doing to meet the various institutional challenges. The data in Table 13 are discouraging with respect to both categories of institutional imperatives: the actors do not appear to be taking a long-term view, and it is not clear that firms are "collaborating" within a competitive environment. Below, we characterize the changes in the actors' current strategies and highlight other policy options.

Taking a Long-Term Outlook

Governments can play an important role in increasing the *supply of skilled labor,* in a number of ways. They can, for example, introduce courses of study relevant to industry needs, and provide incentives for the private sector to enhance language and communication skills for

the industry, something the industry has demanded for quite some time. They can assist the BPO segment by screening college graduates for their readiness for work. Focusing on the low-cost BPO segment, state and city governments have a key role to play in *reducing HR costs* by improving the public transportation infrastructure. Providing safe, reliable public transportation would shave about 40% off the human resource costs in the low-end BPO segment.

{{**Table 13 about here.**}}

Governments can also help reduce both *recruitment and training costs.* Some state governments have introduced various assessment tests to evaluate work "readiness," helping streamline the flow of college graduates to the BPO segment. Column (3) of Table 13 details the variety of actions taken by the central government and state governments. We characterize these steps as tentative, preliminary, and variable, with little coordination between the central government and state governments.

If India's central government and state governments have been slow to act in some areas, they have almost completely ignored the arena in which they have the greatest contribution to make, that is, the development of *long-term high-skills human resource capability.* Furthering this objective requires improving the higher education infrastructure to produce more high-skilled and doctoral-level researchers, scientists, engineers, and postgraduates in a number of different disciplines for the knowledge processing and R&D segments. In short, governments must create the kind of self-sustaining high-skills eco-systems that are found in Silicon Valley (a model for Bangalore and Hyderabad, as Saxenian [2000] noted), the Boston high technology corridor, Cambridge (U.K.), and the "high mech" clusters in Emilia Romagna in Italy (Finegold 1999; Locke 1995).

Some key elements needed for self-sustaining eco-systems are (a) "catalysts" in the form of growth stimulants (in this case, outsourcing); (b) nourishment in terms of both venture capital and human capital, the latter through symbiotic relationships between industry actors and educational institutions; and, perhaps most important, (c) a supporting environment (infrastructure, schools, opportunities for culture and leisure activities, regulatory regimes that promote innovation and risk-taking, and so on). India faces considerable deficits in the nourishment dimension. Increased government spending for education or increased private contributions to education are also necessary. (Tuition revenues at some of the nation's top-ranked public universities account for less than 2% of the university budget! [Chatterjea 2007].)

With the exception of a few private institutions, the Indian education system is run by the state and central governments. There is some evidence that the country's top educational institutions are becoming more entrepreneurial, developing the symbiotic relationships with firms that are a hallmark of nourishment in the Silicon Valley high-skills eco-system. The key challenge, however, is improving the second- and third-tier institutions so that they train students better, foster more research, attract better faculty, and establish symbiotic ties with outsourcing firms, following the pattern of the first-tier institutions. This will require a complete re-evaluation of a heavily entrenched higher education establishment to produce high-quality professors, high-quality students, and better research. Any re-evaluation must recognize that large-scale reform in public universities is necessary, since almost every dimension of higher education needs change (Chatterjea 2007).[18] Financial issues—notably, the low pay for professors and research associates—loom especially large.

The *industry association (NASSCOM)* has thus far been more pro-active than government in taking a longer-term view of the development of the industry, and has introduced a number of initiatives to address both short-term labor supply issues and longer-term skill development issues. Attracting favorable public notice have been NASSCOM's short-term responses (reported in Table 13) to *address labor supply problems* and *reduce recruitment and training costs* for the BPO segment, such as its certification program for managers to solve the "managerial bandwidth problem," its introduction of a national assessment tool to help identify new talent for the industry, and its creation of a National Skills Registry. Taking a longer-term view, NASSCOM recently began funding new English language training schools to increase the supply of English speakers (Sengupta 2006). In addition, it has sought to increase the *supply of skilled labor* for the software segment through its IT Work Force Development Program, which includes the sponsoring of linkages between firms and academia; a number of leading software companies (for example, Mind Tree, TCS, SUN, Symphony, Aditi Technologies, Intel, Thought Works, and Philips Software) are active participants in this initiative.

Firms, the most important actor, have not yet taken a long-term perspective, but are beginning to do so. HR managers defend their inability to take a long-term view to control attrition in BPOs given the headlong growth of the BPO segment. As one manager said, "All we do is recruit and recruit to keep up with the demand" (interview, Varadarajan). Some of the larger firms are recruiting 4,000–5,000 employees per month! Firms' strategies to control

turnover are listed in column (3) of Table 13, and a more detailed evaluation of BPO firms' strategies to control turnover can be found in Ranganathan and Kuruvilla (2008).

An interesting illustration of the shift from short-term thinking to a more long-term orientation can be found in the change in focus of employee retention strategies. Initially, BPO firms adopted strategies specifically designed to attract and retain a young work force, by portraying the segment as a fun place to work. At Wipro BPO, one of the largest BPOs, "fun is a core, written-down, defined value which is even linked to the performance management system whereby employees are rewarded for living up to the value of fun at the workplace," notes its Vice President for Talent and Engagement. He adds, "Make no mistake, fun is serious business here [as it] helps reinforce the values of the organization" (*Economic Times* 2004:1). Consequently, HR departments have focused on a variety of ways to make work-life fun—parties, outings, pleasant physical work environments, state-of-the-art recreational facilities, multi-ethnic restaurants, and so forth. These strategies are coordinated by a new cadre of "fun officers." For example, Progeon (now called Infosys BPO) has hired a "Chief Fun Officer" (CFO) who articulates new "fun" strategies. Our research suggests that all large BPO firms have these fun culture events (given the benchmarking that takes place).

However, BPO firms have now started taking a more long-term and strategic perspective regarding turnover, by trying to address its underlying causes better. Table 13 lists initiatives indicative of this new emphasis. Some examples are sponsoring career development programs, education programs, and multi-training; developing job enrichment strategies, which include outsourcing "boring work" and breaking up the company work force to locate some positions in smaller cities where skills may be in greater supply; finding ways to attract and hold older workers; and introducing stock-option plans. Furthermore, to counter the disapproval of conservative middle-class parents, who see BPOs as eroding traditional values and corrupting their children, many firms have introduced policies that seek to "embed" the family into the workplace through a variety of mechanisms (such as allowing family visits, providing jobs to siblings, and sponsoring family days). In addition, Indian firms have begun outsourcing some of their "outsourcing" work to some of their subsidiaries in China, the Philippines, Malaysia, Brazil, Romania, Morocco, Romania, and Uruguay.

Collaboration in a Competitive Environment

Collaboration within an environment strongly marked by competition (both inter-firm and between firms on the one hand and other actors on the other, such as governments, industry associations, and educational institutions) has proved successful in addressing a variety of human resource problems, such as skill mismatches, inadequate skill development, and recruitment shortfalls (Finegold and Soskice 1988; Kuruvilla, Erickson, and Huang 2002). Collaboration between competing firms has not yet occurred in the outsourcing industry, where there is a high degree of poaching as firms compete for talent. Leading firms have tried to establish "no-poaching pacts"—the two key elements of which are pledges by each firm (a) not to poach employees from the other firm(s) and (b) not to hire employees from other firms within three months of their leaving their last employment—but with little success (*Economic Times* 2006).

One way forward is collaboration among firms to set up, fund, and manage training schools from which they can collectively draw talent, with each firm entitled to claim a percentage of the graduates in proportion to its contributions. Centralizing training at the industry level has the potential to raise the quality standards of the industry as a whole, in no small measure by helping to solve the problem of a shortage of adequately qualified trainers. It could eliminate the unevenness in quality that we see today and simultaneously guarantee a steady supply of well-trained graduates for those firms that invest in the system. The dynamic industry association NASSCOM could play a key role in bringing such a scheme to fruition. Leading firms have already begun collaborating with academic institutions. Table 13 lists a number of instances in which firms have established joint research and training programs with the top academic institutions in the country in order to address the longer-term human capital issues.

In sum, although governments, firms, and the industry association are increasingly taking a long-term view, and are beginning to find ways to collaborate in a competitive environment, by no means can it be said that India has developed a *concerted and integrated* national multi-level effort to solve the HR problems of the outsourcing sector along the lines suggested by Singh and Zammit (2000) and Finegold and Soskice (1988). It is possible that the micro HR problems will be solved as growth rates slow, the industry consolidates even further, and the current strategies of actors yield success. However, achieving the larger macro goal of ensuring a supply of high-

skilled labor for the long-term growth of the industry requires major changes in the government's macro human resource development policies (especially the restructuring of higher education), changes that have yet to be undertaken. Until such efforts are made, the potential of the outsourcing industry to be the primary "development engine" for India will not be realized.

Conclusion

Our case study reveals a new industry that is experiencing rapid growth, is increasingly vital to Indian economic development through its contribution to GDP, exports, and employment, and demonstrates a potential for long-term growth and development as the appetite for outsourcing increases in developed countries. Blinder (2007) suggested that between 210–284 occupations, comprising roughly 22–29% of U.S. employment, are potentially off-shorable, and the rate at which jobs are being off-shored is increasing rapidly enough to lend credence to Indian planners' estimates that the sector will triple in size over the next five years.

The industry is undergoing a discernible transformation from low-cost services to higher–value-added services. The software segment, for example, largely draws its revenues from the provision of software services, but Indian firms have also begun to design and market their own software products. The BPO segment is even more varied in terms of the composition of services, with a stable low-cost customer service component and a variety of higher–value-added services. And the rapid growth (30% per annum in recent years) in high-end research and development services, particularly in engineering design, medical research, and financial services, led NASSCOM to treat these processes as a new category effective 2006.

Our study finds that national-level human resource policies threaten to retard the growth of this industry. The resolution of the macro-level problems hindering short-term and long-term HR supply to sustain the long-term development of the industry requires dramatic changes in national human resource development policies, defined in the broadest possible terms. The micro human resource problems, such as costs and turnover, are beginning to be addressed by firms and the industry association, although much work remains to be done. Firms are already experiencing difficulties in recruiting suitably qualified candidates. It is the inter-relationship between macro and micro problems that is the bigger challenge, that is, the development of a

concerted national effort involving multiple levels and actors, suggested by Singh and Zammit (2000). We believe much remains to be done to shore up human resource policy development in India.

More generally, the success of the Indian outsourcing industry has raised the possibility that a development strategy based on the export of low-cost and high-end services is a viable alternative to the more traditional low-cost export-oriented manufacturing strategies for developing countries (especially given the competitive advantage enjoyed by China as a low-cost manufacturer). Several countries have in fact begun to articulate service sector strategies, given the very large potential for increased outsourcing from the West. This case study illustrates that closely aligning macro-level human resource policies with such a development strategy is crucial for the success of the strategy.

APPENDIX A

Acronyms

BPO	Business Process Outsourcing
CMIE	Center for Monitoring Indian Economy
EOI	Export-oriented industrialization
EOS	Export-oriented services
GECIS	GE Capital International Services
IIT	Indian Institute of Technology
IISc	Indian Institute of Science
IT	Information Technology
ITES	Information Technology Enabled Services
NASSCOM	National Association of Software and Service Companies

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FOOTNOTES

[1]These are estimates from Gartner, a consulting firm that follows this industry. The literature is replete with such projections. The first author's analysis of various projections made since 1991 suggests that while there are differences in the numbers, usually the actual growth rate occurring over the two years following a projection has exceeded the predicted rate. We later argue that Western firms' increasing tendency to outsource work, coupled with new ways of outsourcing different jobs, will prove the 12.3% figure to be understated as well.

[2]To provide a comparative perspective, the largest contributor to U.S. GDP is the information industry, at 7.4% (Bureaus of Economic Analysis, U.S. Department of Commerce).

[3]The Americas (where off-shoring is growing at an annual rate of more than 20%) account for 67% of all Indian exports in this industry, while Europe (where off-shoring is growing at a slower rate, with the exception of Britain) accounts for 25%.

[4]Clearly this industry is important. But in a large country like India, it is often a mistake to attribute too much significance to one industry. The Bharatiya Janata Party government lost the 2004 elections partly because it highlighted the outsourcing industry's growth in its "India Shining" campaign, overlooking the fact that the industry touched only a small percentage of the Indian population.

[5]A Smart Classroom is already up and running at Franklin Public School in Santa Barbara, California. A knowledge center set up at the school acts as the nerve center of the network. It is connected through a campus-wide network to the existing classrooms, which simply turn into ETECs (Educomp Technology Enabled Classrooms). The teacher then uses the digital resources, such as animation, graphics, images, and video clipping, while teaching the

chosen topic in the ETEC. For instance, a geography class on volcanoes might include a video on geophysical and other features of volcanic eruptions.

[6]They use an index based on 39 criteria, which are organized under three broad categories with varying weights: financial structure (40%), people skills and availability (30%), and business environment (30%). Each of these categories is further subdivided. For a more detailed discussion of the methodology, see http:/Knowledge.wharton.upenn.edu/article/922.cfm.

[7]In the words of a BPO HR manager, "At the low end of the BPO spectrum, our revenues are linked to BOS—'bums on the seat.'"

[8]The 10 largest software firms in 2006, in descending order by size, were Tata Consultancy Services (TCS), Infosys, Wipro, Satyam, HCL, Patni, I-Flex, Tech Mahindra, Perot Systems, and L&T Infotech.

[9]These are, in descending order by size in 2006, Genpact, WNS, Wipro Spectramind, HCL BPO, ICICI OneSource, IBM Daksh, Progeon, Aegis BPO, EXL, and 24/7 Customer.

[10]One example of the difficulty of making estimates in this rapidly growing industry (and of using the past as a basis for future predictions) can be seen in the experience of recent years. In 2003–2004, the BPO industry added 55,000 jobs. At that time, NASSCOM predicted that over the next two to three years, the industry would grow by about 55,000–70,000 jobs. But in the next year alone (2004–2005), 95,000 jobs were added.

[11]NASSCOM's estimate is that 1.416 million would be required. Productivity increases would reduce this figure by about 413,000, leaving 1.003 million. The expected supply by 2009 is 741,000, leaving a projected shortfall of 262,000.

[12]The absence of figures stems from the division of responsibility in the education sector of India. This sector is on the "concurrent" list, which means that it falls under the jurisdiction of the central government and state governments (Dossani 2006). In addition, several states permit the private sector to operate schools and colleges. Furthermore, no central statistics agency covers all these sectors.

[13]At least three factors could, however, mitigate the shortfall. First, the number of English-speaking graduates could increase, as more and more attention is paid to spoken English in educational institutions and private training institutes. Second, it is possible that graduates who have not been attracted to this industry will be motivated to join it in the future, especially

given the growth in salaries. Finally, the number of educational institutions may increase, consistent with prior trends, although it is unclear where the faculty will come from (there is a shortage of faculty). In fact, the number of private training institutes claiming to provide training for the BPO industry has grown dramatically over the last few years.

[14]NASSCOM sponsors an annual summit for HR managers to discuss common HR problems. The first author attended the NASSCOM HR summit in Mumbai in July 2004, and the second author attended the NASSCOM HR summit in Chennai in July 2007, where she interviewed a sample of 12 HR managers from predominantly large firms. The top firms closely benchmark each other in terms of HR policies. As such, there is not a lot of variation in practices between large firms.

[15]Manual laborers from Asia, particularly China and India, in the 19th century and early 20th century were called "coolies." The term is used pejoratively today.

[16]An advertisement commonly used by critics of BPOs and their impact on traditional values in India goes as follows: "Your daughter leaves home in the evening, all dressed up, but comes back in the early hours of the morning, looking disheveled and tired. What does she do?"

[17]Although there is a lot of variation in the ways in which people calculate bandwidth pricing (the normal way is to use the cost of leasing a 1 Mbps link between two cities, such as Mumbai and New York), most data show a steady decline, and this decline has more than offset the increase in wage costs at BPOs for some time. GECIS suggested that if the index for full-time employee costs stood at 100 in 2003, by 2005 it was only 86. NASSCOM's strategic review in 2006 reported similar figures.

[18]As a matter of interest, the gross salary for a senior professor at the IITs is roughly $675 per month, not very different from what his or her student would earn at an entry-level job in the high-tech industry. While professors are allowed to consult (they retain 65% of the revenues), not many of them do the cutting-edge research that provides consultancy opportunities.

Table 1. Growth of India's Outsourcing Industry.

Year	*Total Industry Value (US$ billions)*	*Total Industry Growth Rate*	*Software Segment Value (US$ billions)*	*Software Segment Growth Rate*	*BPO Segment Value (US$ billions)*	*BPO Segment Growth Rate*	*Hardware Segment Value (US$ billions)*	*Hardware Segment Growth Rate*	*R&D Segment Value (US$ billions)*	*R&D Segment Growth Rate*
00–01	12.1	48%	7.8	47%	1.0	66%	3.4	42%	NA[a]	NA[a]
01–02	13.4	11%	8.7	12%	1.6	60%	3.2	–6%	NA[a]	NA[a]
02–03	16.1	21%	9.9	14%	2.7	68%	3.4	6.2%	NA[a]	NA[a]
03–04	21.6	34%	10.4	5.5%	3.4	26%	5.0	47%	2.9	
04–05	28.4	31%	13.5	30%	5.2	53%	5.9	18%	3.9	34%
05–06	37.4	32%	17.8	32%	7.2	38%	7.0	19%	5.3	36%
06–07	47.8	28%	23.7	33%	9.5	32%	8.2	17%	6.5	23%
2009	62	24%	28	9%	21	64%	13	29%	NA[b]	NA[b]
2012	148	46%	55	32%	64	68%	29	41%	NA[b]	NA[b]

Source: NASSCOM Strategic Review (2007).

[a]New segment called Engineering Services, R&D, and Software Products created (earlier encompassed by software and BPO segments).

[b]Projections (made before the creation of the new segment).

Table 2. Contribution of the Outsourcing Industry to India's GDP, Exports, and Employment.

Year	*Contrib. to India's GDP (%)*	*Total Services Export (US$ billions)*[a]	*Growth Rate of Services Exports*	*Services Exports as % of Total Export Earnings*	*Software Exports (US $ billion)*	*Growth Rate of Software Exports*	*BPO Exports (US$ billion)*	*Growth Rat of BPO Exports*	*R&D Exports (US$ billion)*	*Growth Rate of R&D Exports*	*Contrib. to empl. (millions of workers)*
00–01	2.7%	6.2	56.9%	13.9%	5.3	55.6%	0.9	64.6%	NA[b]	NA[b]	0.4
01–02	2.9%	7.7	24%	17.6%	6.2	16.4%	1.5	60.8%	NA[b]	NA[b]	0.5
02–03	3.2%	9.6	25%	18.2%	7.1	14.6%	2.5	67.2%	NA[b]	NA[b]	0.7
03–04	3.5%	12.9	34%	20.2%	7.3	2.8%	3.1	24%	2.5		0.8
04–05	4.1%	17.7	37%	21.2%	10.0	37%	4.6	48%	3.1	24%	1.1
05–06	4.8%	23.6	33%	23.0%	13.3	33%	6.3	37%	4.0	29%	1.3
06–07	5.4%	31.3	33%	25.0%	18.1	36%	8.3	32%	4.9	23%	1.6

Source: NASSCOM Strategic Review (2007).

[a]Total Services = Software + BPO + R&D.

[b]New segment called Engineering Services, R&D, and Software Products created (earlier encompassed by software and BPO segments).

Table 3. Growth by "Service Lines" in the Software Segment, 2003–2004.
(billions of U.S. dollars)

Service Line	*FY '03*	*FY '04*	*Growth*
Project-Oriented Services	**3.23**	**3.85**	**19.2%**
IT Consulting	0.08	0.12	50.0%
System Integration	0.10	0.14	40.0%
Custom Application Development and Maintenance	3.02	3.54	17.2%
Network Consulting and Integration	0.03	0.05	66.7%
IT Outsourcing	**1.94**	**2.45**	**26.6%**
IS Outsourcing	0.01	0.02	100.0%
Application Outsourcing	1.85	2.16	16.8%
Network Infrastructure Management	0.08	0.27	260.0%
Support and Training	**0.37**	**0.61**	**64.9%**
IT Training and Education	—	0.02	—
Hardware Support and Installation	0.02	0.04	100.0%
Packaged Software Support and Installation	0.35	0.55	57.1%
Total	**5.54**	**6.91**	**24.8%**

Source: NASSCOM, IDC (2006).

Table 4. Comparing Cost Structures in the U.S. and Indian Call Center Segments.

	United States		*India*		*Saving*
Cost Element Base	*Value*[a]	*Share*	*Value*[a]	*Share*	*On U.S. Cost*
Personnel Costs	42,927	73.3%	6,348	48.4%	85%
IT/Telecom Costs	2,400	4.1%	3,770	28.7%	–57%
Office Facility Costs	3,700	6.3%	1,991	15.2%	46%
Other G&A Expenses	9,571	16.3%	1,012.5	7.7%	89%
Total Cost	58,598	100%	13,121	100%	78%

[a]USD/FTE/Year.

Source: NASSCOM, Evalueserve Analysis, Strategic Review (2006).

Notes: Blended rate for voice and non-voice operations. The above figures are indicative only, and the actual cost savings could vary by process. FTE: Full Time Employee. G&A: General and Administration.

Table 5. Growth by "Service Line" in BPO Segments, 2004–2005.

Service Line (Low End)	*Export Revenue (US$ millions), 2004*	*Export Revenue (US$ millions), 2005*	*Growth Rate*
Customer Care	1,200	1,500	25%
Payment Services	430	620	44%
Finance	835	1300	55%
Administration	540	840	56%
Human Resources	75	165	120%
Content Development	550	670	22%

Source: NASSCOM Strategic Review (2006).
Note: This table contains data from the "traditional" low-end BPO operations.

Table 6. Service Lines and Billing Rates in the BPO Segment, 2005.

Service Line	*Billing Rates ($US/hr.)*
KPO	
	3
0–75	
Content Development	
	1
8–42	
Human Resources	
	1
6–30	
Administration	
	1
2–28	
Finance	
	1
2–28	
Payment Services	
	1
2–28	
Customer Care	
	1
2–22	

Source: NASSCOM (2005)

Table 7. Export Revenue per Service Line in the R&D Segment (Engineering Services, R&D, and Software Products).
(billions of U.S. dollars)

Service Line	*Export Revenue 2003*	*Projected Export Revenue, 2010*
Basic Data Search Integration & Management	0.3	5.0
Market Research/Business Intelligence	0.1	0.5
Equity Research/Actuarial Analytics/Data Modeling	0.4	0.5
Engineering Design	0.4	2.0
Animation & Simulation	0.2	1.4
Medical Content and Services (X-Rays, etc.)	0.1	0.3
R&D (outside of IT)	0.2	2.3
Biotech and Pharmaceuticals	0.28	3.0

Source: Study by Evaluserve, reported in NASSCOM Strategic Review (2005).

Note that these are the most conservative estimates we could find. NASSCOM's annual business report on the growth of each of these segments paints a far more positive picture of growth, although we have not been able to find comparative data on the different service lines in high-end KPOs.

Table 8. Indian Software Industry: Labor Supply Estimates.

Statistic	*2003–2004*	*2004–2005*	*2005–2006*
	2006–2007		
Number of Engineering Graduates	215,000	284,000	348,000
382,000			
Degree (4-year course)	112,000	155,000	210,000
235,000			
Degree (3-year course)	103,000	129,000	138,000
147,000			
Number of IT (Computer Science, Electronics, Telecom) Professionals	141,000	165,000	181,000
193,000			
Engineering IT Graduates (degree)	95,000	100,000	111,000
117,000			
Engineering IT Graduates (diploma)	46,000	65,000	70,000
76,000			
Number of IT Professionals Entering the Work Force	80,000	94,000	103,000
109,000			
Engineering IT Graduates (degree)	55,000	58,000	64,000
68,000			
Engineering IT Graduates (diploma)	25,000	36,000	39,000
41,000			
Number of Non-IT Engineers Entering the IT Work Force	40,000	40,000	40,000
40,000			
Number of Graduates (Other Disciplines) Entering the IT Work Force	30,000	30,000	30,000
30,000			
Total Fresh IT Labor Supply	150,000	164,000	173,000
180,000			

Source: Gereffi and Wadhwa (2006); NASSCOM (2006).

Table 9. Estimates of HR Supply for Low-End BPO Segments, 2005.

Group	*Number*
Output of Graduates (253 universities and 13,150 colleges)	2,460,000[a]
Some English-Speaking Capability (30%)	738,000
Labor Force Participation (65%)	480,000[b]
Effective English-Speaking Ability for Employability in Call Centre (50%)	240,000
Effective Supply of Labor in 2005	168,000[c]

Source: Compiled by authors.

[a]Institute of Applied Manpower Research.

[b]NASSCOM-KPM.

[c]This figure appears to jibe with numbers obtained from our interviews with human resource managers (who, at the time we spoke to them, were claiming that the English-speaking market was already saturated). The figure is also consistent with another recent estimate that 5–10% of the total graduate pool (123,000–246,000 people) speak English and are available to work in the industry (Bhattacharjee 2003).

Table 10. Indian IT Software & Services Industry: Median Pay.

Description ($US)	*Level*	*2004*	*2003*
Software Segment			
Software Engineer	HA 1	6,560	6,040
Senior Software Engineer	HA 2	9,932	9,593
Team Leader/Module Leader	HA 3	14,820	13,190
Project Leader	HA 4	21,155	19,231
Project Manager	HA 5	30,816	26,653
Program Manager/Sr. Project Manager	HA 6	42,626	40,748
Head–Software Development/Large Business Unit	HA 7	63,125	60,410
BPO Segment			
Customer Care Executive (CCE)/Coordinator	HA 1 (1–2 yrs.)	3,235	3,032
	HA 1 (1–2 yrs.)	3,914	
Senior CCE/Executive	HA 2	4,638	4,321
Team Leader/Sr. Executive	HA 3	7,240	6,855
Assistant Manager	HA 4	10,023	9,865
Manager	HA 5	17,240	17,987
Assistant Vice President	HA 6	36,110	33,056
Vice President/Director	HA 7	71,406	63,058

Source: Assembled from NASSCOM Hewitt Total Rewards Study 2002 2003 2004

Table 11. Per Hour Wage Differentials between the United States and India, 2002–2003.

Profession	*U.S. Wage per Hour*	*Indian Wage per Hour*	*Silicon Valley Wage per Hour*
Telephone Operator	$12.75	Less than $1.00	$13.24
Health-Records Technologists, Medical Transcriptionist	$13.17	$1.50 to $2.00	$14.54
Payroll Clerk	$15.17	$1.50 to $2.00	$19.50
Data Entry Clerk	$20.00	$1.50 to $2.00	$24.44
Legal Assistant, Paralegal	$17.86	$6.00 to $8.00	NA
Accountant	$23.35	$6.00 to $10.00	$27.00
Computer Programmer	$28.90	$3.00 to $10.00	$38.85
Financial Research Analyst	$33.00 to $35.00	$6.00 to $15.00	$34.00
Software Designer	$60.00	$6.00	NA
Software Engineer	$120.00	$18.00	NA
Entry-Level Programmers (annual salary)	$50,000 to $60,000	$8,000 to $10,000	NA

Sources: Greene (2006)

Table 12. International Utility Patents Filed in the United States, 1980, 1990, 2000, and 2005, Selected Countries.

Country	*1980*	*1990*	*2000*	*2005*
U.S.A.	62,098	90,643	164,795	207,867
Japan	12,951	34,113	52,891	71,994
S. Korea	33	775	5,705	17,217
Taiwan	367	2,035	9,046	16,617
Brazil	53	88	220	295
China	7	111	469	2,127
India	23	58	438	1,463
World Total	104,329	164,558	295,926	390,733

Source: U.S. Patent and Trademark Office

Table 13. Finegold and Soskice Institutional Pre-Requisites and Current Progress in India.

Institutional Prerequisite	*Factors Forcing Actors to Take a Long-Term Outlook*	*Specific Action Taken by Actors to Address Short- and Longer-Term Labor Supply and Quality Issues*
TAKING A LONG-TERM OUTLOOK	(a) The significance of the industry in terms of exports, contribution to GDP, potential for economic development, and employment creation. (b) Need to ensure that the industry continues its rapid growth trajectory and movement up the value chain. (c) Increased competition from other countries.	***Central Government*** *National-Level Nodal Consortium for Indian Information Technology Education (CIITE):* coordinates and standardizes education in the IT arena for the long term. *New Educational Institutions*: add two IIT (Indian Institute of Technology) campuses and one IISc (Indian Institute of Science) campus. ***State Governments*** *Andhra Pradesh and Karnataka:* new Institutes for Information Technology to supply graduates to the software industry. *Kerala*: standards for ITES training and appointment of ITES trainers (Kurian 2003). *Orissa*: new training program in IT and the English language. *Karnataka and Orissa*: aptitude tests (for example, BPO-SAT) to screen applicants for the BPO industry. *Andhra Pradesh:* Graduate Employability Test (GET) to screen and certify employees (KPMG 2004). ***NASSCOM*** *National Assessment of Competence*: to identify new talent pools in various parts of the country, and to provide the industry, universities, and governments with information regarding key training and development needs. *National Skills Registry (NSR)*: centralized database of all employees working in IT services and BPO companies in India, containing third-party-verified personal, qualification, and career information on IT professionals to help improve recruitment practices. *English language training schools* (Sengupta 2006): to overcome industry's dissatisfaction with the labor market intermediary firms. *Certification program for frontline managers*: managed by NASSCOM's executive development program and QAI (the leading "quality" consultancy in India), this offers industry-relevant certifications (for example, Certified BPO Quality Analyst, Certified BPO Team Leader, Level 1) that have become popular among participants as well as businesses. ***Firms*** *Initial Approaches to Turnover: "Fun" Culture* (through the physical environment, recreational activities, informal atmosphere, fun-filled activities, parties and trips, campus life) and *Educational Opportunities* (management or technical certification). *-Recent Strategic Longer Term approaches:* leadership development, employee stock options, career development, job enrichment, counseling, cross-functional training, developing the HR supply chain, early recruitment, recruitment of older workers, move to second-tier cities, alternative locations.
COLLABORATION BETWEEN ACTORS	(a) High average turnover rates of 50% (BPO industry) and 20% (software industry) (b) High levels of "poaching."	***Central Government:*** None. ***State Governments:*** Many state governments have commenced/facilitated dialogue between firms and state-owned academic institutions. ***NASSCOM*** *Memorandum of Understanding* between NASSCOM and the University Grants Commission of India to strengthen professional education through *curricula* (for example, Zensar Technologies and Vishwakarma Institute of Technology [VIT] allow students at VIT to work on Zensar's projects), *faculty* (through a Faculty Development Program), and *infrastructure* and *pedagogy* improvements.

Firms

No-poaching agreements.

Academia-industry linkages for:

Research: IIT Bombay with Boeing, Honeywell, Microsoft, Sun, Hitachi and Intel; IIT Kharagpur with Blackberry.

Establishing infrastructure: new Center for Applied Research in Electronics and Center for Biomedical Engineering; new Center for Electronic Design and Technology.