Indian Information Technology Industry : Past, Present and Future& A Tool for National Development

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Abstract

The present study examines the growth and the performance of India's IT industries, with particular attention paid to the role of policy in this process. **The study recognizes that emergence of a strong Indian IT industry happened due to concerted efforts on the part of the Government, particularly since 1980s, and host of other factors like Government-Diaspora relationship, private initiatives, emergence of software technology parks and public private partnerships**. In this study we further look at the major parameters of the global and Indian IT industry in particular and give justification for including the main factors responsible for the IT boom in India. The study will look into the past and present trends of the Indian IT industry and consider further needs of IT sector to act as a catalyst of growth and development. The study will also examine whether the Indian IT growth does have enough lessons for other countries to model their IT policy which may help them to shape their IT industry as driver of growth and development and which could also reduce digital divide within and across countries and regions.

Introduction

Riding high on the outsourcing wave[2], India is likely to witness software and services exports growth of 25-28% clocking revenues of $36-38 billion in fiscal year 2007. IT- ITES [3](Information Technology enabled services) exports are likely to grow by 27-30% in FY 06-07, posting revenues between $29-31 billion, according to National Association of Software and Service Companies (Nasscom), which stated that exports for FY 05-06 had risen 33% to register revenues worth $23.6 billion as compared with export revenues of $ 17.7 billion in FY04-05.FY 05-06 also saw the overall Indian IT-ITES industry(including domestic market) grow by 31%, revenues of $29.6 billion up from $22.5 billion in 04-05(see Appendix Table I which summarizes the IT performance in

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[2] Outsourcing is a business strategy that many corporations have used for decades. The most common processes that carriers are outsourcing are software development, system maintenance, core systems hosting and other systems hosting. In the last decade, the IT and BPO industries have seen substantial offshoring. India has been the leading offshore destination during this period, and now accounts for 65 per cent of the global industry in offshore IT and 46 per cent of the global Business Process Offshoring (BPO) industry.

[3] Information technology essentially refers to the digital processing, storage and communication of information of all kinds. IT consist of software and hardware. Therefore, IT can potentially be used in every sector of the economy. The true impact of IT on growth and productivity continues to be a matter of debate, even in the United States, which has been the leader and largest adopter of IT. However, there is no doubt that the IT sector has been a dynamic one in many developed countries, and India has stood out as a developing country where IT, in the guise of software exports, has grown dramatically, despite the country's relatively low level of income and development. An example of IT's broader impact comes from the case of so-called IT-enabled services, a broad category covering many different kinds of data processing and voice interactions that use some IT infrastructure as inputs, but do not necessarily involve the production of IT outputs.

India). Over a period of time, India has established itself as a preferred global sourcing base in these segments and they are expected to continue to fuel growth in the future. These segments have been evolving over the years into a sophisticated model of operations. Indian IT and ITES companies have created global delivery models (onsite-near shore-offshore), entered into long term engagements with customers, expanded their portfolio of services offerings, built scale, extended service propositions beyond cost savings to quality and innovation, evolved their pricing models and have tried to find sustainable solutions to various issues such as risk management, human capital attraction and retention and cost management. A key demand driver for the Indian IT services and ITES industry has been the changing global business landscape which has exerted performance pressures on multinational enterprises. The IT industry and IT-enabled services, which are rapidly growing offer opportunities for FDI as well. India has emerged as an important venue for the services sector including financial accounting, call centers, and business process outsourcing. There is considerable potential for growth in these areas. Biotechnology and Bio informatics, which are on Government's priority list for development, offer scope for FDI.

The industry has crossed $I billion dollar mark, with a growth rate of 36.55 per cent**,** compared to only 8 percent for the economy as a whole in 2005 reaping. Software exports accounted for 20% of Indian export revenues in 2003-04.By 2008 it would account for 7% of India's GDP and would contribute 30% of total Indian export revenues. The IT sector is likely to give employment to 9 million people in India by 2008(see McKinsey Report, quoted in the Department of Information Technology webpage http://www.mit.gov.in/dbid/eproduction.asp- appendix Table II). The IT industry is envisaged to achieve a production target of Rs. 2,82,000-crore by the terminal year of Tenth Plan (2006-07), with the software sector accounting for Rs. 2, 13,000-crore and hardware production Rs. 69,000-crore. The total direct employment in the Indian IT-ITES sector is estimated to have grown by over a million, from 284,000 in FY 1999-2000 to a projected 1,287,000 in the current fiscal (2005-06) .In addition to the nearly 1.3 million-strong workforce employed directly in the industry, Indian IT-ITES is estimated to have helped create an additional 3 million job opportunities through indirect and induced employment. Indirect employment includes expenditure on vendors including telecom, power, construction, facility management, IT, transportation, catering and other services. Induced employment is driven by consumption expenditure of employees on food, clothing, utilities, recreation, health and other services. Against the level of $9.5 billion achieved in 2002-03, software and IT services exports are expected to grow to $87 billion by 2008. While the software export target is set at $50 billion, the target for export of hardware has been kept at $10 billion by 2008..India's share in the overall global software market is expected to increase from the present 2 per cent to 6 per cent by the terminal year of the Tenth Plan.

India's strength has emerged through large client wins, cross border mergers and acquisitions, and the movement of the industry towards a stable pricing model. With low costs no longer being the deciding factor for foreign companies looking for developing software in India, research, chip design and financial analytical modeling are some of high-end services increasingly coming to India. In an industry which has been one of the

flywheels of robust economic growth in India gaining a reputation for being able to handle complex contracts, the country top firms are now looking at large-sized, multi-year orders to boost revenue stability. Asia's third-largest economy has become a hub for global firms like Motorola Inc. and International Business Machines Corp. for services such as handset software and supply chain management. India's large English-speaking engineering workforce and cheaper wages of nearly one-fifth of western salaries have helped to attract outsourcing. The top three Indian software exporters, flagship Tata Consultancy Services Ltd., stock market darling Infosys Technologies Ltd. and Wipro Ltd., each boast more than a billion dollars in annual revenue. -- The United States is the biggest market for Indian software firms, accounting for as much as 70 percent of revenue. The domestic software sector is dominated by ready-to-use products and packages, which account for 40 per cent of the market followed by projects, around 30 per cent. Domestic companies account for less than 20 per cent of the total market, indicating a high demand for imported products.

India has an estimated 40 million Internet users, making it the country with the fifth-largest number of Internet users. Yet, that number only represents 3.6 per cent of the total population. The USA, with over 100 million Internet users, has a penetration rate of 68.7 per cent and Australia, with approximately 14 million users, has a penetration rate of 68.2 per cent.

Since 1984 under the rule of Prime Minister Rajiv Gandhi, India has been pursuing liberalization policies that have helped the IT industry develop. On the other hand, the People’s Republic of China provided little state support for this endeavor until the late 1990s. Now lagging behind, China is trying to catch up by replicating India’s model.

The government recognizes the significant economic opportunity that the information technology (IT) explosion represents to India and is committed to the policies, infrastructure development and education investment to maintain the growth. The Government of India is providing for more liberal policy framework for the IT sector. As stated above one of the major factors of excellent and consistent growth of Indian software industry can be attributed to continuous liberalization of policies of the Government of India. NASSCOM and the government have worked together in close co-operation over a long time for forming and implementing these policies. During 1991, NASSCOM lobbied with the Government and for the first time, secured income tax exemption from profits of software exports. Later, Government, systematically and gradually, reduced import duty on computer software from a high 114 percent to nil. Copyright laws were also amended.

The Ministry of Information Technology is meant to act as a nodal institution for the promotion of the sector, facilitating and coordinating the various initiatives of the central and state governments and the private sector. Priority will be given to e-governance, development of software in Indian languages, IT for the masses, distance education, e-commerce, cyber security and HRD. Postgraduate education and research in IT would be pursued as will R&D in the emerging areas of Bluetooth technology, e-commerce, and nano-technology and bioinformatics solutions.

Foreign investment in the sector will be encouraged by further simplifying policies and strengthening and upgrading telecommunication and IT infrastructure. Establishing an interface of computers with diverse Indian languages. The endeavor will be to develop suitable software and technologies to enable the people to use computers in local languages. Attempts to take IT to the masses will be accelerated by promoting Internet accessibility, content creation in local languages, IT applications for various disabilities, empowerment of the masses with special thrust on women and children, rural healthcare systems, digital libraries in order to preserve the country's cultural heritage and social identity. Enrolment in Indian technology schools is expecting to reach 600,000 by 2008. The government has set a target of 20 million broadband users by 2010. The Indian federal and state governments are committed to developing and broadening e-governance. Fourteen state governments have IT-specific priority policies and many have implementing IT-related projects. Thus, we see that India's proactive government played an instrumental role in encouraging the IT industry.

The present study examines the growth and the performance of India's IT industries, with particular attention paid to the role of policy since 1970s in this process. **The study recognizes that emergence of a strong Indian IT industry[4] happened due to concerted efforts on the part of the Government, particularly since 1980s, and host of other factors like Government-Diaspora relationship, private initiatives, emergence of software technology parks and public private partnerships**. In this study we further look at the major parameters of the global and Indian IT industry in particular and give justification for including the main factors responsible for the IT boom in India. The study will look into the past and present trends of the Indian IT industry and consider further needs of IT sector to act as a catalyst of growth and development. The study will also examine whether the Indian IT growth does have enough lessons for other countries to model their IT policy which may help them to shape their IT industry as driver of growth and development and which could also reduce digital divide within and across countries and regions.

Information and Communication Revolution (ICTs) Across the Globe: A tool for National Development

During 1960s and 1970s, the developing countries received technical assistance from developed countries for improving their technological base. Considerable assistance was available for the purchase of foreign manufactured hardware. Various studies showed that

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[4] Indicators of the strength of India's software export capabilities include the depth of its base, and the breadth of its global reach. There are over 2,500 Indian software exporters, and while only the top five (TCS, Infosys, Wipro, Satyam and HCL) are – or are approaching the status of – global brands, they together account for only about 35% of software exports. The United States remains by far the largest market for India's software exports, its share of India's software exports being 63%, with Europe coming in at 26%, and Japan and the rest of the world accounting for the remaining. . Going forward, the more traditional IT outsourcing service lines such as hardware and software maintenance, network administration and help desk services will account for 45 per cent of the total addressable market for offshoring and are likely to drive the next wave of growth. While the addressable market for the global offshore IT and BPO industries is quite large, industry evolution will largely be shaped by the interplay of three major forces: (1) supply (the capacity and quality of offshore locations); (2) demand ramp-up (realistic adoption of offshoring by companies); and (3) industry conduct (the actions taken by industry players).

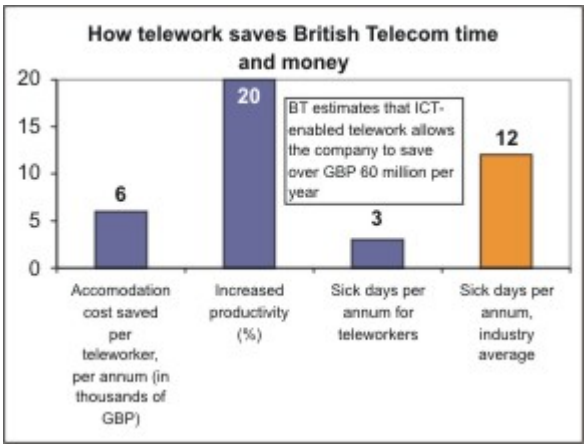
the primary beneficiaries were the foreign companies that provided the equipment. This gave rise to a debate within the UNESCO and the United Nations General Assembly about the efficacy of foreign technology. Considerable thought was also given to the need to maintain balance between technical assistance and the human resource development to use these technologies. Eventually a New Information and Communication Order was formulated which provided the framework for the development of ICTs in developing countries. Following this and related developments, in 1980 the UNESCO General Conference initiated the international program for the development of communication.

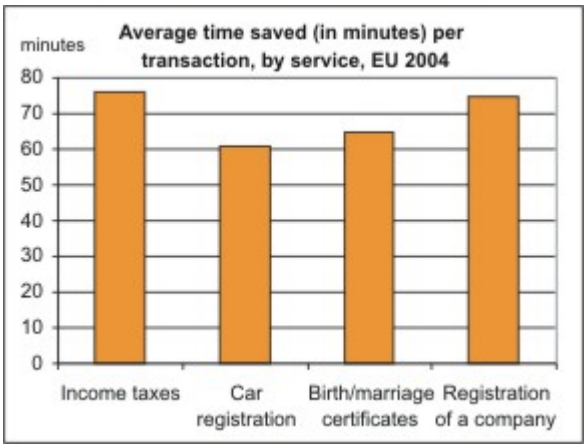
Information and Communication Revolutions(ICTs) across the globe and particularly in developing countries contribute to economic growth, productivity, can help achieve the Millennium Development Goals (MDGs) and sustainable development and create jobs, and contribute to and improve the quality of life. The ICT sector is growing faster than the overall economy[5], and represents a substantial (and often increasing) share of GDP in some countries. However, the real potential of ICTs is not the direct impact of the ICT sector itself. The key economic impact of the spread and use of ICTs is indirect, by transforming the way individuals, businesses and other parts of the society work, communicate and interact. Of particular interest is the ability of ICTs to raise productivity. Different macro-economic and firm-level studies confirm high potential productivity gains from ICTs but emphasize that the benefits of ICTs depend on a number of other factors. To maximize the effects of ICTs, other changes, including a new set of ICT skills, structural changes within business models and institutional and regulatory adjustments within the economy, must be made.

Besides increasing productivity, ICTs are transforming economic relationships and processes in the private and public sector. Positive impacts have been observed and measured across developed and developing countries. Just as e-commerce and teleworking allow companies to reduce costs and increase revenues, e-government has the potential to save money, increase efficiency and raise transparency in the public sector (see Figure I below). There have been a number of successful efforts by governments, organizations, and industry to quantify the positive impacts of ICTs. It is obvious that both administrative data and case studies and sector-specific surveys need to be carried out to measure the impact of ICTs.

[5] Access to information and communication technologies continues to grow at high speed and the digital divide – in terms of mobile subscribers, fixed telephone lines and Internet users - keeps getting smaller. International Telecommunication Union(ITU) statistics show that by the end of 2004, the telecommunication industry had experienced continuous growth, as well as rapid progress in policy and technology development, resulting in an increasingly competitive and networked world. There are more ICT users worldwide and more people communicating than at any other time in history. By the end of 2004, the world counted a total of three billion telephone subscribers, 1.8 billion mobile subscribers and 1.2 billion fixed lines. Both, the number of mobile subscribers and the number of Internet users more than doubled in just four years. By end 2004, the world had over 840 million Internet users, which means that on average 13 percent of the world's population was online.

Figure I: How ICTs save time and money





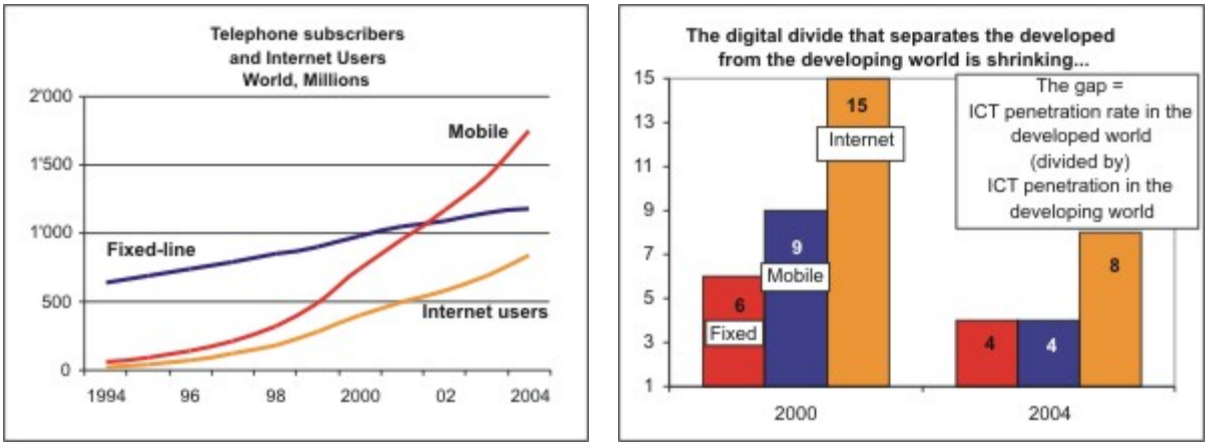
Source: ITU adapted from Broadband Stakeholder Group (BSG, 2004) (left) and ITU adapted from the EU (right).

The sector that so far has had the strongest impact in developing countries is the mobile sector, particularly since mobiles are not just a different or complementary way of communication but have opened up entirely new communication means in many parts of the developing world. The boom of the mobile industry has not just created new jobs and revenues but also contributed to economic growth by widening markets, creating better information flow, lowering transaction costs, and substituting for costly physical transport. ICTs are also having a real impact on social development, although the quantification of this impact and the development of indicators are complex and must be seen as a constantly evolving process

Apart from the impact of the mobile sector, the transformation of economic relationships and processes is particularly visible in those countries and areas that have the highest Internet penetration levels. The spread of broadband seems to have a particularly important role in certain areas, including for the emergence of e-commerce, teleworking, and e-education and health. This highlights the need for developing countries to pay special attention to broadband deployment and strategies.

It is true and encouraging, that overall, the digital divide has been reduced. ITU statistics show that within four year, from 2000 to 2004, the gap separating the developing and the developed countries has been shrinking in terms of mobile subscribers, fixed telephone lines and Internet users. ITU measure the gap (the digital divide) by dividing the ICT penetration rate in the developed world by the ICT penetration rate in the developing world. Phenomenal growth rates in the mobile sector, particularly, have been able to reduce the gap from nine in the year 2000, to four by the end of 2004. This gap has also been reduced in terms of fixed lines, from six to four, and from 15 to 8 in terms of Internet users.

Figure II : Digital opportunities are growing…



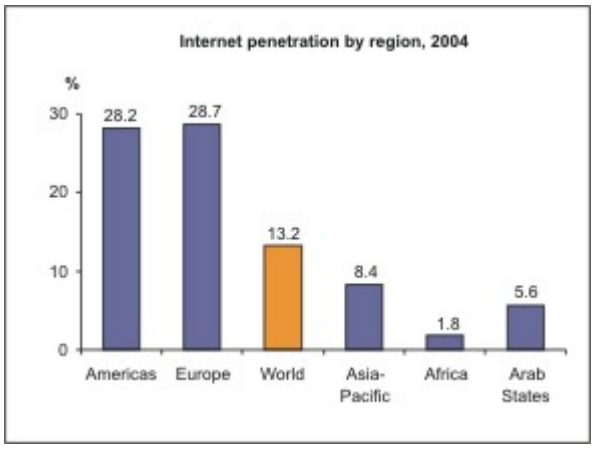
Source: ITU World Telecommunication Indicators Database.

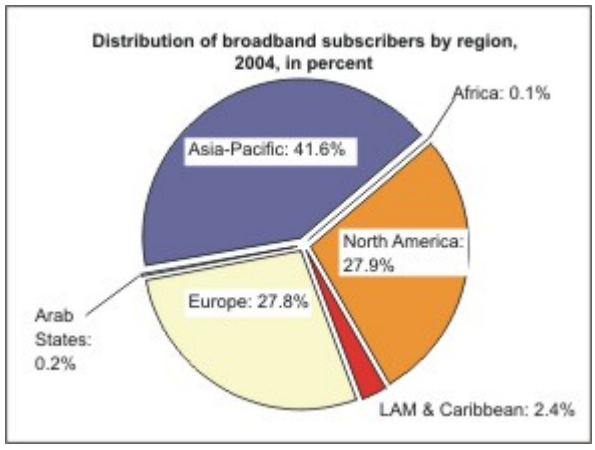
At the same time, the world continues to be separated by major differences and disparities in terms of ICT levels(see Figure II). In 2004, almost one third of the population in Europe (29%) and the Americas (28%) was online, compared to eight percent in Asia Pacific. Europe has almost 15 times the Internet penetration of Africa, where less than two out of 100 people use the Internet. Internet penetration also remains below world average in the Arab States, where less than six out of 100 people are online.

High growth rates in some areas, and particularly the mobile sector, are not sufficient to bring digital opportunities to all and many developing countries risk falling behind, particularly in terms of Internet access and newer technologies such as 3G and

broadband. The introduction of high-speed Internet access is of great importance for the transformation of Information Societies since it opens up new possibilities and visions on how the Internet can provide a platform for enhancing countries' social and economic development. This is why it is disturbing that the vast majority of broadband users are in the developed world. Of the world's broadband subscribers, no less than 97 percent are located in Asia-Pacific, Europe and North America. Africa, and the Arab States, particularly are lagging behind and many countries have not yet commercially launched high-speed Internet services.

Figure III: …but major disparities remain and new divides must be addressed!





Source: ITU World Telecommunication Indicators Database.

It is important to counteract such a new technology divide, particularly since broadband is playing a crucial role in transforming countries into Information Societies. ITU research shows that some of the applications that are having the greatest impact on people and businesses are closely linked to broadband uptake. Since access to basic communications in the developing world has largely been achieved through mobile communications, broadband wireless access (BWA) is expected to play a key role for developing countries seeking to foster the Information Society. It may be said that the

mobile boom by itself is not enough, and increasing efforts must be undertaken to take advantage of the great potential offered by these new technologies(see Figure III).

In 2004 in ASIA-PACIFIC

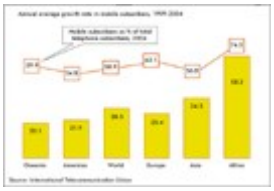
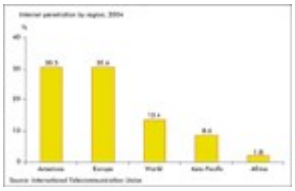
… Internet penetration ranges from below 1% in countries like Bangladesh, Cambodia and Lao, to above 65% in countries like Australia and the Republic of Korea.

…mobile penetration ranges from below 1% in countries like Bhutan, Myanmar, Nepal and Papua New Guinea to 90% or more in countries like Hong Kong (China) and Singapore.

…China remains the region's powerhouse. During 2004, the country added an average 5.4 million new mobile subscribers every month. China already represents almost 50% of the entire Asian mobile market in terms of subscriber numbers, yet domestic penetration still hovers at around just 25%. That translates into another one billion more potential mobile customers.

…India has overtaken China to become one of the region's fastest-growing mobile markets, with growth rates of over 90% per annum every year since 1999. With just total mobile penetration rates of just over 4%, potential for growth is enormous.

…the Republic of Korea leads the world in broadband penetration, with high-speed lines serving more than a quarter of the population.

Global fixed lines comparison	***Global mobile comparison***	***Global Internet comparison***
		

Source: ITU World Telecommunication Indicators Database

India has left China and Russia far behind in the technology race, taking leaps in the information and communication field. According to the latest report 'Global Information

Technology Report', released by the Geneva-based World Economic Forum, the USA has regained the top position in 2005 after slipping to the fifth place in 2004.

Singapore, first in 2004, came second and Denmark third. Four Nordic countries - the others being Iceland, Finland and Sweden - are in the top 10 alongside Canada, Taiwan and Switzerland.

India is ranked at 40 despite its booming ICT sector. But China, which is set to overtake the USA in the number of Internet users, has fallen nine places to 50 and Russia to 72, and Pakistan to the 67th rank.

The UK, at the 10th place, is top-ranked among the European Union's large economies, followed by Germany (17), France (22) and Italy (42).

The WEF, which for 2005 ranked 115 economies worldwide, said information and communications technologies were clearly emerging as one of the key drivers of economic growth and competitiveness.

there is some official confirmation on how much foreign exchange the country has earned through software exports.

MAIN FINDINGS OF STUDIES EXAMINING ICT IMPACT ON GROWTH AND DEVELOPMENT

• ICT plays a vital role in advancing economic growth and reducing poverty. A survey of firms carried out in 56 developing countries finds that firms that use ICT grow faster, invest more, and are more productive and profitable than those that do not.

• Over the past 25 years, developing countries have considerably increased ICT access, especially for telephone services. Between 1980 and 2005, the number of telephone subscribers in developing countries rose by over 30 times. In 1980, developing countries accounted for only 20 percent of the world's telephone lines. In 2005, 60 percent of the world's phones were in developing countries. Such expansion has been driven by the technological revolution of mobile telephony as well as private competition.

• Opening up to private competition has led to huge inflows of investment from overseas. Between 1990 and 2003, 122 of 154 developing countries received close to US$200 billion foreign investment in telecommunications.

• Completing the transition to well-regulated and competitive service provision remains the foundation to providing ICT access. And there is some way to go in this transition – for example, nearly half of the World's countries retain monopolies on fixed local international service provision.

• While the developing world has seen huge progress in rollout of basic ICT infrastructure, the picture is more mixed for advanced use of ICT. Worldwide, Internet

use more than quadrupled between 2000 and 2005, but differences in the number of secure Internet servers, a proxy for the availability of e-commerce, remain stark. While developed nations have more than 300 such servers per 1 million people, developing nations have fewer than 2.

• There is a continued need for government support to "access" and application initiatives. The report outlines innovative public-private partnerships to extend access to rural and remote areas, for example.

• A review of 40 national e-strategies from developing countries finds that more than 85 percent aim to expand ICT use in governments and schools, expand telecommunications infrastructure, and provide an adequate legal and regulatory framework.

• Although many countries have made significant progress, more work is needed to make e-strategies effective tools for development. The report calls for e-strategies to develop clear cross-sectoral objectives and specific interventions with clarity in terms of budget and responsibility.

• Countries should increase efforts to collect and share ICT data. The international community can facilitate more effective coordination of such efforts.

INDIAN IT INDUSTRY: Study of the Past till Present

The 1970s and 1980s – Software Exports

During the 1950s and 1960s, there was no Indian software industry. Software came bundled with hardware provided by multinational hardware companies like IBM(from the US) and ICL(from UK). IBM's unbundling of software from hardware in the late 1960s is seen as a generic global catalyst for the existence of independent software firms (*Financial Times* 1989).

In the 1970s too, there was no separate software industry. Multinationals such as IBM and ICL were the largest providers of hardware to the industry, which used to be bundled with the operating systems and a few basic packages that were generally written in FORTRAN and COBOL languages.

Larger enterprises (including the Indian defense and public organizations) that needed customized applications employed in-house teams that did everything from installing systems to writing software. In fact, when specific software applications became popular, stand-alone boxes were made for them. In 1970s, the concept of stand-alone word processing software did not exist. Later, when local companies grew (after IBM's exit in early 1980s), these companies also had their own proprietary operating systems that generally executed only their computer programs.

India exported its first software services and products in the mid-1970s.Although India was among the first developing nations to recognize the importance of software, the key

driver behind exporting software was foreign exchange. To export software, Indian companies had to design it for hardware systems that were the standard worldwide, which in the 1970s were the IBM mainframe computers. However, Indian import duties on this hardware were extremely high (almost 300 percent) and hence during the late 1960s and early 1970s, IBM used to sell old, refurbished and antiquated machines (because that is all that Indian companies could afford). Fortunately, within a few years, the Indian Government lowered import duties on all IT equipment but with a pre-condition that the exporters would recover twice the value of the foreign exchange spent on importing computers within five years – a clause that was modified in the 1980s. Hence, overall, the regulatory scenario was not very favorable for software exporters and this constitutes the beginning of the Indian software industry.

The first software exporting company from India was Tata Consulting Services (TCS) that started operations in 1968. Fortunately, after a few local orders, TCS bagged its first big export assignment in 1973-74, when it was asked to provide an inventory control software solution for an electricity generation unit in Iran. During this period, TCS had also developed a hospital information system in UK along with Burroughs Corporation (which was at that time the second-largest hardware company in the world) and it became a role model for other Indian IT companies to follow in the 1980s.

Despite the tough policy with respect to imports, by early 1980s, India was the only developing nation to have any significant software exports – USD 12 million – a substantial leap over the 1979 level of USD 4.4 million and 30 companies were already beginning to export software.

The main competitive advantage for Indian companies was obviously the cost and the ability to communicate using the English language. The total charges for a software developer in India varied from USD 16,000 to USD 24,000 annually whereas the corresponding charges of sending the same developer to the US varied between USD 32,000 and USD 42,000 annually. Comparing this to the total cost of a US software developer (USD 60,000 to USD 95,000 yearly) in 1980, the savings were clearly quite significant.

Inspite of the cost advantages and a relatively good proficiency in English, the Indian software industry continued to face the following challenges in 1970s and 1980s:

• Lack of availability of hardware: Import of hardware – especially mainframe computers -- was very tedious and expensive.

• Shortfall in trained manpower: Although the education system was producing substantial number of engineers who were very talented, very few colleges were offering any computer training or IT courses.

The following three unrelated incidents contributed heavily in shaping the Indian IT industry:

• In late 1970s the Indian Government passed a controversial law (which was later repealed in 1992) that forced all multinationals to reduce their equity share in their Indian subsidiaries to less than 50 percent. Since IBM did not want to reduce its equity in its subsidiary, it decided to leave India, thereby, making Indian companies less reliant on mainframe computers.

• The advent of Personal Computers in 1980s reduced the cost of importing hardware substantially, thereby, spawning an industry that has over 2,700 companies today.

• Realizing that the Indian college system was unable to provide any computer training or IT courses, three Indian entrepreneurs (living in India) took it upon themselves to provide tutorials and training classes in Information Technology. Their early days were often marked with one person driving a scooter or a motorcycle and the other riding behind with a PC in his lap so that they could impart this training in rented college and school spaces in the evenings. The training institute (NIIT) started by them is today a USD 167 million company and it continues to be number one in providing IT courses and training to Indians .

With these as the humble beginnings, the Indian IT industry witnessed the Indian Government policies becoming more favorable in late 1980s, representative industry associations getting formed (one of which eventually became NASSCOM – the National Association of Software and Service Companies) and the IT training and education level gradually becoming strong enough for creating a full-fledged industry.

Finally, in the initial years, export of software initially meant a physical transfer – either of the programmer himself -sometimes called ‘body-shopping(the provision of labor intensive ,low value added programming services, such as coding and testing at client sites’) or of software on floppies. However, in 1985, Texas Instruments (TI) set up an office in Bangalore with a direct satellite link to the US and, in 1989, an Indian Government Telecom Company (VSNL) commissioned a direct 64-kbps satellite link to the US, thereby, offering software exporters a completely new way of functioning.

In terms of products and services, there have been continuous exports of software products since the early 1980s. These include enterprise systems, design software, and database management tools. However, such exports have consistently formed less than about 5% of total exports. Indian software exports have been, and remain, dominated by services .

Within the overall segment of software services exports, though, trends of change are detectable. Indian firms began with a strong emphasis on 'bodyshopping' In the late 1980s, around 75% of export earnings came from bodyshopping. By the early 2000s, this had dropped to nearer 60% (Dataquest 2001), indicating a slow but steady trend towards offshore working.

This has been paralleled by a second trend: that of moving up the value chain from supply of programming services to addition of design/analysis services to complete turnkey project services. As with offshore working, the trend of change has been greater within individual client—vendor relationships than in the industry overall.

The 1990s – The Emergence of Offshore Outsourcing

In 1993, the US Immigration and Naturalization Service made changes that made it difficult to get B-1 visas and the new H-1 visa required a certification from the US Department of Labor that prevailing market wages were being paid to immigrant workers. As a result, US companies had less incentive to hire software engineers from India. Also, Indian software professionals who were brought under the umbrella of the Immigration Act, had to pay social security and related taxes to the US government, which added additional burden on the employees and the companies.

The two factors mentioned above led a few IT companies in India to gradually move to a mixed model, wherein some software programmers would work at the Client's premises (in the US) whereas others would continue to work in the IT company's back-office in India. As the Indian IT industry adapted to this new business model, Indian IT exports boomed from USD 128 million in FY 1990 to USD 485 million in FY 1994. It is worth pointing out that the shift to the new business model was gradual because the savings even after sending Indian IT programmers to the US were quite large and many IT companies continued to follow the old model and send their programmers to the US, the UK, and Canada.

And then came the 'Y2K problem', the Internet-Telecom boom and the Dot.com boom. All these forced companies in the US, UK, and Canada to hire lot of computer programmers and this caused such a shortage in the US that the US government had to increase its H-1 quota from 65,000 in 1998 to 130,000 in 1999 and then to 195,000 soon thereafter. Indeed, this was a very good opportunity for the Indian IT industry, which thrived by sending more and more IT professionals to the US, thereby creating a larger and larger Indian IT Diaspora.

In particular, the 'Y2K problem' presented a unique opportunity to Indian firms. Owing to this problem, the US firms needed software professionals with COBOL programming skills. COBOL had already become obsolete in 1990s and was no longer a part of university curriculum in the US. However, in India, COBOL was still taught, even in the 90s, since most of the local computer science curriculum was quite obsolete. This provided significant advantage to Indian IT services vendors, particularly because working on Y2K contracts helped Indian firms in entering new markets and building trust with their client enterprises.

By the end of 1999, the Indian IT industry was on an all-time high and the Initial Public Offerings (IPOs) of Indian software companies (in India) were getting oversubscribed. This, in turn, led to the creation of a venture capital industry in India.

Significance of Outsourcing Business & Millennium Years Performance of Domestic Market

While producing hardware in the 1980s was part of the manufacturing sector, the high technology jobs of the 1990s and present require a sophisticated enough skill set to write software and maintain computer systems. Only a few select countries have a ready supply of workers who are both technically trained and proficient in English to accept the opportunity American companies offer. For such reasons, China, Russia, and Vietnam are also prime locations; India, however, by far has become the leader of what has come to be known as the "outsourcing" revolution, as it captures a commanding 70% of the total spending on outsourcing

Outsourcing has been defined by two types of activities: (1) foreign companies launching "liaison, project, or branch" offices in India that retain the name of the founding corporation; and (2) foreign companies contracting out stages of their production processes to already-formed Indian companies as "a joint venture or wholly-owned subsidiary."
It is important to distinguish between these two types of outsourcing because the requirements that foreign companies pursuing offices in India must meet differ significantly from those placed upon multinational partnership firms. These types of offices are limited in scope and Indian law specifically prohibits branch offices of foreign companies from carrying out manufacturing activities on its own. Rather, it encourages the subcontracting of these manufacturing tasks to established Indian manufacturers.

Foreign companies looking to partner with existing Indian companies have several advantages over those wanting to launch an entirely new company in India. Foreign investors can utilize the contacts, financial resources, and pre-established marketing strategies of the Indian company. Companies achieve this type of strategic alliance by subcontracting parts of the production process to Indian companies. For example, several American high technology companies have moved software development and support operations to companies in India. There is a significant cost advantage in doing so, as hiring a programmer in Silicon Valley costs approximately $78,000 annually including benefits while an Indian programmer costs only $8,000. two key factors have facilitated these forms of outsourcing. The first is the low cost of skilled labor in India. For an hour's worth of project work, American IT professionals typically charge between $80-$120, whereas Indian software engineers can be paid $40 for the same work due to currency exchange rates and the customary absence of employee benefits to Indian workers. Because of the recent downturn in the American economy, the Bureau of Labor Statistics estimates that 500,000 information technology professionals have lost their jobs in the United States since 2001, a figure which reached one and half million by the end of 2006. American companies are looking to cheaper sources for production, and the Indian IT industry has filled this need.
This transnational work is made possible by technology. High-speed data connections and software tools have allowed for great distances to be bridged, making possible the collaboration between geographically disparate groups. This technology also changed the structure of the production process; rather than a few large vertically-integrated

corporations in which hardware and software are produced together, a “more fragmented industrial structure” now allows for production processes to be performed in different locations. Global communication has thereby assisted the growth of the IT industry.

To show how the government has in fact encouraged the IT industry in India, we can examine the counterexample of China. In quantitative measures, China exceeds India in geographic area, population, gross national product, and measures of well-being such as life expectancy. China has gleaned more foreign investment and holds a larger share of the world’s exports. This domination is not replicated in the IT industry, though, as Indian software exports far exceed those of China. Impressed by India’s business models in this industry, China has sent delegations to India both for purposes of cooperation and reconnaissance. While Indian officials say they learn from the Chinese as well, the air between the two nations is rank with competition and secrecy.

Domestic Market

India has emerged as the fastest growing and the fourth largest IT market in Asia Pacific, according to an IDC study. The result has been that – for many years – India has been the developing world's software leader. There are few large firms that control much of the exports of the Indian Software industry.The top five firms account for 32 % of total software exports.The IT industry is concentrated in TN, Karnataka and AP. Almost 90% of the software development and export activity are confined to four metropolitan areas in India namely Mumbai, Banglaore, Chennai and Delhi. The Indian software industry has grown at a compound annual rate of over 50% in the 1990s,the highest for any country during this period. The revenues have risen from $ 175 billion to $ 8.7 billion during the decade. Indian nationals account for 45% of HI visas issued by the USA every year and a large proportion of them go as software engineers. India is home to some 650000 software developers or about 10%b of the world’s developers population. The Indian software developer population is growing at an annual compound growth rate of 32% which means that in next three years the Indian developers will be the highest in the world. Among the Fortune 500 companies over 250 outsource their software’s related work to India.

The IT output has been doubling every 2.2 years as its is growing at 37.4% compounding in the period 1990-91 to 2001-02.This rapid pace of growth was enabled by IT exports which have been growing at 54% per annum. The share of exports in total IT output is around 61 % in 2001-02.

Complementing the continued growth in IT-ITES exports is a steadily evolving domestic market.(see Table I below)

Table I: IT Industry-Sector-wise break-up(% GROWTH)

USD billion	FY 2004	FY 2005	FY 2006E
IT Services	**10.4**	**13.5**	**17.5**
-Exports	7.3	10.0	13.2

-Domestic	3.1	3.5	4.3
ITES-BPO	**3.4**	**5.2**	**7.2**
-Exports	3.1	4.6	6.3
-Domestic	0.3	0.6	0.9
Engineering Services and R&D, Software Products	**2.9**	**3.9**	**4.8**
-Exports	2.5	3.1	3.9
-Domestic	0.4	0.7	0.9
Total Software and Services Revenues	**16.7**	**22.6**	**29.5**
Of which, exports are	**12.9**	**17.7**	**23.4**
Hardware	**5.0**	**5.9**	**6.9**
Total IT Industry (including Hardware)	**21.6**	**28.4**	**36.3**

Total may not match due to rounding off

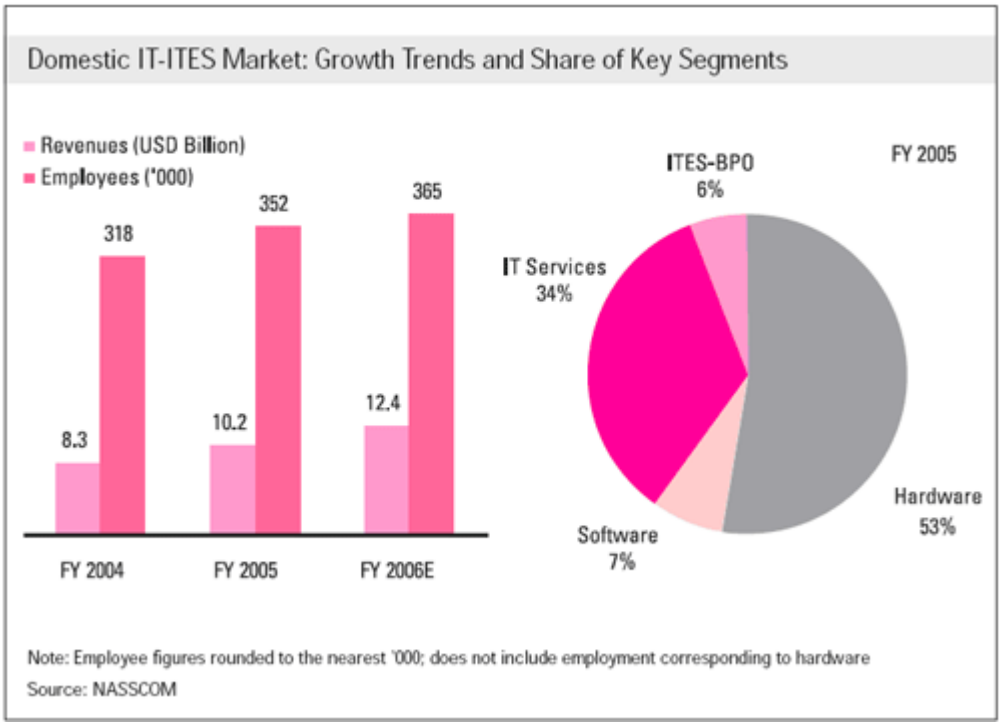
** NASSCOM estimates have been reclassified to provide greater granularity*
- Revenues from Engineering and R&D services and Software Products reported separately (erstwhile clubbed with IT Services / ITES-BPO)
- Historical values for a few segments have changed
- For ease of comparison, details for two preceding years have been restated as per the new classification

As stated above strong demand over the past few years has placed India amongst the fastest-growing IT markets in the Asia-Pacific region. While hardware still accounts for a majority share, with spending on services and the outsourced model gaining noticeable traction, growth in the domestic market is witnessing the early signs of service line depth that characterizes maturing markets.

BFSI, Telecom, Government and Manufacturing are the key vertical markets driving growth across categories including hardware systems, networking, storage, security, enterprise application products and related services. Education and healthcare are a few emerging areas expected to drive additional growth. ITES-BPO demand in the domestic market, though at a nascent stage with contact centre activities for customer care, and sales and marketing accounting for over two-third of current demand, is also witnessing increased levels of activity. BFSI, telecom and consumer durables are the early adopters of ITES-BPO in the domestic market and currently account for nearly three-fourths of the business in this space.

Recognizing its potential, leading global players (Indian as well as MNC) are also focusing some of their attention towards tapping the domestic market - with significant success. Revenue aggregate earned from the domestic market by the leading, predominantly export-focused Indian service providers have grown and several of the key IT outsourcing contracts awarded in the past year were won by MNCs. Global product companies are also looking to introduce localized versions of their software products to drive usability and penetration. This specific focus on the domestic business opportunity is helping create an environment of healthy competition in the industry that augurs well for the development of the domestic market.

As depicted in the following chart, the domestic IT-ITES market was valued at USD 10.2 billion in FY 2004-05 and is expected to exceed USD 12.4 billion, growing at nearly 22 per cent in the current fiscal (FY 2005-06).



The observed growth in the domestic market reflects the strength of the Indian economy, which has grown at an annual rate of nearly 7 per cent since 2002 and at more than 8 per cent over the first three quarters of the current fiscal year (FY 2005-06).

Future of IT industry

In India, the software boom started somewhere in the late 1990s. Most of the Indian software companies at that moment offered only limited software services such as the banking and the engineering software. The business software boom started with the emergence of Y2K problem, when a large number of skilled personnel were required to fulfill the mammoth database-correction demand in order to cope up with the advent of the new millennium

The profile of the Indian IT Services has been undergoing a change in the last few years, partly as it moves up the value chain and partly as a response to the market dynamics. Ten years ago, most US companies would not even consider outsourcing some of their IT projects to outside vendors. Now, ten years later, a vast majority of US companies use the professional services of Indian Software engineers in some manner, through large, medium or small companies or through individuals recruited directly.

The market competition is forcing organizations to cut down on costs of products. The professional IT services on the other hand are becoming increasingly expensive. The

offshore software development model is today where onsite professional services were ten years ago. There is a high chance (almost a mathematical certainty), that in less than ten years, the vast majority of IT services (software development being just one of them) from developed countries, will be, one, outsourced and two, outsourced to an offshore vendor.
Despite the global economic slowdown, the Indian IT software and services industry is maintaining a steady pace of growth. Software development activity is not confined to a few cities in India. Software development centers, such as Bangalore, Hyderabad, Mumbai, Pune, Chennai, Calcutta, Delhi-Noida-Gurgaon, Vadodara, Bhubaneswar, Ahmedabad, Goa, Chandigarh, Trivandrum are all developing quickly. All of these places have state-of-the-art software facilities and the presence of a large number of overseas vendors. India's most prized resource is its readily available technical work force. India has the second largest English-speaking scientific professionals in the world, second only to the U.S. It is estimated that India has over 4 million technical workers, over 1,832 educational institutions and polytechnics, which train more than 67,785 computer software professionals every year. The enormous base of skilled manpower is a major draw for global customers. India provides IT services at one-tenth the price. No wonder more and more companies are basing their operations in India.

The industry is in an expansion mode right now, with dozens of new offshore IT services vendors emerging everyday, the industry has a high probability of being subjected to the 80:20 rule in not too distant a future. In perhaps another ten years, 80 percent of all outsourced offshore development work will be done by 20 percent of all vendors, a small number of high quality, trusted vendors. Only a few select countries and only the most professional companies in those countries, will emerge as winners. India will definitely be the country of choice for offshore software development. We have the potential to become and remain the country of choice for all software developments and IT enabled services, second only to the USA. The third choice could be far distant.

India is among the three countries that have built supercomputers on their own. The other two are USA and Japan. India is among six countries that launch satellites and do so even for Germany and Belgium. India's INSAT is among the world's largest domestic satellite communication systems. India has the third largest telecommunications network among the emerging economies, and it is among the top ten networks of the world.

To become a global leader in the IT industry and retain that position, India needs to constantly keep moving up the value chain, focusing on finished products and solutions, rather than purely on skill sets and resumes. India needs to be able to package their services as products, rather than offering them as raw material

Geographical Breakdown of Exports

An interesting industry trend that has been noticed in recent years is the expansion of the Indian IT industry's presence from beyond traditional destinations, to newer geographies. The industry's focus is no longer on English-speaking countries alone, and a key strategy

for Indian IT majors has been to harness local talent to tap domestic markets and de-risk the revenue model by reducing their dependence on one geographical region.

Americas and Europe remain the key markets, accounting for over 90 per cent of IT-ITES exports. However, export earnings from markets other than the US and the UK are also witnessing significant double-digit year-on-year growth.

While Indian service providers have built delivery centers in key source markets (e.g. US), they are expanding their footprints in specialist locations like China for engineering and design; South Africa for insurance, and near-shore locations like Eastern Europe and Mexico. Apart from companies in the US, organizations from Europe, South East Asia, Australia, Japan, Hong Kong, New Zealand, etc. are also reaching out for Indian software expertise, supported by the conducive policy environment and incentives for software exports offered by India(see Table II).

Table II: Geographical Breakdown of Exports

Location	FY 2004	FY 2005
Americas	69.4%	68.4%
Australasia	22.6%	23.1%
Europe	7.4%	8.0%
Others	0.6%	0.5%

IT Services Exports by Verticals

Services exports in FY 2004-05 witnessed continued strength in traditional vertical market segments including BFSI, manufacturing and telecommunications.

Underlying the increasing geographic and vertical market penetration is the continuing supply-side maturity of the Indian industry. This is reflected in

the ongoing scale expansion without compromising on quality or productivity and growing deal sizes;

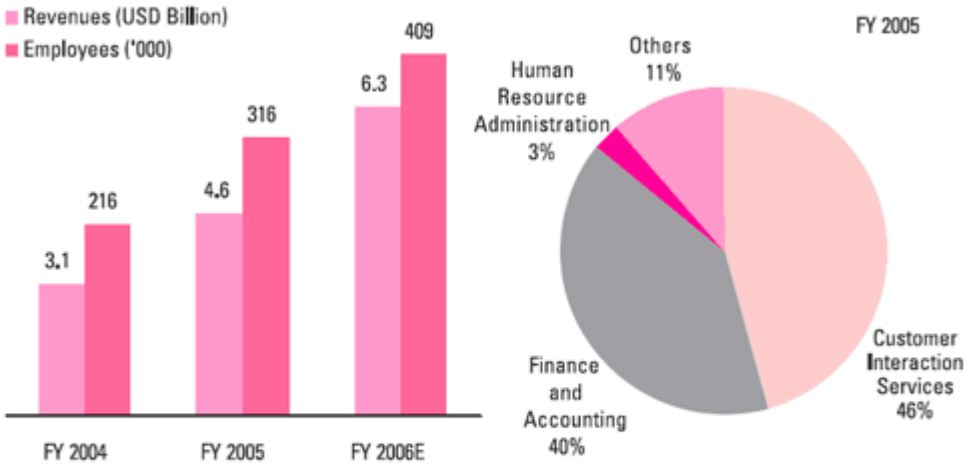
demonstrated abilities of India-based firms to broaden their service portfolio, leverage productivity and utilization levels to sustain competitiveness and enhance their global service delivery capabilities - while maintaining high levels of growth.

The Indian IT-enabled Business Services (referred to as ITES-BPO) segment continues to chart strong year-on-year growth, estimated at 37 per cent for FY 2005-06. Growth is being driven by a steady increase in scale and depth of existing service lines, and by the addition of newer vertical-specific and emerging, niche business services.

To better reflect how the industry and customer markets view the portfolio of services sourced from India, NASSCOM has re-classified the manner in which it reports the various segments included within IT-ITES. For instance, this year onwards, engineering and R&D services are being identified as an independent service line and will be reported separately. Consequently, some of the services (e.g. GIS), earlier included under ITES-BPO, will now be reported under engineering and R&D services. Further, NASSCOM has increased its overall estimate of industry exports for the previous year (FY 2004-05), based on the details reported to NASSCOM and STPI by individual companies. As a result of the re-classification and the revision of estimates, the historical values for a few segments have changed. In addition to the projections for FY 2005-06, to help ease comparisons we have re-stated the details for the preceding years FY 2003-04 and FY 2004-05 as per the new classification.

Indian ITES-BPO (re-classified) exports are estimated to have grown from USD 3.1 billion in FY 2003-04 to USD 4.6 billion in FY 2004-05, recording a growth of nearly 48 per cent, and are estimated to reach USD 6.3 billion by the end of the current fiscal year (FY 2005-06).

Indian ITES-BPO Exports: Growth Trends and Share of Key Segments



Note: Over the years ITES-BPO service lines have matured into three distinct groups of Customer Interaction, Finance and Accounting and Human Resource Administration, and a wide range of other vertical-specific and niche services (that do not come under Customer Interaction Services (CIS), Finance and Accounting (F&A) and Humar Resource(HR)). NASSCOM has re-classified its earlier service line break-outs to reflect this categorisation. As a result, the segment level break-outs for the previous years are not directly comparable.

Source: NASSCOM

Net employment in the ITES-BPO segment is estimated to have grown by approximately 100,000 in FY 2004-05, taking the total direct employment to 316,000. Based on hiring trends observed over the year, this segment is likely to end the current financial year (FY 2005-06) with total employment projected to reach 409,000. Employee turnover/ attrition

levels appear to be stabilizing with the talent acquisition, development and retention initiatives being undertaken by the players, beginning to deliver results.

Factors Responsible for IT Boom in India: A Closer Look

The study will discuss in detail three initiatives which were responsible for the present IT status for India: policies that mobilize the Indian Diaspora., the formation and work of the Ministry of Information and Communication Technology, software technology parks

Government-Diaspora Partnership

The Role of Diaspora in the Emergence of the Indian IT Industry –The Indian Diaspora has been very successful in Knowledge-intensive sectors in the US, and more so in the IT sector. Almost simultaneously, a very competitive and successful IT industry emerged in India. This section analyses various factors that helped in the emergence of the successful IT industry in India (during the last 35 years) and the role that the Diaspora community played in this evolution. The Diaspora Support during the Initial Years -The Indian engineers in the US were quickly recognized as excellent technologists but during the 1970s and 1980s they had to fight a strong perception - in some cases a self-perception - that they did not have front office or general management capabilities. As a partial reaction, many engineers took a conscious decision not to emphasize their ethnicity and there was remarkably little ethnic collaboration (of Indians) with in the US. In fact, their emphasis was on their careers within the 'white-people' managed corporations and they were rarely even aware of the progress being made by Indians in other organizations. However, this situation changed substantially in the late 1980s when several Indians became CEOs of new public companies and it became apparent that the community had the complete range of skills for leadership within the IT industry. Not only did the Indian engineers and IT professionals in the US not collaborate with each other, they also invested very little in the Indian IT industry. In fact, the few attempts and investments that were made by PIOs in the 1970s and early 1980s were quickly abandoned because of bureaucratic obstacles by the Indian government and the limited capabilities of Indian partners. Hence, the only crucial role played by these PIOs was limited to being tolerant mentors of early Indian software development companies

In early 1980s, several small Indian companies came to Silicon Valley in search of low-end contract software development work. Several PIO executives were willing to help but most found the Indian companies' work to be unsatisfactory and many suffered from deficient development tools and computers. This is partly because even until 1985-86, the Indian government was promoting Russian computers over American computers and Indian companies had just started working with PCs; hence, the companies' professionals could not meet, or sometimes even understand, US standards for quality and timeliness. To mitigate this problem, the Diaspora executives sometimes created programs within their US companies whereby Indian programmers could work in the US and with US technology (at Indian wages plus travel related costs). Further, they coached and guided

the Indian companies to enable them in improving their quality and performance standards.

Hence, during the 1970s and 1980s, the role of Indian Diaspora in the evolution of Indian IT industry was limited to that of a patient mentor and brand ambassador in most of the cases.

1990s

Many Indian engineers, who had started moving to the US in 1960s, had by now either become entrepreneurs, or Venture Capitalists or high-level executives in large and medium sized companies. And, these professionals had started to coalesce especially because many had graduated from the same top-notch colleges in India (such as the IITs) and most of them also knew their counterparts in India (who were often also alumni of the same colleges). Some of these relationships quickly matured in forming non-profit associations such as TiE and SIPA (Silicon Indian Professional Association).

TiE, originally designed as a Silicon Valley organization provided mentoring to promising young expatriate IT professionals, soon developed into a worldwide network of Indian professionals which has had a substantial influence on the Indian IT industry and government policies towards it. Currently, TiE has 38 chapters and over 6,800 members, worldwide.

Since many in these people knew their counterparts in India and since most were closely observing the growing Indian IT industry, in the mid and late 1990s, some of them started their own IT companies in India (e.g., Cognizant, Techspan, Mphasis) whereas others invested in nascent IT and Dot.com companies in India. Further, since US, Canada and UK were facing a shortage of IT professionals during 1996-1999, many in the Indian Diaspora convinced their companies to hire Indian IT professionals and this resulted in the 'Indian IT Diaspora' becoming stronger and the Indians constituting 24 percent of the entire Silicon Valley IT professional population by late 1999.

All these developments in turn permitted another crucial Diaspora role. Some Indians had become senior executives at many major US corporations, like IBM, GE and American Express. In nearly every instance where these companies invested in or outsourced work to India a well placed expatriate executive crucially influenced the decision. In part the individual's own success supported the emerging positive reputation of Indian engineers. And in part the individual's direct experience of India gave them credibility in vouching that the well-known problems of India's infrastructure and bureaucracy could be overcome. The US investment and outsourcing partly drove Indian software industry annual growth to 40 percent during the 1990s .

There were other Diaspora roles as well. Some younger Indians in the US moved to India as 'Expatriates' and started IT Research and Development Laboratories (e.g., IBM India Research Laboratory was started in April 1998) whereas others moved to supervise US

investments, outsourcing contracts, and to train and manage Indian professionals to US efficiency and standards.

2000 & Beyond and Government Programs to Strengthen Diaspora Relationships in Promoting IT sector

By 2000 Indian engineers were at the helm of 972 Silicon Valley-based technology companies, which accounted for approximately $5 billion in sales at 25,811 jobs. Moreover, the pace of Indian entrepreneurship accelerated rapidly in the 1990s: while Indians were running only 3 percent of the technology companies started between 1980 and 1983, they were running 10 percent of those started between 1995 and 2000."[39]

The success of these former Indian nationals is evident, and the Indian government recognizes that connections with these individuals can help promote the domestic market for IT. The Indian Diaspora of IT professionals in Silicon Valley has established social networks like The Indus Entrepreneur (TiE) and the Silicon Valley Indian Professionals Association. The existence of these organizations shows that Indian immigrants maintain close ties to those of their own origin and value the professional connections that such a network can offer. To address the effects of brain drain, then, the Indian government began with mechanisms that strengthened the ties between the diaspora and its roots.

India's Ministry of Science and Technology formed a High Level Committee on the Indian Diaspora in 2000 in order to facilitate communication and interaction between the expatriates and their home nation. The organization's 2002 report recognizes that scientists of Indian origin abroad "are keen to contribute to their country of origin." One obvious way in which these immigrants can contribute to outsourcing in the Indian IT industry is to encourage their companies to partner with Indian firms for software development or other production processes, thus alleviating the effects of brain drain. If individuals hold leadership positions within their corporations and make managerial decisions, there is no better way to encourage outsourcing than to engage it firsthand. Another way of exploiting the connections with the diaspora is through organizations like The Indus Entrepreneur. The organization currently has established chapters in Bangalore, Bombay, Delhi, Hyderabad, Calcutta, and Chennai. The global connections have paid off, as the non-resident Indians "in turn invested in promising start-ups and venture funds and have begun to serve as role models and advisors for local IT entrepreneurs."

The government is pursuing a number of different bilateral programs simultaneously. The first of these programs is an exchange program called "The Transfer of Knowhow Through Expatriate Nationals" (TOKTEN). The concept, formed by the United Nations Human Development Program (UNDP), encourages expatriate nationals to undertake short-term consultancies in their home countries. In India, TOKTEN has enabled 650 professionals to visit 250 institutions from 1980-2001. The alumni networks of the government-funded Indian Institutes of Technology (IITs) have been another method of encouraging interaction. Alumni from America have recently given 60 crores in Indian Rupees to IIT Kanpur and 30 crores in Indian Rupees to IIT Karagpur "for upgrading

infrastructure and human resource development" and "tracking…alumni to other Indian premier academic-cum-research institutes." Investing in the IITs has helped in some way in tackling the problems caused by the shortage of computer professionals that has been predicted for the next several years.Two other notable initiatives have been taken by the government to connect with the diaspora. One of these is advisory panels with eminent non-resident Indians that have spurred investment and led to several IT joint ventures. The next is the placement of many non-resident Indians in honorary fellowships at universities, funded by professional scientific and technical societies.

Through these various programs and incentives, India has found a viable method for fighting the "brain drain" which could so easily strip the country of one of its most valuable resources, a skilled labor force. Short of working extremely hard to entice Indian nationals back to the country, fruitful interaction with the Indian Diaspora is an excellent way to push the IT industry in India to even higher levels and mitigate the shortage of IT professionals there.

Indian IT Industry: Role of Government Institutions and Ministry of Information Technology

Before 2000

In India, the Department of Electronics (DOE) was the primary agency overseeing government IT policy formulation and implementation. Three government-funded computing organizations played important roles in new technology development: the National Centre for Science and Technology (NCST) in Bombay, the Centre for Development of Advanced Computing (C-DAC) in Pune, and the National Informatics Centre (NIC) headquartered in New Delhi. C-DAC is now one of the most advanced IT development centres in India. The NIC was the second major Indian computer-related project funded by the UNDP in 1977. It operates the largest data communications network (NICNET) in India with more than 600 earth stations linking government agencies at all levels. There are many lessons to be learnt from the two decades of NIC operations in the country. NIC has done a pioneering work in popularising the use of computers in the government sector, breaking the geographical boundaries and encompassing all sectors of economic activity. In the process, it has carved out a niche for itself among the public sector organisations. It has taken upon itself the job of creation of IT applications for different government departments.

In 2000 and Beyond

In 2000 India set up a science and technology bureaucracy to coordinate government-administrated projects relating to information technology. A number of different government agencies, formerly under the Ministry of Science and Technology that are concerned with IT, were brought together into an integrated Ministry of Information Technology (also referred to as MIT). It has since undertaken a large number of projects aligned with its vision of "making India an IT Super Power by the year 2008."Among the

objectives identified are “creation of wealth, employment generation, and IT-led economic growth.” As a policymaking body, the organization’s leadership consists of a minister, a minister of state, a secretary and additional secretary, a controller, and several group coordinators and senior directors. This ministerial hierarchy fills a previous void in the Indian government; until the Ministry of Information Technology was formed, there was no “single apex institution or focal point for formulating national policies and strategies for the IT sector…and the lack of any central oversight and a critical mass of in-house expertise in the public sector often hinder[ed] the sharing of information…and the development of information standards and protocols and common information infrastructures.” It is further recognized that “in general, the institutional framework [was] underdeveloped for dealing with systemic problems of computer and software requirements, planning, procurement, coordination among agencies, and IT diffusion.” The Ministry of Information Technology has been India’s solution for strengthening that framework.

India’s Ministry of Information Technology seems to satisfy some of the prerequisite conditions for a science policy bureaucracy. These are -recognizing that India had the potential to exploit its reservoir of highly-skilled software engineers that existed before the outsourcing boom, the government’s installation of a government body that coordinated projects specifically toward this end was a logical step. It has continued to do so, as India graduated 375,000 engineers compared to America’s 70,000 in 2003. Second as a developing economy progresses, “it will become more technology-intensive and so require more scientific support.… Indicators of economic development, such as per capita gross domestic product (GDP) should predict the creation of a science policy organization.” Overall GDP for the country began an upward trend in 1980, when the IT industry was nascent. It has since increased every year. The security conditions has prompted the GOI to have science policy bureaucracies. One can view security as the guarantee of foreign investment in a developing nation. At a time when the developing nations of the world continually compete for foreign investment, demonstrating that one country has a comparative advantage in production of a certain good provides the nation with economic benefits. Forming a national administrative institution specifically to promote that industry in India’s case, information technology displays commitment to that industry and to development in the country as a whole. Therefore, the Ministry of Information Technology helped India gain security despite global competition for foreign investment.See Appendix III for the GOI strategic approach for promoting the Indian IT industry.

Taken more literally, a strong IT industry can help a country maintain security during a time of information warfare. The “ability to attack and disable the military and civilian communications networks of potential adversaries” is a potentially significant technological tool in modern warfare and an organization that can oversee such technology serves both to bolster the national security of the country itself and to properly direct the use of the technology should this type of warfare be necessary

The formation of an umbrella institution, however, is not the end in itself; the body must actually propose policies and implement projects to gain legitimacy

Software Technology Parks of India : A Business, Academia & Government of India Initiative

The website of Software Technology Parks of India is subtitled "Catalyst to the IT Industry Growth." This description is quite accurate if one examines government policies that have spurred the IT industry to its current levels. The concept of software technology parks (STPs), which provide the technical infrastructure necessary for IT development, emerged from a growing problem that policymakers began to notice in the early 1980s.An STP is like an export processing zone for sotware. The New Computer Policy of 1984 and the 1986 Policy on Computer Software Export, Software Development, and Training set out the objective of expanding the Indian software export and development through data communication links. The policies' aim was to develop software in India using Indian expertise on sophisticated computers that were being imported duty-free. Protectionist policies had, until then, stunted the growth of the industry by imposing duties of up to 200% on the imported hardware needed for advancement of both the hardware and software components of the industry

The next and more significant difficulty firms faced was the high cost of the data communication links needed for software development. The poor telecommunications infrastructure India had at the time was inadequate. Foreign corporations were looking to expand their global production networks to India because the country offered a skilled, English-speaking workforce, but the corporations could not be accommodated at a reasonable cost. Though companies were allowed by law to establish the data communication link through their own initial investment, few companies could pay the high price without other incentives. From this necessity, the idea of software technology parks was born. The Ministry of Information Technology developed the concept of STPs and lists the following as the objectives of the project:

To establish and manage infrastructure resources such as Data Communication facilities, Core Computer facilities, built-up space and other common amenities; to provide 'single window' statutory services such as project approvals, import certification, software valuation, and certification of exports for software exporters; to promote development and export of software services through technology assessments, market analyses, market segmentation and marketing support; to train professionals and to encourage design and development in the field of software technology and software engineering.

Though these are lofty ambitions, the STPs now serve as intersections where a viable business model, strong Internet infrastructure, and government interface come together for a successful enterprise: "The infrastructure facilities include modern, high-speed, broad-band telecom links, powerful computers and network systems beyond the reach of individual firms, consultancy, and training support." The first of these parks were established in 1991 at Bangalore, Pune, and Bhubaneswar; by 1999, over twenty-one cities in the country housed STPs. In nearly all of the literature on the subject STPs have been heralded as one of the most profitable institutional initiatives for developing the IT industry.

While software parks have proven to be successful in practice, the STP model has theoretical underpinnings grounded in the triple helix model of development. This model consists of a triadic relationship between government, industry, and universities. Central to the model is the principle of incubation, which refers to the special roles each of the triad participants plays in encouraging research, investment, and development. In the original theory of incubators, physical proximity of the participants was not considered a crucial feature; but in the contemporary incubator model, “a common physical space where cross-fertilization among companies can more easily take place” has become much more important. Software technology parks in India fill this requirement well, offering places where several different companies can come together and engage in the networking activities that spur innovation in both business models and actual products. Governments have the unique catalytic ability to push collaboration among public, private, academic, and foreign agencies; the Indian government has chosen to achieve these ends through STPs, where shared infrastructure and support services encourage firms to learn from each other. Software Technology Parks of India now boast 350 clients including Texas Instruments, Motorola, and Microsoft most of which are software companies taking advantage of the high speed data connectivity provided by satellite earth stations and international private-leased circuits.This initiative of the Indian government has helped to expand the IT industry in India by providing physical space and technology that allow firms to flourish and take advantage of the human capital the country offers.

Causes of Indian IT Industry BOOM today and India's edge

This boom is largely fuelled by the following factors: a)The Role GOI played in providing impetus to promotion of software exports since 1980s, b) India has a vibrant news and entertainment industry, and a large domestic audience which is hungry for content, c) Indian success stories in Silicon Valley, which by now are legion, are inspiring entrepreneurs and young people in the homeland, and d) venture financing to India’s information technology sector has grown dramatically in the last year, aided in part by Indian net-millionaires from overseas playing a key role as ‘angel investors(e) its low cost -high quality-scalability model, which gives it an edge over other emerging ITES-BPO destinations such as Ireland, the Philippines, China and some Latin American countries. (f) a high quality, pool of knowledge workers who have English Speaking and relevant domain skills give India an edge over other offshore outsourcing locations.(g) The ability to focus on core competencies and use offshoring to access new technologies and talent to strengthen and expand existing business offerings.

Major global players who have recently invested in Indian IT and Internet firms include Walden, Draper, Chase Manhattan Bank, Citibank, Microsoft, Intel, Pacific Century Group, News Corp and Kerry Packer Ventures. Approximately US $ 1 billion has already been invested or pledged by these and other venture capital firms, and industry reports suggest that a further US $ 10 billion is waiting to be tapped in the next 4 years.

Indian businesses are also moving aggressively to have a web presence, and over 200,000 large and medium sized firms are expected to launch net-based operations in the next year. Some private banks have already started on-line banking and advisory services, and regulatory authorities are expected to allow on-line stock brokerage in the next few

months. Many of these companies are motivated more by a fear of losing out than by any cogent business strategy, but a positive spin-off which is likely is that it will bring into focus the importance of service quality in business. On-line transactions and customer relations are just the beginning, and in time this will lead to bigger and better ideas. Internet is already aiding a gradual process of de-intermediation in many areas, such as in recruitment, business research, travel, real estate and insurance, and e-governance initiatives at different levels of government are now being planned. In future, interacting with various authorities for routine permits and information will become simpler and quicker, and MNCs will probably waste less time in low-level tasks.

Private sector developments have actually gone hand in hand with official measures to give a boost to the IT sector, including rapid adoption of Internet in various government departments, removal of irritants in tax rules for venture capital, reduction of import duty on computer parts, duty free import of software, laying of 8,000 kilometers of optical fiber cables between cities, and strengthening the domestic Internet backbone. Just recently, the Indian parliament passed a new cyber law that provides legal sanction to e-commerce.

Many of these initiatives are still many months away from being fully implemented, but their overall impact will be to sustain and perhaps even accelerate the IT momentum over the medium term by lowering costs and increasing access. For instance, more than 80 percent of India's corporate websites are currently located in USA because Indian servers are costlier and less reliable, but many of them are expected to shift to India once optical fibers and broadband become a reality.

India: ICT as a Tool for Development

Any government will have a dual role in the ICT sector and India is no exception. It acts as a regulator and formulates long term policies for the promotion and development of various industrial and service sector reforms including the ICT related activities; and at the same time, it deploys these services for the governance and improving the efficiency of its decision making and administrative control. The government's reform agenda is also affected by bilateral and multilateral agreements. This is particularly true of the ICT because of its international outreach and impact. The recent advances in ICT will have a profound impact on the way the governments function in the coming years. While the move towards decentralized planning and management will gain momentum, the need for high quality of information for decision making, control, monitoring and evaluation will increase in all sectors of social and economic activity. To what extent the Government of India can benefit from the development and application of emerging technologies for information storage, processing and communications? What has the Government of India done in this context? Has it kept pace with global trends in ICT and to what extent it has been active in policy formulation? Has it been an effective user of ICT in its day-to-day administration and decision making? These are some of the questions, the answers to which are difficult to get.

India is in a relatively better position as compared to many South Asian/SAARC countries with regard to the development and applications of ICTs. Nevertheless, there are large imbalances in the development and use of ICTs within the country. China, which has a larger population base than India, has better availability of ICTs. Sri Lanka stand out clearly as compared to other countries of the region. The high level of socio-economic development are associated with the high availability of ICTs. The World Development Report has also shown that there is a positive relationship between literacy and the application of ICTs for development purposes.

The Software Export Success Model

We analyze the experiences of three successful major software exporters

A summary of the export success(Table III)

Table III: Export Success in Three Leading Software Exporters

	India	**Ireland**	**Israel**
Demand	High external demand; weak domestic demand	High external demand; weak domestic demand	High external demand; strong domestic demand
National Vision and Strategy	Vision and strategy present: software services, then climbing the value chain	Vision and strategy present: product-related services for multinationals, then diversification	Vision and strategy present: home-grown product exports, then innovation and differentiation
International Linkages and Trust	Diaspora and state-funded links; reputation and trust, partly through ISO and anti-piracy	Diaspora and state-funded links; reputation and trust, partly through ISO and anti-piracy	Diaspora and state-funded links; reputation and trust, partly through ISO and anti-piracy
Software Industry Characteristics	Some competition; clustering and collaboration	Some competition; clustering and collaboration	Strong competition; clustering and collaboration
Domestic Input Factors/ Infrastructure	Strong, low-cost human capital; catching-up in telecoms; access to capital; limited R&D success	Strong human capital; strong telecoms; access to capital; some R&D base	Strong human capital; strong telecoms; access to capital; strong R&D base

On the basis of this analysis, the dimensional model presented earlier can now be drawn in greater detail. It is shown in Figure IV as the 'Software Export Success Model'. It shows drivers at top (pull) and bottom (push), and enablers in the middle.

Figure IV: Export Success Model

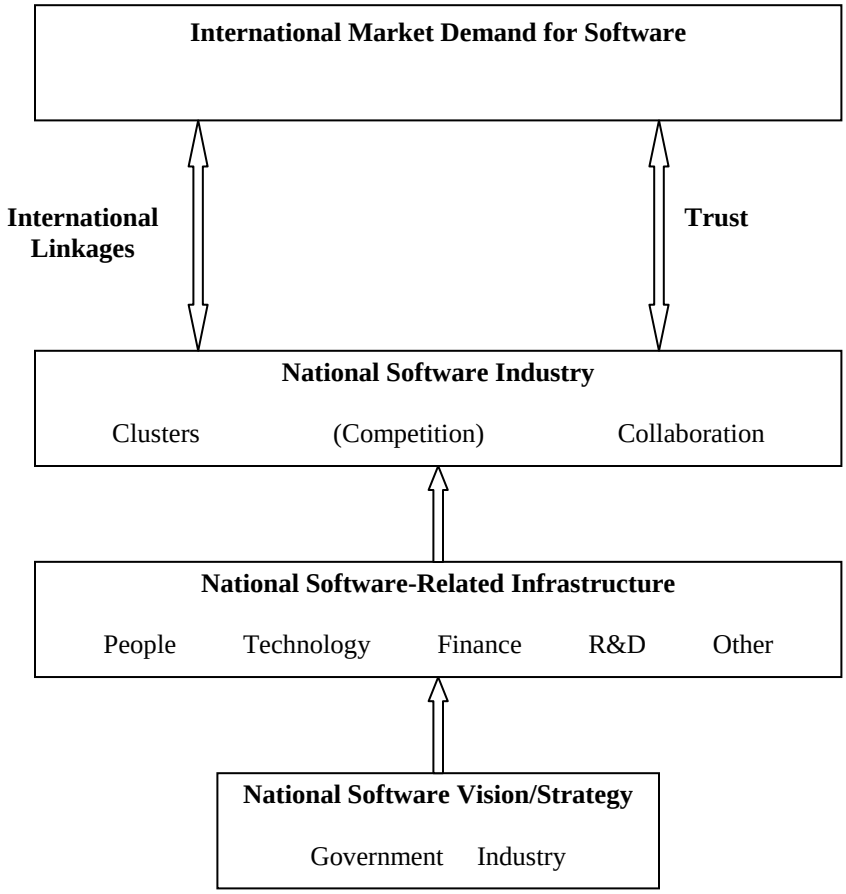


Figure : The Software Export Success Model

In a general sense, the software export success model has proven useful as a way of understanding the experiences of developing and transitional economies. It offers a template against which to analyse national strengths and weaknesses. It also offers some more general guidance for countries seeking to increase their software exports

Does India Have Enough IT Professionals to Meet Future Demand ?

Rapid growth of the Indian IT industry in the past few years has already stretched the current demand-supply balance of skilled manpower, and there are fears being expressed by industry leaders and market analysts that the country may soon face a severe shortage of qualified workers. India's education system is largely a government monopoly which

has been unable to cater for past growth, and the bulk of over 200,000 new software professionals who join the workforce every year are trained in private computer schools. These institutes, however, at best provide only medium-caliber training, and their graduates are often not up to Indian industry standards, leave alone international ones. Indian salaries have increased about 50 percent in the last two years as a result of people leaving for foreign jobs, and an increasing number of Indian firms are now complaining about 'country poaching' rather than 'company poaching.' What was once considered a flattery to the country's technical strength is slowly becoming a threat to the local industry.

While the problem is real, we do not expect this problem to have a severe impact on India in the medium term. Developments in India and abroad are likely to keep the country internationally competitive, and new sources will be tapped in future that will provide adequate manpower to sustain current growth.

Other software exporting countries are going to be even worse affected by a future shortage of skills. Salaries in some of these countries, such as Singapore or Ireland, have already risen to such high levels that an increasing number of their firms are now looking for Indian sub-contractors or partners. India will also continue to maintain an edge over new software rivals, such as China, because many of the 'new economy' applications require even more extensive knowledge of the English-language than did earlier software assignments.

India has many smaller cities and towns where the general educational infrastructure offers a large pool of manpower. With just the right amount of technical training this manpower can easily be tapped and brought into the IT industry. Bangalore and Hyderabad may be the more recognized symbols of India's IT success story, but cities like Indore, Jaipur, Coimbatore, Baroda, Chandigarh and Lucknow (all of them with major universities and technical colleges) offer immense opportunities in future.

There are an increasing number of IT-trained people in India – housewives, college students, small businessmen – who are looking for a supplementary source of income and who can be used by firms as subcontractors for low-level tasks and applications. This may require careful targeting, proper incentives and innovative employee-partner programs, but it can be done.

Various initiatives to attract and retain skilled workers have been set in motion by Indian IT firms and are beginning to show results. These include employee stock option plans, flexible work hours and in-house education programs. Many firms are also increasingly hiring and training graduates from liberal arts and other disciplines. Since 1992, industry-wide attrition rate has dropped from 25 percent to 14 percent.

In the interim, till new sources of skilled manpower come on line, Indian firms could find subcontracting partners in Bangladesh or Sri Lanka where English-speaking talent is relatively abundant and cheap.

Whatever be the future scenario in manpower availability, it is very unlikely that major Indian software firms will simply stop growing in the short to medium term. Many of them have already carved a successful international brand equity for themselves and have moved on to the higher-end of IT skills. In the worst case scenario, low-margin firms may get crowded out and there may well be some internal re-structuring and re-positioning of the software industry. But in the end, overall industry growth is unlikely to be seriously affected.

What's The Future Of The Indian Software Industry ?

It was earlier feared that the Indian software industry might witness a slow-down in the post-Y2K period, but corporate results and other industry data point to robust growth in the future.

The net cost of hiring Indian programmers is still less than one-third the equivalent cost in either Europe or North America, though there has been a gradual bridging of the salary gap between India and developed countries. Demand for Indian software professionals is increasing rapidly in existing and new client countries. For instance, the US is likely to absorb further 50,000 software engineers every year from India once the proposed Bill to increase visa quotas for technical workers is passed by the US Congress, and both Germany and Japan are now seeking to hire as many as 30,000 yearly workers.

Rapid growth of Internet will create a whole new category of demand in software and allied services in future, such as in internet service applications, web design, internet call centers, validations systems, yellow pages and data mining. India is well positioned to capture a significant share of global business in these areas, even with its relatively low-tech skill base.

Domestic demand will perhaps become another key driver of future growth. Increasing penetration of IT and Internet, pro-active government support and changes in technology will all combine to lower costs in computer hardware, software, telecom and Internet access in the short term. Personal computer sales are already registering double-digit growth in segments such as Government, Insurance, Banks, Public Tax System, Education and Small Office Home Office. India is expected to cross the one million PC shipment mark in 2000 and will have a total base of over 10 million PCs by 2005. These developments will create large domestic demand over the next few years for programmers, training institutes, web designers, system administrators and network engineers. In fact, domestic IT revenue is already increasing faster than exports and currently accounts for almost 30 percent of total industry turnover. Over the next 2-3 years, exports will continue to be the main pillar of the Indian software industry but domestic sales will also attain critical mass in importance and macro-economic impact.

Based on current and future trends, we expect overall revenue growth in software and allied services to be in the region of 40-50 percent annually for the next five years.

Studies of IDC points out that India will be a potential star in bioscience field in the coming years after considering the factors like bio-diversity, human resources, infrastructure facilities and government's initiatives. According to IDC, bioscience includes pharma, Bio-IT (bioinformatics), agriculture and R&D. IDC has been reported that the pharmaceutical firms and research institutes in India are looking forward for cost-effective and high-quality research, development, and manufacturing of drugs with more speed.
Bioinformatics has emerged out of the inputs from several different areas such as biology, biochemistry, biophysics, molecular biology, biostatics, and computer science. Specially designed algorithms and organized databases is the core of all informatics operations. The requirements for such an activity make heavy and high level demands on both the hardware and software capabilities.

This sector is the quickest growing field in the country. The vertical growth is because of the linkages between IT and biotechnology, spurred by the human genome project. The promising start-ups are already there in Bangalore, Hyderabad, Pune, Chennai, and Delhi. There are over 200 companies functioning in these places. IT majors such as Intel, IBM, Wipro are getting into this segment spurred by the promises in technological developments.

Overall Forecast

From a macro perspective, the Internet revolution in India is quite real. With a whole array of knowledge-based skills and legacy to draw upon, India is very well suited to integrate Internet into its industry, public institutions and education system. Perhaps more so than any other country in Asia, Internet will have a profound impact on India’s progress towards a more open and accessible business environment. However, the potential of Internet in the corporate sense of profit making has being overstated, and many pure web-based Indian businesses are likely to fail. But even though Indian society is not yet ready to adapt to the ‘new economy’ in a consumer sense, the increasing ubiquity of Internet technology will create new global opportunities for India on the supply side, and especially in software. There will very likely be an acceleration in the pace of domestic IT penetration, and this will help in increasing productivity and efficiency in the larger economy. At a minimum, continued growth in software exports and inbound investments will provide a comfortable source of hard currency, which in turn will act as a hedge against any adverse changes in India’s balance of merchandise trade. Even more, the direct and indirect impact of all Internet-related benefits could be as high as an extra 1 to 1.5 percentage point GDP growth over the medium term.

HURDLES AHEAD the sector would have to overcome several problems, including inadequate quality and skills of graduates, rising salaries and weak infrastructure, which resulted in frequent power shortages. The Government of India has a continued role to play in addressing such issues.

Indian software exports have shown very high growth rates for many years. Yet, behind this success lie a number of skews. Software exports have also been dominated by large firms located in a few metropolitan areas, notably in Bangalore.

Despite India's emphasis on import-substituting industrialization, it has not developed a robust, world-class manufacturing industry, and this includes IT hardware. Much of India's hardware industry consists of assembly tasks, almost entirely for the domestic market. India's software industry is, of course, more robust – at least in certain areas. While selling packaged software to consumer (and most business) markets requires economies of scale and scope, as well as marketing and customer support muscle, project-oriented components of software development do not do so, to quite the same degree. To some extent, therefore, India's software industry remains narrowly focused. For example, of India's 2001-02 software and services exports of Rs. 365 billion, two thirds came from IT services, and close to 88% of that amount came from custom application development and application outsourcing

Conclusions, Discussion and Suggestions

India's presence in the software industry dated back to 1970 when the TATA consultancy services entered the IT business sector. The foundation for the intellectual capital for software industry was laid by the establishment of the IISc in 1909 ,IITs, IIMs. The presence of a national strategy for software exports is therefore be recognized as a vital part of software export success (Balasubramanyam & Balasubramanyam 1997). Indeed, it goes beyond this – critical to each country's success has been a vision of what software could achieve for the country; a vision shared by a relatively small but committed group of government officials and private entrepreneurs. Such visions first emerged in the 1970s, were sustained through lean early years in the 1980s, and only truly came to fruition in the 1990s.The study believes that the initiatives on three different levels(as discussed above) served and continue to serve as the backbone of the government's approach in promoting the Indian IT sector since its formative years. The first of these is the Ministry of Information Technology, formed as an umbrella organization to coordinate the activities of the multiple government agencies that deal with the information technology. The second is the implementation of software technology parks where business, government, and academia can come together both for networking and production. Last, there is the set of initiatives that urge communication and interaction with the global Indian diaspora with hopes of encouraging investment in the country from those who have emigrated and become successful in other nations.This study is not comprehensive of the efforts taken by the government of India to promote outsourcing in the IT industry for one realizes that a myriad other public policies and private initiatives have fueled the growth of the sector as well. Nor does study attempt to argue that the three policies discussed are the best or most successful institutional projects with regards to promoting outsourcing. Rather, studying these three specific policies sheds light on potential components of a model that possibly could be replicated in other developing countries operating under similar conditions to those India faces. By attacking on three fronts, the government of India spread its influence and likely pushed the IT industry more than if it had neglected any of the policy areas discussed.

The late 1970s/early 1980s saw a number of developments that mark the true emergence of an Indian software industry. A US multinational – Burroughs – set up the first software-related joint venture when it saw an opportunity to combine sales of its hardware products into the growing Indian market with use of Indian staff to produce software (almost entirely working at the US sites of Burroughs' clients). In-house software groups began trying to sell their products in the Indian marketplace, sometimes leading to their being spun-off as software firms. At the same time, IBM withdrew from India, catalysing the creation of a number of computer services/software firms by its ex-employees, mainly seeking to serve the domestic market.

1980s saw very strong growth in the domestic hardware base, partly due to the advent of the personal computer, partly due to the – related – liberalisation of hardware policy in 1984. Despite this – or perhaps because of the growth in software piracy associated with standard PC software – the domestic market began to lose its significance with more and more firms seeing greater opportunities in software exports.

There have been continuous exports of software products since the early 1980s. These include enterprise systems, design software, and database management tools

Within the overall segment of software services exports, though, trends of change are detectable. Indian firms began with a strong emphasis on 'bodyshopping': the transportation of software staff to work overseas at the client's site. In the late 1980s, around 75% of export earnings came from bodyshopping. By 2000, this had dropped to nearer 60% (*Dataquest* 2001) and by 2006 it was closer to 45%, indicating a slow but steady trend towards offshore working.

This has been paralleled by a second trend: that of moving from supply of individual programmers to complete turnkey programming project services. As with offshore working, the trend of change has been greater within individual client—vendor relationships than in the industry overall. Nor has the industry overall diversified much from its main market: the US. Figures from the early 1990s up to 2005/06 consistently show around two-thirds of software exports going to the US, one-fifth going to Europe (mainly the UK, Germany and France), and about 10% going to other English-speaking OECD nations (e.g. Australia, Canada)

Although it faded into the background during the 1980s and 1990s, the domestic market has continued to grow, bolstered in recent years by strong private and public sector investment in e-commerce and e-government applications respectively. Neverthless, exports remain the 'jewel in the crown', representing more than 80% of industry revenues

As evident from this study much before the first generation of reforms, that is, 1991, the government was pursuing a structuralist approach toward economic development. After liberalization in 1991, the government embarked on pro-active economic policies for the diffusion and production of IT. Consequently, the IT industry experienced an unprecedented growth rate in domestic as well as export markets. However, foreign direct investment (FDI) policies have not been successful in attracting the desired level of foreign investment, which is very important for a high-tech sector such as IT hardware manufacturing. The study suggests that immediate corrective measures need to be taken to augment the IT manufacturing industry, which can significantly contribute to national economic development and employment generation. To achieve sustained growth in the IT sector, high-quality professionals in adequate numbers are required. The new policy envisages continuous upgradation of standards at the school level with emphasis on physics, mathematics and English; make microelectronics and biology the new focus areas of tertiary education, updating the syllabus of computing engineering, electronics and IT in various technical institutions in line with the demands of industry. There were several initiatives taken up in the IT sector. The Ministry of Information Technology, set up in October 1999, was rechristened as the Ministry of Communication and Information Technology in September 2001.

Setting up of National Task Force on HRD in IT, creating an IT Venture Capital Fund of Rs. 100-crore [US$22.22 million], upgradation of the Education and Research Network (ERNET) connecting various universities and regional engineering colleges (RECs)

through a high-speed network and upgrading all RECs to the level of National Institutes of Technology, computerization of government departments by spending up to 3 percent of the budget on IT are among some key initiatives that were implemented.

Post-graduate engineering education and innovative research in IT are imperative in order to maintain quality and face new challenges in this dynamic sector.

To maintain skilled knowledge-workers with the right mix of technical, business and functional skills, the workforce needs to increase by at least 10-fold by 2008. As per the NASSCOM-McKinsey report 1999, India needs to have at least 2.2 million knowledge workers in IT software and service-related areas by 2008.

The Media Lab Asia project was initiated in 2001 for taking IT to the masses. Enactment of a comprehensive law called the Information Technology (IT) Act, 2000, provides legal recognition for transactions through electronic data interchange. Many e-governance applications were initiated and a number of government portals were hosted. Technology development and content creation in Indian languages was promoted. The government initiated moves to set up 487 Community Information Centres at the block headquarters in the Northeastern states and Sikkim for bridging the digital divide.

Information and Communications Technology (ICT) can be used as an effective tool for rural development in India. One of the best examples of this is the adoption of ICT by a rural community in Warana, as part of a "Wired Village" project, in the state of Maharashtra. The Warana Group of Co-operatives (WGC) is using ICT to streamline operations connected with sugar cane growing and harvesting. The "Wired Village" project, launched in 1998, as a collaboration between the National Informatics Center (NIC), the Government of Maharashtra, the Warana Vibhag Shikshan Mandal (Education Department) and the WGC, was aimed at bringing agricultural, market and educational information to 70 villages around Warana Nagar. It also intended to simplify other business operations of the co-operative.

Moving on to a much sustainable model is the "e-Choupal." Launched in June 2000, it has already become the largest initiative among all Internet-based interventions in rural India."e-Choupal" services today reach out to more than 3.5 million farmers growing a range of crops, including soya bean, coffee, wheat, rice, pulses, and shrimp, in over 31,000 villages through 5,200 kiosks across six states (Madhya Pradesh, Karnataka, Andhra Pradesh, Uttar Pradesh, Maharashtra and Rajasthan).

ITC's "e-Choupal" empowers over 3.1 million farmers by enabling them to access crop-specific, customized and comprehensive information in their native village habitat and language.Vernacular web sites, relating to each agricultural crop that ITC deals in, provide even marginal farmers with ready and real-time information on the prevailing Indian and international prices and price trends for their crops, expert knowledge on best farming practices, and micro-level weather forecasts. The "e-Choupal" model and

movement has helped aggregate demand by creating a virtual producers' co-operative, thus facilitating access to higher quality farm inputs at lower costs for farmers.

Various corporates like Wipro have also been undertaking programs for the rural communities. The company has launched its Applying Thought In Schools Program, even as giant chip-maker Intel has introduced its Intel Innovation in Education initiative and Microsoft its project Shiksha. With all these interventions, corporates are now targeting school students in a major way, in order to leverage technology in education.

The CBFL program, developed by Tata Consultancy Services, is another case in point. It operates under the aegis of the Tata Council for Community Initiatives and uses a mix of methods-such as teaching software, multimedia presentations and printed material-to teach an uneducated person. The method is implemented using computers, which deliver the lessons in multimedia format to the learners. Supplementing computers in this process are reference textbooks of the National Literacy Mission. Today, the CBFL project is operational in more than 1,000 centers in Andhra Pradesh, Tamil Nadu, Madhya Pradesh, Maharashtra, Uttar Pradesh and West Bengal, and it has touched the lives of over 20,000 people. More centers are in the process of being set up.

2005 was a year of steady growth with gradually increasing optimism for the global IT-ITES sector. Increasing outsourcing adoption and maturing global service delivery were the key drivers of growth. India is probably the largest beneficiary of services offshoring. Is that likely to continue? If labor cost arbitrage (bolstered by sensible policies and capital economies of scale) is the primary cause for offshoring, it suggests that an increasing proportion of offshored services will be located in the country with the largest low-cost labor pool, i.e., India. This has implications for the global distribution of work.

Worldwide spending on information technology (IT) and IT-enabled business services (together referred to as IT-ITES) grew by nearly seven per cent in 2005, on the back of healthier spending across key markets of the US and Western Europe, and strong growth in emerging markets.

Outsourcing continued to be the primary growth engine with global service delivery forming an integral part of the strategies adopted by customers as well as service providers.

The year 2005 also witnessed the coming of age of the Indian IT multinationals with the traditionally India-centric, indigenous players beginning to build noticeable global presence – through cross border acquisitions and organic growth in other low cost locations. This was complemented by global majors continuing to significantly ramp-up their offshore delivery capabilities – predominantly in India, vindicating the success of the global delivery model and highlighting India's increasingly important role in the new world IT order.

India's unparalleled attractiveness as an IT-ITES destination is now a well known fact. However, demonstrated IT-ITES prowess is not the only factor attracting international

investors to the country. Strong economic prospects backed by sound fundamentals of favorable demographics and investment ratios, human capital, trade openness, increasing urbanisation and rising consumption spending make India an attractive investment destination – as a sourcing base as well as a significant market.

For India to fully capitalise on the opportunity and sustain a disproportionate lead in the global IT-ITES space, key stakeholders need to focus on five key areas; a) enhancing the talent pool advantage – focus on skill development to better leverage the world's largest working population, b) strengthening urban infrastructure in existing (Tier I) and emerging (Tier II and Tier III) cities and continued emphasis on proactive regulatory reform to facilitate greater ease of doing business, c) driving a philosophy of operational excellence amongst industry players (across the board) to ensure that India based delivery sustains world-leading benchmarks in performance, d) catalysing domestic market development, and e) actively promoting an uncompromised agenda towards global free trade.

Recognising the potential of the sector and the opportunity it holds for the country, relevant constituents of the key stakeholder groups are actively engaged in developing and implementing initiatives that will strengthen India's bid for sustained leadership in this space. Successful execution of these initiatives effected through a concerted effort by the key stakeholders, including the government, industry and NASSCOM, and the academic community will ensure that India achieves its full potential.

The evidence is clear that outsourcing to the Indian IT industry has grown rapidly in the last two decades. **We can attribute this increase to the policies the government of India has instituted to promote the industry after it realized the potential that the industry held for economic development in the nation**

Another important consideration is whether lessons we can learn from India's success can be applied to other developing countries. India's skilled and English-speaking workforce was a clear contributory factor in the development of the IT industry. A starting point for other countries may be to launch education programs with focus on mathematics and science subjects and which can t teach their citizens marketable skills for this and other industries, while being careful to distribute training among industries in case there are economic changes.

Furthermore, an interesting future area of research into this subject could examine if the growth of a white-collar industry has ramifications for India: drastic poverty, poor healthcare, and widespread hunger. If such growth is found to have positive effects, other developing countries would be well-advised to study the policies the Indian government has undertaken and emulate them within the contexts of their own national goals. Though information technology is certainly not a panacea for the problems of developing countries, it may be a good first step.

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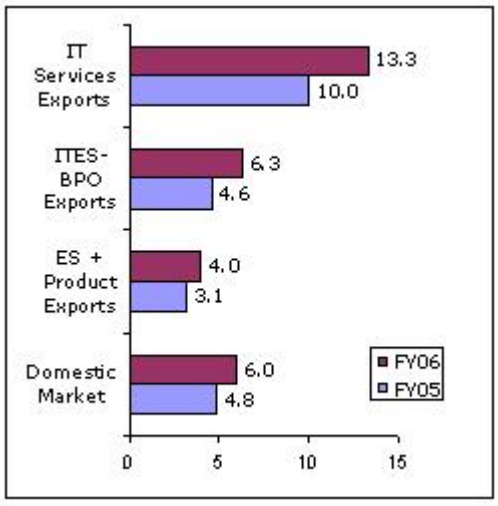
Appendix Table I

IT Software And Services Exports Grow By 33% In FY 2005-06

- Exports grow by 33% to USD 23.6 billion.
- IT industry growth of 31.4% in FY 2005-06 to reach $ 29.6 billion.
- Domestic market revenues grow by 24%
- Indian IT software and services industry forecast to register strong growth of around 25-28% in FY 06-07

NASSCOM, the chamber of commerce and "voice" of the IT software and services industry in India, on 1 June announced the findings of its annual survey on the performance of the Indian software and services industry (excluding hardware) and the outlook for FY 2006-07.

As per the NASSCOM survey, the Indian IT-IT Enabled Services (ITES) industry has recorded 33% growth in exports, to USD 23.6 billion in FY 2005-06, as compared with export revenues of USD 17.7 billion in FY 2004-05. FY 2005-06 also saw the overall Indian IT-ITES industry (including domestic market) growing by 31% registering revenues of USD 29.6 billion, up from USD 22.5 billion in 2004-05.



*Figures in USD Billion

Of the total IT-ITES exports in FY 2005-06, IT software and services grew by 33%, registering revenues of USD 13.3 billion; while ITES-BPO segment revenues reached USD 6.2 billion, recording a growth of 37%. Engineering services and product exports grew from USD 3.14 billion in FY 04-05 to USD 4 billion in FY 05-06. Domestic market revenues reached USD 6 billion in FY 2004-05 from USD 4.8 billion in FY 2005-06.

NASSCOM has projected **overall software and services will grow by 25-28% to USD 36-38 billion in FY2006-07**. IT-ITES exports are likely to grow by 27-30% in FY 2006-07, posting revenues between USD 29-31 billion.

The excellent performance of the Indian software and services industry once again reinforces our confidence that the industry is on course to meet the projected target of USD 60 billion exports by FY 2009-10, as projected in the NASSCOM McKinsey Report. This growth is also reflected in the employment trends, both direct and indirect which according to our estimates is to the tune of 4.3 million.

With less than 10% of the market currently addressed, a large market opportunity exists for the sector which will ensure sustained demand led growth. Factors like evolution of global delivery model, unbundling of large IT outsourcing deals with larger India based delivery shares, and the large contract values due for renewal over next two years are some of the positive indicators for the sector. In the last year India's strength has emerged through large client wins, cross-border mergers and acquisitions, movement of the industry towards stable pricing model and a gradual positive shift in the outsourcing debate".

However, along with the opportunity, there are a challenges that call for focused efforts. These include concerns about the quality and skill sets of graduates, infrastructure, maintaining the attractiveness of India for IT investments and steps to boost the domestic market

NOTES:

Employee numbers:

Numbers in '000s	**FY04**	**FY05**	**FY06**
IT Software and Services	614	741	878
ITES-BPO	253	316	415

Note: These numbers include domestic IT services captive staff

Sector-wise break-up:

USD billion	**2004-05**	**2005-06**	**2006-07 Estimate**
IT Software and Services Exports[1]	13.1	17.3	21-22
ITES-BPO Exports	4.6	6.3	8-8.5
Domestic Market	4.8	6.0	7-7.3
TOTAL EXPORTS (IT Services + ITES-BPO + ES, Product Exports + Domestic Market)	**22.5**	**29.6**	**36-38**

Key highlights of the NASSCOM survey:

*Industry employee base estimated at nearly 1.3mn in FY06

- Employment in the exports segment estimated at nearly 930,000 which translates into a year-on-year increase of ~32%
- IT software and services added over 120,000
- ITES-BPO added ~100,000
- Indirect employment attributed to IT-ITES was 3 million
- Exports grew by over 33% - was the main factor in the industry performance exceeding expectations

*Industry performance

- Exports grew by over 33% - was the main factor in the industry performance exceeding expectations
- Strong growth in the industry corroborates the economics of offshore outsourcing
- The last year was marked by scope and scale expansion
- Key trends indicate a strong demand for traditional services (ADM) as well as new services (EAI, package implementation, etc.); continued expansion of service portfolio, higher-value processes and an increased traction in Engineering Services as well as domestic demand

*India has maintained its distinctive lead over other offshore destinations on parameters like financial structure, business environment and people skills / availability.

- India has 28% of the suitable talent available across all offshore locations
- Outranks the next destination by a factor of 2.5
- Focus on security, quality and leveraging experience to gain from operational excellence and sustained total cost competitiveness, driven by utilization and ability to deliver multiple dependent processes are the key driving factors.

*Six key focus areas for sustained leadership have been defined as

- Enhance the talent pool advantage by focusing on skill development
- Urban infrastructure strengthening – plan for emerging cities and aim for proactive regulatory reform to facilitate business in India
- Operational excellence to be driven amongst industry players to ensure world leading benchmarks in performance in India based delivery model
- Catalyzing domestic market development
- Promoting an uncompromised agenda towards global free trade, actively
- Fostering an ecosystem to breed innovation

*Projections for FY 2006-07 estimate overall software and services to grow by 25-28%

- Lower growth rate masks the fact that incremental revenue of $6-8bn is higher than ever before
- Exports growth projected at 27-30%; IT software & services $21-22bn; ITES-BPO $8-8.5bn
- Domestic market growth forecast at around 20% with a significant upside potential in e-governance and high growth sectors e.g. retail, healthcare etc.

***[1]** **Includes Engineering services and Product Exports (FY 05 – USD 3.1 billion; FY 06 - USD 4.0 billion)**

Appendix Table II: Targets for the Year 2008

Opportunities in Software Sector by the Year 2008

(McKinsey Report, in Department of IT webpage http://www.mit.gov.in/dbid/eproduction.asp)

Software Sector		
	Total Market	**Exports**
IT Services	$ 28-30 billion	$ 28-30 billion
Software Products	$ 8-11 billion	$ 8-11 billion
IT Enabled Services	$ 21-24 billion	$ 21-24 billion
Domestic Market	$13-15 billion	
Total	**$ 70-80 billion**	**$ 57-65 billion**

IT Industry by the year 2008

Employment Generation Year 2003-04

IT Exports

- **35% of India's Total Exports in 2008**
- **from 21.3% during 2003-04**

Share of IT Software & Services Industry in GDP

- **Likely to be 7% of GDP in 2008**
- **from 2.64% of GDP during 2003-04**

Hardware Production Projections for Tenth Plan

Rs. Crore

	Realistic Scenario	Optimistic Scenario
2001-02	32,750	32,750
2002-03	39,500	41,600
2003-04	45,000	50,500
2004-05	52,000	61,500
2005-06	60,000	74,700
2006-07	69,000	90,900
CAGR	**15**	**22**

Employment Generation Year 2003-04	
Software Sector & Service Sector	813,500
of which ITES& BPO Sector	245,000
Hardware Sector	
Direct Employment	395,000
Indirect Employment	250,000

Employment Generation Year 2008	
Software Sector ITES / BPO Industry Indirect Employment	2.2 million 1.1 million 2-3 million
Hardware Sector Direct Employment Indirect Employment	 1.6 million 3.2 million
Total Employment Generation	**over 9 million**

APPENDIX III

STRATEGIC POLICY FOR IT INDUSTRY BY THE MINISTRY OF IT

1. Productivity of the Indian Software Industry will be continuously upgraded by de-licensing and de-regulating the import of software productivity tools. The per capita productivity level of Israel for Software Development shall be kept as a target for surpassing by the year 2003.
2. For keeping pace with the fast changing trends in the software technology, companies and Software development organizations will be progressively encouraged to spend at least one-fourth of their total software Budget for the purchase of software productivity and quality tools and nascent software related to the latest software technology trends.
3. The high quality of Indian Software Services and Software products exported, will be sustained by compulsory insistence of ISO-9000/SEI level-5 Standards or equivalent, certified by one or more competent certification agencies in India.
4. In their drive to increase the international credibility, the software companies shall be allowed to utilise a part of their export earnings for putting in place all necessary means for meeting strict delivery schedules and customer satisfaction.
5. With software export growth poised to reach annual doubling rates by the year 2001, Government will fund a number of study projects to understand the problems precipitated and solutions required under conditions of such high growth rate. The findings will be publicised through appropriate media to all the companies and organizations directly or indirectly serving the export market. The Government will endeavour through crash programme efforts to help the industry overcome major bottleneck situations arising therefrom. In particular, the fast growth rate is making a large number of project managers to become entrepreneurs, thus creating a gap in demand and supply of project management skills. Special funds will be enabled for commensurately increasing the supply of project management skills.
6. With India having the largest pool of English speaking IT manpower in the world, the Government of India will encourage furtherance of this strategic advantage for increasing software export. At the same time, special incentives will be given for increasing the language advantage in exports by promoting sections of IT manpower to cultivate other languages like European languages, Russian, Japanese and Chinese. For internal spread of IT culture, the knowledge and

experience gained in language computerisation will be adequately extended to all the Indian languages by the year 2003.

7. One of the factors attributed to the software success of India is the mathematical and logic expertise in the background of more than 2000 years of mathematical culture. The Government will encourage migration of mathematical talents into mathematically oriented software development through adequate number of scholarships as well as promotional retraining programmes.
8. To create confidence among the recipient organizations in developed countries for Indian software export, the existing Copyright Law, which is one of the toughest in the world, will be implemented in practice by suitably enforcing the existing Laws.
9. As the trend of setting up of global research and development units by national and multinational companies is a major opportunity for India, which has one of the largest scientific and technical manpower talent pools, the Government will extend the facilities and supportive policies given to local R&D to such global R&D units also.
10. Offshore software development in India, through high speed satellite and fibre optic links, shall be maximally de-regulated for enabling the creation of such linkages dedicated to software and related services export from India.
11. With about 160 out of Fortune 500 companies having out-sourced their software to companies in India by 1998, Ministry of Commerce will work out a crash programme for awareness building for increasing this number to 300 by the year 2001 and 400 by 2003.
12. Ministry of External Affairs will create a Cell operating through specialised franchisees, for creating the best possible ambience for Indian software exporters to do business outside India. This would include resolutions conducive to Indian enterprises and Indian enterprises trading overseas to combat protective and non-tariff barriers created in the developed world, including Visa control. The country will launch major proactive technical and diplomatic actions at ITA-2 of WTO.
13. All large IT projects taken by Indian companies in overseas market requiring more than 300 man-years of effort, will be eligible for all concessions under project exports.
14. To enable tapping the vast global market in products and packages, which is the next step of the value chain, the following policies will apply to leverage our software development/management skills in the international market, to encourage trend-setting Indian companies and to pave the way for the new entrant's confidence in the Product Software business:
    - A definite time lead will be given for the Indian product software, where global standard products are existing/emerging which will be for a period of 24 months, termed as Indian software products promotion period.
    - Encouraging the infrastructure industries like Petroleum, Power, Steel, Banking, Insurance, Hospitals and Mining to work with the various Indian product software companies and to create global reference sites.
    - Banks will extend working capital limits for Product Software companies and will be in multiples of net owned funds similar to the provisions applicable to NBFC and other such service companies at present.

- It is very important to build brands internationally. The Government will provide soft loans/subsidies for Brand Building of product software developed in India through the India Brand Equity Fund of the Ministry of Commerce.
- The provisions of Section 35(2AB) of Income Tax Act will be applicable to Product Development also.

15. With India making an entry in 1999 into the listings in major overseas Stock Exchanges, a stage is set for attracting requisite Foreign Direct Investments. Taking note of the advantages of such overseas listing, the Government of India will maximally simplify the procedures to enable any registered Software Company to get itself listed in overseas Stock Exchanges like NASDAQ, NYSE, etc. After the listing, the companies can avail without restriction, post-listing services like Internet-based Information services, daily summary of activity in the Stock Market, quality, analytics, foreign market data, etc., as well as make it easier to participate in analyst meetings, regional conferences, satellite broadcasts, Internet hot links, Board meetings, etc. In the country's drive to create Indian multinationals around the world, listing in overseas stock exchanges will be an essential facility.
16. A major industry reorientation programme will be initiated through CII and NASSCOM with promotional Government funding to attain world leadership position in the following areas among others: Y2K solutions, Euro Solutions, IT-enabled Services, Net-based products, Web Technologies, Electronic governance, Electronic Commerce and Management of Convergence.
17. STPI and private STPs can host IT-enabled Service export ventures for which all facilities, concessions, procedures and policies applicable to Software Export will be equally applicable.
18. A Government and industry funded consortium will be established that would scout for suitable business opportunities globally, and subcontract such projects to 'Grameen Data Processing Centres' that would be run and managed as profit centres by various local enterprises, thereby creating quality employment at grass root level.
19. Create a venture capital fund with an initial funding of about US$ 100 million towards funding start-ups and entrepreneurial efforts for catering to IT Enabled Services Market.
20. A Consortium of IT companies will be encouraged to establish 'Indian Institute of Global Services' specializing in Global Services for providing market intelligence on domestic and global services industry to disseminate information such as new trends, market conditions, key indicators, new opportunity areas, etc. The Institute will conduct research and suggest best practices, positioning of India as a global hub for IT Enabled Services, helping start-ups with marketing plans and contact databases, etc. , design and facilitate courses for graduating and developing professionals for this sector.
21. Courses on IT Enabled Services will be introduced as a vocational course under various schemes of Government of India.
22. An industry consortium will be formed by active collaboration of Government of India, NRIs, leading Indian industrial houses, software companies and venture

capitalists to address the huge opportunity offered by IT Enabled Services. Resource infusion from each of the stake holders, besides financial resources, may include mentoring for initial take off stage, establishing a global network to evangelise India advantage and enlist corporations/clients; co-development of quality infrastructure in India; regular advice to authorities on issues to be addressed; strategic and operational assistance; initial managerial deployment, etc. This consortium may also do a continuing job of building India's global brand equity in this area.

Government will enable a paradigm shift to 'Hub to globally competitive value services' as against talent provider, as a means for sustaining India's advantage and protecting future earnings.