Chapter-4 “IT, Education & Job Opportunities”

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IT Education and Job Opportunities

4.1 INFORMATION TECHNOLOGIES AND EDUCATION

The integration of information technology in teaching is a central matter in ensuring quality in the educational system. There are two equally important reasons for integrating information technology in teaching. Pupils must become familiar with the use of information technology, since all jobs in the society of the future will be dependent on it, and information technology must be used in teaching in order to improve its quality and make it more effective.

In recent years, the speedy, effective and global communication of knowledge has created a new foundation for co-operation and teamwork, both nationally and internationally. The increasing role played by information technology in the development of society calls for an active reaction to the challenges of the information society.

Globally, already, new and greater demands are being made as to the core qualifications of individuals, as well as to their understanding and knowledge of the consequences of the introduction of information technology for the work and organisation of a company. Companies are no longer forced to gather all their functions in one place. The knowledge-intensive functions such as development and marketing can be sited in countries where the labour market can supply highly educated employees, whilst production itself can be moved to low wage countries. The result is the efficient handling,
processing, co-ordination and administration of company resources, which is decisive for the competitiveness of the company.

In a society, which is becoming increasingly dependent on information and the processing of knowledge, great demands are therefore made that the individual should have a solid and broad educational foundation on which to build. Educational policy in the information society must ensure that:

- IT qualifications are developed by means of their integration in all activities in the education sector and
- the individual citizen must have an active and critical attitude to developments and not passively allow technological development to set the pace.

Therefore, it is not only companies that have a challenge to face. The individual member of the labour force, or who is en route into the labour force or is under education or training will come to experience a growing pressure for constant professional and personal development. This must be seen, not least, in the light of the fact that development towards a global division of labour will mean fewer and fewer jobs for those with a short education and more and more jobs for the part of the labour force that has a longer education.

Only if society works towards a higher level of education for the population as a whole and involves the individual citizen in life-long education will Denmark maintain its competitiveness and develop a labour market which, in the global competition for jobs, is even today under great pressure.

The keywords in the educational system of the future are: production of knowledge, geographical and temporal independence, pedagogic and structural innovation

The strategic objectives will be expressed in terms of five areas of action:

- Basic skills
- Responsibilities of leadership
Teaching and learning
The electronic infrastructure
Teaching materials

These areas of action are not to be seen as isolated units. On the contrary, they are overlapping components that supplement each other. Basic skills

Over the last fifteen years American schools have dramatically increased spending on classroom technology to more than $5 billion annually, because there has been a widely held belief by governmental, business and educational leaders that "wiring schools, buying hardware and software, and distributing the equipment throughout will lead to abundant classroom use by teachers and students and improved teaching and learning".

Learning with Internet
The Internet is a complex repository containing a huge maze of information from a variety of sources. It has become a prominent source of information for many people worldwide. The Internet wave has also hit the educational landscape in many big ways. The use of technologies such as the Internet as a teaching tool in schools is not the issue now since it is pervasively used. Rather, the issue is how to effectively employ such technologies and harness fully the new opportunities created by them to promote positive student learning experiences.

Schools need to consider how technology-based instructional programs are mounted to ensure that students use the Internet efficaciously as a learning tool for various authentic learning activities such as conducting research on a given topic or finding relevant information for an assignment. Bruce and Levin (1997) posit that the Internet can be viewed as providing the following three basic types of tools in the educational domain:

- Tools for inquiry
- Tools for communication
- Tools for construction
In providing tools for inquiry, the Internet facilitates finding sources of information appropriate to a task, working to understand the information resources and how they relate to the task, and if possible applying this understanding in a 'productive way. The Internet enhances students' knowledge acquisition by facilitating students' access to resources from the outside world including experts in the field, as well as interacting directly with them. Thus exposure to real life contexts of the external world trains the students to face the uncertainties of the ever-changing outside world.

In providing tools for communication, the Internet is a remarkable tool for rapid communication. Such communication can be both synchronous and asynchronous and takes on many forms such as e-mail, mailing lists, newsgroups, chat and videoconferencing. Such interaction involves communication with students and professionals in distant places, cultures and traditions as well as facilitating teachers to be in touch with other teachers.

In providing tools for construction, the Internet promotes learning by scaffolding varieties of authentic learning activities for students. Through these activities the Internet also supports the development of students' higher-order thinking skills. For example students are able to demonstrate their conceptual understanding by constructing products such as web pages. In these activities learners regulate their individual learning progress according to their own experiences and expertise. Learners can access a wealth of resources at their own pace and have meaningful interactions with the content information. For instructional activities, the Internet also has the added advantage of being adaptable for both individual and cooperative learning.

Though offering a myriad of pedagogical benefits, there are also a number of caveats that educators need to bear in mind in their attempts to employ the Internet as a teaching aid. Being aware of possible pitfalls in conducting Internet based lessons, teachers would then be able to invest in proper planning to ensure that the learning experience for their students is a meaningful and stimulating one. Students often go straight to the Web without waiting for guidance from a teacher or librarian. This results in students having a
difficult time navigating the Web and locating appropriate information relevant to the tasks in their homework.

Students may also not differentiate between authentic web sites and sites that contain biased and inaccurate information but masquerade as being reliable. Schools are thus faced with the challenge of teaching the students not just the power of having a wealth of information at one’s fingertips in the Internet but also proper evaluation skills.

Besides being cognizant of the strengths and shortcomings of conducting Internet-based lessons for students, teachers need to consider practical constraints that might otherwise hinder the desired implementation of these lessons. Time is one barrier to the extensive use of the Internet as students may be unable to spend a specific block of time on the Internet due to limitations in availability of computers with Internet access in schools.

In the knowledge based economies of today, it is critical to be able to search for and retrieve information from the Web. Locating appropriate information on the Internet requires a variety of skills such as the ability to use Internet tools (e.g. search engines), having knowledge of search techniques (e.g. browsing through an information tree) and ability to execute the search.

Effective use of the Internet to glean relevant information requires the ability to apply Boolean logic rules (e.g., and, or), an understanding of how information is organized, critical thinking skills that allow the searcher to make informed choices, and a working knowledge of Internet notations. One needs to have abilities such as searching for information, scanning and skimming information, and strategies such as planning, monitoring and evaluating in executing the search.

In conclusion, the Internet has been beneficial in the educational domain as a repository of gargantuan amounts of rich information. However schools, educational policy makers, and instructional/curriculum designers who intend to employ the Internet as a learning tool in their instructional programs must bear in mind and highlight to students the fact that just not any piece of information found on the net can be accepted as being authentic.
Thus it is imperative that students be taught a wide range of internet literacy skills from verifying the veracity of content hosted by the Internet to seeking for information by using various search strategies and techniques. This will help to ensure that the true potential of the Internet as a learning aid is properly tapped to inject greater vigor into teaching practices in schools.

New Evidences
Recently, a growing number of researchers have published studies that provide substantial evidence that technology can play a positive role in academic achievement. Several organizations like Edutopia, the North Central Educational Lab (NCREL) and the Center for Applied Research in Educational Technology (CARET) are documenting research studies that link technology to increases in academic achievement. Two studies are reflective of the growing body of research on technology's role in academic achievement.

Harold Wenglinsky's study, "Does it Compute: The Relationship between Educational Technology and Student Achievement in Mathematics," concluded that for 4th and 8th graders technology has "positive benefits" on achievement as measured in NAEP's mathematics test. But it is critical to note Wenglinsky's caveat to this conclusion. He argues that not all uses of technology were beneficial. Wenglinsky found using computers to teach low order thinking skills, "...[W]as negatively related to academic achievement...." Put another way, this type of computer use was worse than doing nothing. By contrast, teachers who had students use computers to solve simulations saw their students' math scores increase significantly. As he explored the reasons for the differing ways teachers used technology, Wenglinsky found that professional development was the difference between those teachers who used skill and drill software and those who used software that could create simulations. Teachers who had training and skills used technology in ways that focused students on simulations and applications that encouraged students to develop problem solving skills. Those teachers who hadn't had training used skill and drill software.
More recently, educators in Missouri issued their findings on a study of the impact the statewide eMints program had on academic achievement. This program is designed as a comprehensive approach to assist teachers to integrate technology. Participating teachers receive classroom equipment, and over two hundred hours of professional development over a two-year period. In addition to traditional workshops, eMints training includes peer coaching for individual teachers. The training is designed to help teachers integrate technology so that they can use inquiry-based teaching and emphasize critical-thinking and problem-solving skills. As one of the program leaders noted, "We find that when you put the two, (inquiry based learning and true technology integration) together there's a synergy created that really boosts students' learning". The power of pairing technology with inquiry learning was directly reflected in the test scores of more than 6,000 third and fourth grade students who recently took the Missouri Assessment Program (MAP) test. "Results show that a higher percent of students in eMINTS classrooms scored in the 'Proficient' or 'Advanced' categories...when compared with other students who took the MAP tests..."1

Technology and Learning: Two Pieces of the Puzzle2
These two studies highlight the importance of rethinking our current beliefs about technology. Educators can no longer accept the belief that technology is a silver bullet. Secretary of Education Rod Paige recently told educators they need to look beyond their focus on wiring schools and providing classroom access to computers. "The (real) issue," Paige insisted, "is how we use this access-how we get results." Paige encouraged educators to ask how technology can "add value to student performance?"

The two research studies highlighted above offer clear direction for educators who are trying to answer the questions raised by Secretary Paige. Both studies argue that improvements in student learning occur when technology is paired with instructional strategies like project-based instruction, which actively involves students in intellectually

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2 Ibid [http://www.newhorizons.org/strategies/technology/foltos.htm]
complex work that demands higher-order thinking and problem-solving skills. Henry Becker's research adds further weight to the argument that technology is a particularly strong tool for supporting active, inquiry-based learning. Becker argues that the kind of active learning necessary to master principles and concepts and explain student work is easier to implement in a technology-rich environment where "students have a rich array of information to work with (rather than only pre-selected, quality filtered textbook content), when communications structures enable students to pose relevant questions to appropriate individuals...and when technology-based tools such as databases, analytic software, and composition software help them to extract understanding from information".

Each of these studies also highlights the importance of Michael Fullan's observation that "The more powerful that technology becomes, the more indispensable good teachers are". If we expect teachers to use technology in ways that enrich and enhance student achievement, we must provide them with the professional development they need to develop the confidence and skills to apply technology, and an understanding of how technology supports standards-based education. Preparing teachers to use technology effectively may also mean following the example of Missouri's eMints program and ensuring that professional development focuses on instructional strategies like project-based learning, and cooperative or collaborative strategies, in addition to technology skills.

This need to prepare teachers to use technology effectively means schools and district's have to adopt new models of professional development. Too often the limited staff development available focused on the computer, not technology's role in learning and teaching. As a result, the President's Commission on Web-Based Learning found that the training teachers received was "usually too little, too basic, and too generic to help them develop real facility in teaching with technology". Ninety-six percent reported that the most common training they received was on basic computer skills. Another survey of public school teachers found that while most (78%) received some technology-related professional development in the 1998-99 school year, the training was basic and brief, lasting only 1 to 5 hours for 39% of teachers, and just 6 to 10 hours for another 19% of
those trained. The results of this failure to prepare teachers to use these new teaching tools were predictable. In 1999 a survey commission by the U.S. Department of Education reported that two-thirds of teachers surveyed were not comfortable using technology.

There is a consensus about the characteristics of a new, more effective model of professional development. One of the most salient of characteristics is that "...teachers need opportunities to work with colleagues, both in their school building and beyond. They need chances to learn from one another's successes and failures and to share ideas and knowledge". Professional development also needs to be ongoing, and if we are to overcome the barrier of time, teachers' daily schedules must include "embedded opportunities for professional learning and collaborating with colleagues...". Others argue professional development must be immediately linked to the work teachers are doing in their class each day, and must model effective classroom instruction. To meet these needs, many leaders who are pressing for new staff development models encourage schools to adopt peer coaching or study groups to provide needed on-the-job collaboration on issues that are immediately relevant to classroom needs.

Educators are increasingly focusing on this research, but must also be mindful of the circumstances in which research studies show technology has been a powerful learning tool. With this understanding of the context for success, educational leaders can shape programs that prepare teachers to use these powerful new learning tools effectively.

**Status in India**

Education and Research Network (ERNET) has been serving educational and research institutions in the country for the last 18 years. The Project ERNET was initiated in 1986 as a Plan Project of Govt. of India under the then Department of Electronics with the support of UNDP. The Project was implemented with direct participation of 5 Indian Institute of Technology (IITs), Indian Institute of Science (IISc), Bangalore and the then National Centre for Software Technology (NCST), Mumbai. The Project came to an end in March 1998.
The Project ERNET was converted into an autonomous society under the administrative control of the then Department of Electronics on 27th January, 1998. ERNET India has 14 Points of Presence (PoPs) at the premier education and research institutions spread across the country.

ERNET India has set up and operating a state-of-the-art network. All the 14 PoPs are equipped with state-of-the-art IT infrastructure which can provide connectivity in the range of Kbps to 155 Mbps. These PoPs are connected on a countrywide fibre optic terrestrial backbone which is of 8Mbps/2Mbps. The terrestrial backbone is connected with satellite backbone at STP, Bangalore. The countrywide backbone is connected to dedicated international links at Delhi, Mumbai, Pune, Chennai, and Bangalore.

ERNET also operates VSAT based network in the C-band of frequency spectrum for providing connectivity to academic and research institutions located in remote parts of the country.

MoU with University Grants Commission (UGC) & AICTE
ERNET India has signed a Memorandum of Understanding (MoU) with University Grants Commission to connect 171 Universities on Intranet and Internet through ERNET on a varying bandwidth from 128 Kbps to 2 Mbps & MOU with AICTE to connect Engineering colleges on ERNET.

MoU with Indian Council of Agricultural Research (ICAR)
ERNET India has also signed a Memorandum of understanding with Indian Council of Agricultural Research to connect 218 educational and research institutions under their control on ERNET.

Today more than 800 educational & research institutions are connected on ERNET
ERNET offers following services:

- Internet connectivity
- E-Mail
The next major area to be tackled is mobilisation of financial resources. We must see how the principle of enlightened self interest can be harnessed for this purpose. For instance, the MOP Local Area Development Scheme (MPLAD) places at the disposal at every MP one crore of rupees to be spent at their respective constituencies every year. So far as electronics is connected, the following five schemes have been approved by the Government. These are:-

I. Computers in every school
II. An "information foot path" which is a combination of computer, modems and printers linking with different educational and other institutions.
III. VSATs for developing electronic bibliographic based industry in small towns.
IV. Citizen Band Radio to be put in transport systems and base station in hospital, which can save, lives.
V. Starting HAM Club in all schools to encourage children's creativity and Curiosity in science and specially communication.

Dr. Srikant jichkar, MP from Nagpur took full benefit of these schemes and has come up with interesting results 15000 school children in Nagpur today are using computers and surfing the internet. Many of them are students below the 8th Standard. Even more important, Dr. Jickhar has put about 50 HAM sets in the Melghat tribal region 200 KM from Nagpur where 100's of tribal children who were earlier dying because of malnutrition and lack of timely medical assistance, are having their levies saved because of the HAM sets. This social consequence of high technology in backward areas is
something, I never anticipated. So, it is possible to bring in concepts like the high tech tribal areas for better benefit.

That brings us one of the fundamental problems in India. It is like a snake whose head is in the 20th century and the tail in the 17th century. We should use IT to see that at least India become a single speed country geared to face the 21st century.

India is a two-speed country. At one level, bright technocrats are making their mark in technology. At another level, 97% of our population does not speak English. India still lives in 600,000 villages with just 30% population in urban areas. Can Information Technology (IT) be a single-speed developed nation? I think it is possible. The first step is to make computers operate in Indian languages. Today, to make this happen we have technologies like Graphic Intelligence Based Script Technology (GIST) developed by the Centre for Development and Advanced Computer software solutions developed the National Centre for Software Technology (NCST).

The second step is achieving total literacy. While we have world class professionals and technocrats, only 52% of India is literate. A 100 per cent literacy program is under way. Use of computers and interactive television can remove illiteracy fast. Dr. Thirumurthy of Vallabh Vidyanagar has developed a software that helps adult illiterates to learn the alphabet in one tenth the time it takes to learn from a human teacher. It can be used for multiplying manifold the potential of a teacher. In Mahabharata, Drona refused to teach Ekalavya who went on to master archery in front of Drona's statue, Today Ekalavyas do not need such statues as interactive television technology is available. Indira Gandhi National Open University is using this technology in its long-distance learning programmes.

We should put rugged computers in all schools. You may wonder how when there are not even black boards in our schools, can we talk about computers? Further, electricity may not be available in all schools. I will cite an interesting experiment. Kantisen Shroff of the Shroff Foundation Trust at Kalali, near Vadodara in Gujarat, generates electricity
using bullocks. Shroff calls it Nandi Urja. After all, the bovine vagabonds that Gates saw in Delhi come in handy in generating rural electricity.

If we have computers in schools, we also need digital educational material. A massive effort at putting all educational material in different Indian languages into a computer readable form must be made. This will also create numerous jobs for the educated youth. Computers with CDROMs will bring a new world of knowledge to each school. 4.8 Am I dreaming? After all, India is celebrating the golden jubilee of its independence this year. Time we had a vision to break away from the vicious cycle of illiteracy, poverty and backwardness. Where is the money for all this to come from? This is the third step.

Every MP gets a grant of one crore each year for development works in his constituency. This is called the Members of Parliament Local Area Development Programme. The Department of Electronics got five schemes approved under this programme. MPs can use this fund for bringing IT in their constituencies.

There seems to be a ray of hope under the MPLAD programme. Dr. Shrikant Jichkar, MP, a HAM enthusiast himself, has used the funds for selling up HAM clubs. Dr. Aram MP, made a VAST available to the Bharathiar University. May be there are other MPs who have taken a similar initiative. Another welcome development is Andhra Pradesh chief minister Chandrababu Naidu's efforts at computerizing state administration.

For creating jobs in database industry or translation of educational material into computer readable form in the different languages, funds from Prime Minister's Rozgar Yojana and Jawahar Rozgar Yojna can be used apart from the MPLAD funds. The industry also can be given tax incentives to fund some of these activities.

It can also be used to make democracy more meaningful in India. Indian democracy measured in terms of Abraham Lincon's definition is only a two thirds democracy. We have the govt. of the people and by the people but is it also for the people? For India to become a full fledged democracy, we need three things. First, a government that is transparent. Second, freedom of information and access to that information for the
citizens and third the citizens are literate so that they are really effective. I have three ideas by which we can meet this requirements. Living in the age of the internet we can have democracy on line in India. As we are in the process of electing a new government, now may be the right time to articulate these ideas.

We are rated as the ninth most corrupt country in the world by the German NGO, Transparency International. There are three root causes of corruption.

(I) Scarcity of goods & services
(II) Delay from red tape
(III) Lack of transparency.

As one source of corruption is lack of transparency and lack of information, providing information should be at least helpful in partly reducing the scope for corruption. In fact, govt. itself is examining for more than a few years a Freedom of Information Bill the Shauri Committee also has given its recommendations. Let us hope in 1998 we may have a freedom of Information Act and this will partly help the citizens to overcome the problems posed by the Official Secrets Act.

We have a problem with all these discussions about information being a source for reducing corruption and making the administration more transparent and simple. Just what is the information which people want? People interact with the Government organisations for different purposes. may be to get a project cleared, or get a license, or a ration card. A lot of information is available with the govt. Thanks to more than Rs. 400 crores spent by the govt. in setting up the National Informatics Center (NIC) and its dynamic Director General Dr. Seshagiri, a lot of data bases have also been created. Nevertheless, the information which the public want is not readily or freely available.

We must break this logjam. I would suggest that NIC should come out of the closet. All the information that is available with the NIC should be made freely available to the electronic and print media. A healthy alliance between NIC and the media must be
cemented by information and computer networks between them. If this is done, information will be available freely, to the media on line at the touch of a computer key.

If the India Democracy has to be really on line we have to build the National Information Infrastructure. Every public call office must provide access to the data with the govt. both at the center and in the states freely and in Indian Languages. But to achieve this meaningfully and also the lyre of growth rates the Asian Tigers achieved, (In spite of the current temporary set back on the currency front) education is the key. A nation which is half illiterate cannot face the challenges on 21st century. After all we are comparable in size to China, but look at the treatment given to China in the United States when Jiang Zemin visits and look at the treatment given to us.

Education is the route for a viable democracy as well as economic development. We have to focus on primary education. With my limited knowledge of the situation in Gujarat, I find that primary education and perhaps secondary education is highly politicalized at the state level. Starting from the appointment of teachers and their transfers, and giving permission to start primary teacher training schools there is a very close linkage between the local politicians and the vested interest.

We find therefore that even though attractive salaries are given to the primary school teacher, many of the single teacher’s schools are not effective. At the same time there are reports that even the poor parents want their children to go to school and study. They are prepared even to pay for it. It is here I think govt. should think imaginatively. After all, nothing happens in our country, unless there is a political will. Political will gets organised only under two circumstances. The first is when there is a crisis as in 1991.

The second is where there is a perceived and immediate advantage in terms of electoral gains. After all, unemployment is a national problem, and to the extent we are able to provide avenues for removing unemployment it will be a politically, popular vote gathering measure. Look at the thousands of crores being spent under the Prime Minister’s Rojgar Yojna The Jawahar Rojgar Yojna, and the Integrated rural development
programme (IRDP). Why not we say that the educated youth can become teachers, and give tuitions to the students in villages? They must be paid the same amount if not even double the amount which is available under the various employment generation and poverty alleviation schemes. My reasons for linking this idea with these schemes are, (A) the funds sub optimally used today will be better used and (B) There will be also a direct link between efforts for removal of unemployment and illiteracy.

4.2 INTERCULTURAL EDUCATION & INTERNET

James Burke, author of many books and creator of the PBS/Discovery Connections series, who has also created a Knowledge Web, observes that:

"As a believer in the view that technology shapes society, I see the dramatically-increasing availability of tools and resources other than that of the schoolroom (or even of the established information media), generating more questions among learners than either teachers or TV programmers can answer satisfactorily, at the level of each individual.

However, the extraordinary speed with which technology costs have been falling and information-processing capability has been rising, now offer the possibility of additional approaches to the old, top-down, one-size-fits-all, ethnocentric classroom product. Moreover, in the wake of 9/11, and in the way information and communications technology is enhancing the abilities of even small communities to survive without having to submerge themselves in larger, more powerful cultures, it has also become urgent that we find ways to inform students about modes of thought other than that of their own locality. The world is already too interconnected for us to continue in the old isolationist paradigm. Nowhere is now too 'far away' to matter. It is no longer acceptable, in a world of electronic proximity, to ignore the views of other cultures. Fortunately, the same technology that has given rise to this complication, also provides means to deal with it.
In a very minor way, I have spent the last few years of my spare time putting together a tool with which to encourage students to think in a more contextual way about the materials they are studying. To work more collaboratively. To reach out, thanks to the Internet, to communities other than their own as far away as they chose, now that 'far' has little meaning any more. But at a time when information technology and telecommunications are about to enhance and empower the viability of even small communities (with luck, even to save many cultures around the world from being wiped out, as so many have been during the last two centuries of colonialism and top-down centralist power-bloc expansion), we are at last going to have the tools to think about diversity in a different way. Not in the old, cookie-cutter, paternalist way that sought to bring the benefits of so-called 'Western civilization' to what were deemed to be 'under-privileged' groups and communities and cultures, but, instead, to watch in appreciation as they use the technology to benefit themselves in ways they choose, based on their own heritage, and in ways that don't undermine their own cultural identities. And if they chose ways that seem to go counter to our own values, all we can (and should) do is try to understand those choices, and learn how best to live with them.

As for the fears (often expressed) of some kind of 'technological determinism,' that the technology brings with it certain technology-oriented way of thinking that put a culture at risk (the old argument that it's becoming a hamburger world), I have seen proof in my own life that this is not necessarily so.

In the 1960s I was living in an Italian city that viewed the arrival of television as indicative of the imminent loss of their centuries-old local dialect and traditions. Forty years later there are two TV stations there, broadcasting only in the dialect, and any decline there might have been in the local culture has been well and truly reversed. So the coming technology offers us the chance to celebrate difference, rather than to suppress it as part of some short-term politically driven egalitarian ideology. We've already lost over ten thousand languages, and with them, idiosyncratic assessments of the world; each one, by definition, a rich and comprehensive view of things. Let's not lose any more.
I hope whatever else knowledge-webs do, they will also use the capability of the next generation of information technology to make it possible for learners to travel cheaply and seamlessly from a web structured by elements of their own local world, into other-culture webs, built in the same interconnected, easy-to-navigate way, and offering a glimpse of the dynamic that made that culture what it is, and perhaps where it may be going next, and what that ought to mean to us. Anything of that nature would be an improvement on the present level of mutual misunderstanding and over-simple solutions, offered on all sides, that daily make the world a more dangerous place to be."

4.3 IT & EMPLOYMENT GENERATION

The potential contribution of information technology to employment generation is both direct and indirect. Directly, the growth of the computer hardware and software industries are generating new job opportunities in India. Indirectly, the adoption of computer technology by other industries expands the range of services they provide and can stimulate more rapid growth of these sectors. The indirect impact of IT is far larger than the direct impact. In the USA, it is estimated that for every direct job created in the IT industry, a minimum of ten additional IT-related jobs have been created in other industries in which IT is applied. This does not include the non-IT jobs created by the growth of other sectors of the economy under the stimulus of information technology.

IT is both a labor-creating and labor-saving technology. As the introduction of automated machines replaced manual labour in factories and on fields, it was once believed that the spread of computer technology would result in massive job destruction.

However, two decades of experience has demonstrated that the reverse is actually the case. Surely specific types of jobs are eliminated, but overall computerization creates far more jobs than it destroys. The spread of computerization acts as a catalyst for the growth of many types of businesses. This is not only true of businesses directly related to the computer industry, such as research and development, computer education, computer repair and maintenance. In fact, every sector of the economy is being energized by the adaptation of computer technology. Studies by the National Research Council in the USA
have found that IT has a stimulating affect on the growth of a wide range of service industries. The fastest growing sectors of the global service economy—education, financial services, insurance and health services—have all expanded by adapting IT technologies. IT has demonstrable benefits for employment and skill levels. Evidence indicates that IT contributes to growth in demand for labor, as well as an overall skill upgrading in the workplace.

For the purposes of this exercise, the IT sector will be defined in a narrower sense as those businesses that are directly related to the manufacture of computer hardware and software, the training of personnel for the manufacture and operation of computer equipment, use of computers in education and the utilization of computer technology for IT-enabled services such as call centers, medical transcription services, etc.

**Recent Performance of India's IT Sector**

In 1999 India’s IT industry generated $7.7 billion in revenues, 15 times the level in 1990. Exports rose from $150 million in 1990 to nearly $4 billion in 1999. With a compounded annual growth rate of more than 50 percent between 1991 and 2001, the Indian IT software and services sector has expanded almost twice so fast as the US software sector though from a smaller base. No other country has consistently grown by more than 50 percent every year in the past ten years. According to mid-2001 projections, the software industry in India is poised to touch revenues of $12 billion by year 2002, of which exports may be as high as $7.9 billion.

Growth of India’s IT sector is spurred by the global market for software services. The global outsourcing market is worth more than $100 billion. In 2000-01, software exports accounted for 13 percent of India’s total exports. By 2003, software exports from India are expected to account for almost 23 percent of India’s total exports. India has already acquired a substantial market share in the global customised software development market. In 1991, according to a World Bank study, India’s share was almost 11.9 % of the global market. In 2000, it was 19.5 percent. Last year 266 of the Fortune 1000
companies out sourced their software requirements to India. India now more than 1,250 companies exporting software.

India’s success can be attributed to a combination of factors, such as

- Resource Endowments—availability of cheap skilled labor
- Favorable government policies, such as investments in higher education
- Presence of large number of Indians working in US firms, who played an important role in matching US buyers with Indian suppliers
- Low level of investment required to launch software services

Projected Growth

In 1999 NASSCOM engaged McKinsey, the international consulting firm, to conduct an in-depth study of India’s potential in IT related industries. McKinsey projected that India could generate 2 million additional jobs in this sector by 2008 and contribute US$ 87 billion to national income. According to the McKinsey study, direct employment in India’s software industry is expected to rise from 1,80,000 in 1998 to 2.2 million in 2008, and will, thereby, account for 8% of the country’s employment in the formal.

**IT Software and Services Industry in India: 2000-08**

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<th>YEAR</th>
<th>EXPORTS</th>
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<tr>
<td>2003-04</td>
<td>20</td>
<td>8</td>
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</tr>
<tr>
<td>2004-05</td>
<td>27</td>
<td>14</td>
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<tr>
<td>2005-06</td>
<td>35</td>
<td>20</td>
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<tr>
<td>2006-07</td>
<td>43</td>
<td>28</td>
<td>71</td>
</tr>
<tr>
<td>2007-08</td>
<td>50</td>
<td>37</td>
<td>87</td>
</tr>
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</table>
Projection of Additional Employment in IT Sector

<table>
<thead>
<tr>
<th>Year</th>
<th>Additional Workforce requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>90,000</td>
</tr>
<tr>
<td>2002</td>
<td>115,000</td>
</tr>
<tr>
<td>2003</td>
<td>150,000</td>
</tr>
<tr>
<td>2004</td>
<td>195,000</td>
</tr>
<tr>
<td>2005</td>
<td>250,000</td>
</tr>
<tr>
<td>2006</td>
<td>300,000</td>
</tr>
<tr>
<td>2007</td>
<td>340,000</td>
</tr>
<tr>
<td>2008</td>
<td>370,000</td>
</tr>
</tbody>
</table>

Estimating growth of employment opportunities in the IT industry is complicated by the fact that more than any other industry IT is international in character and dependent on global trends, which have been subject to wide fluctuations in recent years. Following the publication of the McKinsey study in 1999, the global IT sector actually grew faster than had been anticipated due to the explosive growth of the Internet and dot-com companies. Then abruptly the bubble burst and the euphoria about IT and Internet subsided.

In assessing India’s potential in this industry over the next decade, we must try to avoid both unrealistic euphoria and unrealistic pessimism that result from relying on short-term performance to extrapolate long term trends. The fact is that even now at a time when the newspapers are full of news about lower growth estimates and falling share values for India’s premier IT companies, the IT industry in India is still growing and generating additional jobs, only it is not growing as rapidly as it was a year ago or as it was projected to continue at that time.\[301\]

It is necessary to keep focused on the underlying truths that govern the growth of the IT industry:

- The use of computers and the Internet continue to grow rapidly, both in India and worldwide.
• Technological improvements continue to increase the power and productivity of computers while continuing to lower their cost.
• The adaptation of computer technology in all sectors of the global economy will continue to generate fresh demand for IT related businesses.
• Global outsourcing of software and IT-enabled services will growing rapidly and will continue to expand for the foreseeable future.
• India is specially well positioned to benefit from the growth of the IT industry.

Projections for America’s IT Industry
Since the fortunes of India’s IT industry have been very closely linked to the those of America’s IT industry, projections about the future should take into account the projected growth of IT in the USA. Despite significant layoffs and rising unemployment in the dot-com industry, nearly a half a million information technology jobs in the USA could go unfilled this year for lack of the right candidate.

Although the dot-com bubble has burst, demand continues to grow for skilled IT professionals. This is because IT products and services—and the workers who provide them—are found throughout the economy. The largest group is employed in computer services firms, but large fractions also work in manufacturing, financial industries, government, and retail and wholesale trade. High turnover, as well as growing demand, contributes to employers’ ongoing scramble to fill IT vacancies. At the same time, it is increasingly clear that IT plays a significant role in increasing national productivity and sustaining economic growth.

The US Bureau of Labor Statistics estimates that the number of jobs for computer systems analysts and computer engineers and scientists would double between 1998 and 2008. Those projections suggest IT jobs will grow slightly more than 7 percent per year over the decade, far more quickly than the 1.4-percent average across all jobs. The U.S. Bureau of Labor Statistics estimates that more than 1.7 million new computer jobs will be generated in the USA by 2008, or approximately 170,000 per year, while another 340,000 workers will be needed to fill future openings created through turnover and attrition.
The Information Technology Association of America (ITAA) recently released a report entitled *When Can You Start? Building Information Technology Skills and Careers*, a major study finding a U.S. information technology workforce of 10.4 million individuals and a projected demand for new workers in 2001 of approximately 900,000 – down from a demand for 1.6 million new workers in 2000. Last year, ITAA conducted a similar study titled, *Bridging the Gap*. That research projected a 12-month demand for IT workers of 1.6 million and a shortfall in filling jobs of approximately 850,000. The new study explains how the employment picture has changed. While demand is off by forty-four percent, the talent gap remains large. Hiring managers still predict a shortfall of 425,000 skilled workers this year – down from almost 850,000 in 2000 – a drop of fifty percent.

The ITAA study also finds that, compared with IT companies, non-IT companies remain the larger employer of IT workers with 9.5 million, generate the greater demand at over 640,000, and experience the larger gap at nearly 303,000. In aggregate terms, non-IT companies employ ten times more IT workers than do IT companies.

The US Department of Labor estimates that by 2008, the top three areas of employment growth will be in the technology field: computer engineers, 108 percent; computer support specialists, 102 percent; and systems analysts, 94 percent.

**Other markets**

Although the US claims 60 per cent of India's IT export market, some hitherto unexplored markets hold immense potential. Since Europe is slated to be a $3 trillion software market, according to a report released by Gartner Group, the employment potential for skilled technicians is immense. Germany currently needs 20,000 professionals and has instituted friendly immigrant policies such as the Green Card scheme for Indian professionals. France, which has a negligible share of 0.8 per cent in India's software exports, signed a Memorandum of Understanding with the Indian Chamber of Commerce and is keen to hire 10,000 Indian software engineers and 50,000
technicians. Ireland, in a bid to gain a sizeable share of India's tech pie, has instituted free visa facilities. NASSCOM expects software exports to Australia to increase to $10.4 million in 2000-2001. Recently, Japan took a bold step and decided to grant work visas to over 10,000 software engineers from India. This is the first time that conservative Japan has taken such a bold step and is reflective of the enormous potential that exists in such tie-ups and synergy.

**High Potential Sectors**

There are big opportunities waiting to be tapped in the telecom software and multimedia sectors. The annual worldwide potential for software services in telecom, wireless services and other converged communication services is expected to be in the region US $150 to 250 billion.

The software training market is likely to grow at over 30 per cent annually and here Web-based models will have the highest growth potential. And there are exciting opportunities emerging in multimedia.

Thanks to the developments in digital technology, convergence of information technology, telecom and broadcasting industries has become a reality. That means new media products and services can be made available at homes and to business segments.

The NASSCOM report says that entertainment and information will continue to be the largest generators of revenue in 2008, accounting for US $50 billion of business. Digital content development has the potential to create three lakh employment opportunities leading to Rs 250 billion in revenues by 2008.

The Indian film industry has a large talent pool. This presents one major opportunity for Indian content-developers. There is a large market waiting to be tapped in the USA, UK, rest of Europe, West Asia and Australia. So, the Indian software industry should put in place an integrated set of country-specific initiatives such as beneficial international agreements, business development capabilities, onshore factories, strategic partnerships and dedicated offshore parks.
IT Enabled Services

Perhaps the largest single employment opportunity for India is in the field of IT-enabled services, services made possible by the application of computer and telecommunications technology rather than the creation of computer hardware or software. India has been identified as a major source for IT-enabled services such as back office credit card support services, call centres, medical and legal transcriptions, and insurance processing. One appealing aspect of this sector is that it provides employment opportunities for non-technical graduates with a good knowledge of English language, a much larger population than the population of electronic engineering graduates.

According to a recent survey, there are more than 100,000 call centres worldwide and this is expected to grow to 300,000 by 2002, employing approximately 18 million people. By year 2003 a sum of US $60 billion is expected to be spent on call centre services, mainly driven by e-commerce.

Information and communications technology has created new outsourcing opportunities by enabling services to be provided in one country and delivered in another. Delivered by telecommunication or data networks, the services include credit card administration, insurance claims, business payrolls and customer, financial and human resource management.

According to the McKinsey study, India’s export of IT enabled services to North American markets is expected to grow over 15 times in the next five years. The estimates have been put at $4 billion worth exports in 2005 from the current level of $264 million. During the period, the sector will generate employment for almost 2.5 lakh professionals against the current employment of 30,000.

According to the report:

- There are already over 100 call centers operating in India.
• Nearly Rs. 12 billion ($225 million) was invested in the IT-enabled services sector last year, and investments committed by overseas investors run into a few billion dollars.
• The industry already provided jobs to over 70,000 professionals in 2000, up from 45,000 in 1999.
• Several multinationals including General Electric, American Express, Citibank, Ford and Standard Chartered Bank have already moved back-room operations to India.
• The industry generated revenues worth $900 million in 2000-2001, which is projected to touch $18 billion by 2008.
• The employment potential is projected at 1.1 million white-collar jobs by 2008.

Amongst others, the spectrum of I.T. Enabled Services applications already evident in India include the following broad segments:
• Call Centers
• Medical Transcription
• Back Office Operations, Revenue Accounting and other ancillary operation
• Insurance Claims Processing
• Legal databases
• Content Development/Animation
• Payroll
• Logistics Management

As per the report published by NASSCOM, on the basis of a study made by McKinsey, the world market for IT-enabled services is expected to be over $140 billion in the year 2008.
McKinsey Estimate of Growth Potential for IT Enabled Services in India

(In $ billion)

<table>
<thead>
<tr>
<th>Services</th>
<th>Year 1998</th>
<th>Year 2008</th>
<th>CAGR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer Interaction Services</td>
<td>6.5</td>
<td>33.0</td>
<td>18</td>
</tr>
<tr>
<td>Finance and Accounting Services</td>
<td>1.5</td>
<td>15.0</td>
<td>26</td>
</tr>
<tr>
<td>Animation</td>
<td>1.3</td>
<td>2.0</td>
<td>4</td>
</tr>
<tr>
<td>Translation, Transcription and Localisation</td>
<td>0.3</td>
<td>1.2</td>
<td>21</td>
</tr>
<tr>
<td>Engineering and Design</td>
<td>0.4</td>
<td>5.0</td>
<td>29</td>
</tr>
<tr>
<td>HR Services</td>
<td>0.2</td>
<td>44.0</td>
<td>71</td>
</tr>
<tr>
<td>Data Search, Integration and Management</td>
<td>--</td>
<td>18.0</td>
<td>--</td>
</tr>
<tr>
<td>Remote Education</td>
<td>--</td>
<td>15.0</td>
<td>--</td>
</tr>
<tr>
<td>Network Consulting and Management</td>
<td>--</td>
<td>5.0</td>
<td>--</td>
</tr>
<tr>
<td>Website services</td>
<td>--</td>
<td>3.0</td>
<td>--</td>
</tr>
<tr>
<td>Market Research</td>
<td>--</td>
<td>1.0</td>
<td>--</td>
</tr>
<tr>
<td>Total</td>
<td>10</td>
<td>142.0</td>
<td>30</td>
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McKinsey's Estimate of Revenue & Job Potential by Type of Services

<table>
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<tr>
<th></th>
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<tbody>
<tr>
<td>Back Office Operation/ Revenue Accounting/ Data Entry/Data Conversion</td>
<td>14,000</td>
<td>2,60,000</td>
<td>6.80</td>
<td>1900</td>
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<tr>
<td>Remote Maintenance and Support</td>
<td>4,100</td>
<td>1,80,000</td>
<td>2.70</td>
<td>1350</td>
<td></td>
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<tr>
<td>Medical Transcription/ Insurance Claim Processing</td>
<td>6,100</td>
<td>1,60,000</td>
<td>3.00</td>
<td>110</td>
<td></td>
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<tr>
<td>Call Centres</td>
<td>2,800</td>
<td>1,00,000</td>
<td>1.00</td>
<td>60</td>
<td></td>
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<tr>
<td>Data Base Services</td>
<td>1,400</td>
<td>1,00,000</td>
<td>0.70</td>
<td>65</td>
<td></td>
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<tr>
<td>Content Development</td>
<td>12,600</td>
<td>3,00,000</td>
<td>6.10</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>41,000</td>
<td>11,00,000</td>
<td>20.30</td>
<td>810</td>
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</table>
The overall global market for IT enabled services will amount to approximately US$ 142 billion by the year 2008. The top five opportunities and their value creation potential will be as follows:

- Human Resource Services US$ 44 billion
- Customer Interaction Services US$ 33 billion
- Finance and Accounting US$ 15 billion
- Remote Education US$ 15 billion
- Data search, Integration and Analysis US$ 18 billion

India offers many advantages to serving as an I.T. Enabled Services destination for major global companies. These include:

- A virtual 12-hour time zone difference with USA and other major markets for I.T. Enabled Services.
- A huge pool of English speaking and computer literate manpower that can continue to cater to the growing demand for professionals for I.T. Enabled Services. These professionals are skilled as well as quality conscious.
- Cost of qualified personnel is amongst the lowest in the world.
- Stable legislative and economic framework
- Many State Governments in India offer special incentives and infrastructure for setting up I.T. Enabled Services.
- Thrust by Government of India to make India an I.T. – driven nation with a focus on the services sector where potential for value addition and thus premium is higher.
- India enjoys very strong brand equity in major markets, thanks to its growing and globally competitive software industry. The proliferation of I.T. Enabled Services and its continuing demand-led growth may well emerge to be a strong opportunity for India, both in terms of generating employment and export.

A December 2000 report on ‘Export of IT enabled services from India to North America’ prepared by the US-based consulting firm — Stevens International Consulting (SIC) — for Electronics and Computer Software Export Promotion Council (ECS), an autonomous
organization under the IT ministry, reveals that customer interaction centers or call centre services, which currently earns the total revenues of $60 million, will increase to $2.225 billion by 2005. Another segment that is going to witness a manifold jump is medical transcription. From the current earning of $30 million, it is expected to increase to $800 million during the period. The export from geographic information system (GIS) segment will increase to only $150 million in the next five years from the present level of $60 million. Finance and accounting services, which has an export earning of $50 million in 2000, will increase to $375 million by the end of 2005.

**Employment Opportunities in the Informal Sector**

NASSCOM's estimates focus on employment opportunities that will be created in the formal sector by computer hardware manufacturing companies, software development companies and multi-branch computer training companies. In addition to these, large numbers of job opportunities will be created in the informal sector. This includes opportunities in the informal sector for small firms and self-employed individuals in retail and wholesale trade, computer training, maintenance and repair, web design, desktop publishing, Internet cafes and telephony centers, web-based research, journalism, coaching centers, software development, etc.

Despite a global economic slowdown, sales of personal computers in India continue to register an impressive 34 per cent growth rate, thanks to the increasing use of computers as an educational tool, rise in e-governance projects and the home and small-office-small-business segment. Indian computer manufacturers sold over 1.88 million units during the fiscal year 2000-2001. The present installed base of 6.3 million desktop PCs is estimated to rise to 8.5 million next year. If the industry maintains even a 30 per cent growth during the present year and during 2002, Indian desktop PC market could soon cross 10 million machines. This growth translates into many types of new jobs.

As the number of computers, computer users and internet users increases, the demand for these other types of services will increase rapidly. Most of the jobs in these categories may not require the high levels of education and technical skills required for the jobs
described in the McKinsey study, but they do potentially offer attractive employment and self-employment opportunities for educated youth.

The following are among major categories of IT-related job opportunities in the informal sector:

- *Retail and wholesale* – in computers, parts and accessories
- *Training & Coaching* – in the use of computers and software applications
- *Computer Maintenance & Repair services for residential and commercial customers*
- *Desk top publishing* – self-employment opportunities for
- *Internet Cafes & Telephony Centers* – self-employment opportunities for operation of shops renting out computer and internet access. Use of internet for voice communications will be legal in India from April 2002, resulting in a boom in this sector.
- *Web design* – self-employment opportunities for skilled web page designers
- *Research* – jobs for domestic and overseas organizations in gathering and processing information on a wide range of subjects available on the Internet.
- *Journalism* – the rapid expansion of Internet based news services has generated demand for a large number of additional journalists to write and edit content for the web.
- *Tele-commuting* – a wide range of self-employment and job opportunities will be created for those working from PCs in their own homes.

The growth potential for these jobs is difficult to estimate, but it could represent quite a significant number. A very rough estimate would be that this category can generate an additional one to two million jobs by 2010.
Employment Opportunities in Education

In addition, the spread of computers in Indian schools will generate additional job opportunities for computer instructors, maintenance and repair services. The actual number of jobs created will depend to a very large extent on government policy and investment in computer education. The initiatives taken by the state governments of providing computer education in schools have further boosted the demand for PCs. The Karnataka government has implemented the initiative in over 1000 schools in the state. Kerala has targeted to achieve 100% computer literacy in schools by 2002. Other states such as Tamil Nadu have allocated substantial budgets for rapid development of computer literacy in secondary schools. Already 45% of Goa’s secondary schools have computers.

Currently only 2% of Indian schools are equipped with computers as compared to 99% in USA. There are about 107,000 secondary schools and 600,000 primary schools in the country. If at least 20 computers are placed in every secondary school and 5 computers in every primary school, it would mean a requirement of 5 million computers. That alone could generate at least one million additional jobs for computer instruction, installation and maintenance.

Skills Development

In a predominantly manpower-intensive software industry, issues of manpower availability, its cost, turnover and productivity are critical issues. The quantity of skilled knowledge workers in India will be a major constraint on growth of the industry unless educational facilities expand rapidly. By 2003, the McKinsey study projects additional demand for 150,000 professionals, and double that number by 2006. Out of 1.22 lakh engineering graduates qualifying every year in India, about 73,000 are software engineers from Indian Institutes of Technology and other regional engineering colleges. Thus, around 73,000 fresh software engineers are expected to be available annually. In addition, software training institutes are generating standard software professionals numbering
between 40,000 and 50,000 a year; however, most software companies recruit only those with engineering degrees.

Some initiatives have already been taken. The just set-up Indian Institute of Information Technology and NASSCOM's Indian Computer Professional Institute are expected to churn out an additional 25,000 software professionals by end 2002. Besides, quite a few Indian universities have started courses leading to Masters in Computer Applications and there are private training institutes which offer high-level software engineering courses. These initiatives are welcome, but not sufficient.

Policies
The government will play a crucial role in the future development of the Indian software industry. The vision shared by various industrialists of molding India into the software giant of the 21st century may remain just that, a vision, without ever becoming reality if the government does not take the right measures. It is a big challenge to convert India from simply being a "low cost code source" to a "high quality complete solutions provider". Making this transition successfully will enable the country to enjoy improved standards of living, improved economic growth, and increased capital/aid to fund infrastructure development.

In order to make this transition, the government will have to concentrate in the following areas:

- **Education**: India, like other countries, is facing a shortage of skilled IT workers. Premier institutions such as IIT, IIM and REC can only provide a limited number of graduates every year. For every student who makes it into any of these institutes, there must be at least five others who do not. Faced with very few quality options, these students either register for low quality courses or choose a different field. Indians working abroad have successfully displayed above-average technical skills but have not scored high on managerial skills. There is a very real need to combine technical courses with management courses so as to produce well-rounded managers. Such courses will provide the skills and the boost for
entrepreneurship, which historically has been lower in India than in the western countries.

- Infrastructure: Indian companies suffer from a disadvantage in comparison to their American, European and Japanese peers because of the lack of infrastructure in the country. Infrastructure in this context includes modern telecommunications, broadband access, high-speed data lines, etc. Indian companies may be unable to accept projects because of this handicap or may have to concentrate a large percentage of the work on client sites, which results in lower net profits. It is worthwhile to note here that the end objective of any policy is to foster internal development rather than facilitate acquisition of foreign projects. Development of infrastructure, as mentioned above, will help achieve both objectives.

- Tariffs: There should be reduction in tariffs for international connectivity. Such tariffs should also be discounted as volumes rise. Today, the cost for an 1-MB link is about US $35,000 per month in India against US $4,000 per month for an 1-MB coast-to-coast link in USA. NASSCOM has estimated that there will be a 1,000-fold increase in bandwidth demand over the next five years. If bandwidth is not provided, India could lose the opportunity to earn as much as US $22.5 billion and the opportunity to create as much as 6,50,000 jobs.

- Incentives for hardware development: Indian companies have not forayed into the area of hardware development and if they have, the venture has not been a success. This can be ascribed to very high R&D and development costs, paucity of skilled labor, lack of access to cutting edge technology, etc. Many industrialists have lobbied that developing skills in hardware production will give a boost to other areas in IT namely software development. A strong supplier base is an important determinant of industrial success. A counter argument may be that scarce resources should not be deployed to do something that someone else does better, namely established overseas hardware manufacturers. In either case, the government role is crucial—in the former to promote such activities and in the latter to enable cheaper access to hardware.
• **Consumer education:** The Indian consumer (business and household) is relatively unsophisticated in technology when compared to his US counterpart. The customer forms a factor in Michael Porter’s model of competitive advantage, wherein Porter theorizes that a demanding customer is a key driver for innovation and success. The Indian consumer definitely does not provide any challenge to the IT industry. Private IT companies can only do so much to encourage automation of internal business processes in other companies. The government plays a critical role in educating the Indian consumer through provision of telephone lines in remote areas, provision of Internet connections, etc.

• **Promote a pro IT attitude:** The government needs to promote “IT ness”. The recent plan to open a “Cyber City” in the Indian capital of New Delhi is a step in the right direction. This 1000 acres facility will house R&D, training and other IT related activities. Chandra Babu Naidu, Chief Minister of Andhra Pradesh, has set an example for forward thinking and embraces new technology with fervor. The common man who looks up to him has lost a large part of the “fear” of IT and has begun to see IT as something “good” rather than something “bad”.

In order to achieve the targets set forth in the McKinsey report, NASSCOM has announced a 7-point agenda outlining priority areas that need immediate action from the Government.

1. **IIT/IIIT (Indian Institutes of Information Technology) in each state:** In order to build on the good work done by the five existing IIT’s in developing world class knowledge workers, NASSCOM recommends that a concerted effort be made to establish at least one IIT or IIITs in each state in India by 2008. NASSCOM recommends an allocation of at least Rs 15,000 crore in the 10th five-year plan towards implementing this scheme.

2. **Setting up of Indian Institutes of Information Technology** in every state needs to be implemented without insisting on the mandatory 3-year stipulation.
3. **More Ph.D.s required:** If India needs to create original technology, then we need to resurrect our education system to produce more PhDs. This is essential if India is to produce a highly skilled workforce as well as meet the R&D demands of the industry.

4. **Launch 3T ‘Train the Teacher’ Programme for teachers:** The NASSCOM study has identified an immediate need to launch a nationwide Train-the-Teachers programme to impart a combination of physical and virtual training in Information Technology. This program would need to be implemented at a state level and should be targeted at all educational institutes including engineering colleges and primary schools.

5. **Industry Led Fund:** It is recommended that the IT software and services industry donate a certain percentage of its profits towards an ‘Industry Led Fund’ for Human Resource Development. This fund could be utilized for establishing more engineering colleges, IITs, IIITs and improving existing infrastructure and educational facilities in the country.

6. **Upgrade 43 Regional Engineering Colleges:** There is an urgent need to upgrade 43 RECs to the level of IIT as far as quality and quantity of faculty, availability of lab and equipment and infrastructure is concerned.

7. **Providing IT modules to every graduation course:** NASSCOM proposes that training in Information Technology be made mandatory in every graduate course in the country. In addition to this, special IT modules should be made available at the state level.

NASSCOM also announced a 5 point agenda that will help ensure that Software Exports continue to grow at more then 50 percent.

1. **Increase Quality and Quantity of knowledge workers:** At least one IIT / IIIT in every state during 10th 5 year plan; increased industry funding and participation
2. **Create world-class telecom infrastructure:** Ensuring provision of at least 10 Gaps of International bandwidth by end of 2001 and at least 2.5Gbps of national Internet backbone within the country; Reduction in tariff for national connectivity and removal of procedural hassles.

3. **Enhancement of physical infrastructure:** Building international Airports and better Roads to facilitate trade; Scheduling of daily international flights to important business hubs like Bangalore, Hyderabad, Ahmedabad and Pune.

4. **Tapping opportunity in Communication Software and Original Technology space:** Corner large share of global Communications software market; position India as a developer of bleeding edge Original Technology; more spending on R&D in Indian software companies.

5. **Continued Government support:** No additional incentives required but no withdrawals either; Removal of procedural obstacles.

NASSCOM has also presented a ten point call for action for the Government and Industry in May 2001, to help India emerge as a sustainable hub for IT Enabled Services. It includes steps to be taken by the Government and Industry such as:

1. Immediate dialogue between Government and Industry to clearly define the parameters for each segment of the IT Enabled Services sector. This will remove ambiguity with regard to Income Tax Exemption applicable to ITES units.

2. Applicability of international standards in Telecom Infrastructure including:
   - Inter-connectivity of International Call Centers
   - Setting up of international gateways for captive need in IT Enabled Services
   - Permission to IT Enabled Industry to freely purchase bandwidth from international markets
   - Services like toll free numbers to encourage domestic Call Center activities
3. Institution of a Single window clearance for IT Enabled Services Industry

4. Support from Local authorities and State governments to ensure ease of operations and start up assistance for IT Enabled Services units.

5. Flexibility to call centers to merge Domestic and International business in the same facility

6. Setting up of IT Enabled Service training infrastructure and involvement of ITI's and polytechnics for Call Centre management and Degree level courses for IT Enabled Services industry

7. Initiation of 'One' industry standard for Indian IT Enabled Services industry as a tool to certify quality and global standards

8. Creation of an 'India Brand' Marketing fund by government and industry, for promoting India as a preferred destination for the IT Enabled Services Sector

9. Establishment of a $100 million VC fund for the IT Enabled Services sector

10. Special incentives to promote entrepreneurship and tele working for women in the IT Enabled sector.

4.4 SOFTWARE TRAINING INSTITUTES

Software training is imparted in various institutes. These institutes can be classified as follows:

(a) Indian Institutes of Technologies-All the five IITs are having separate departments of Computer. They impart training for the degree of B.Tech. and M.Tech. in Computer Science.

(b) Indian Universities-Almost all the Indian Universities are having specific courses in B.Tech or M.Tech. or B.E. or M.E. in computers, computer application or B.C.A. or M.C.A.
(c) Technical Institutes—There are large number of technological Institutes approved by AICTE which are imparting computer education and granting Diplomas, Postgraduate Diplomas and Certificates.

A list of some of the important software training institutes is as follows:

- National Informatics Centre
- NIIT Ltd.
- Infosys Ltd.
- Satyam Computers Ltd.
- Aptech Ltd.
- CADD Centre
- Nutech Systems Pvt. Ltd
- Deldot Systems CADD Center
- MAARS Software International Ltd
- First Computers
- ZED Career Academy
- Focus Infotech
- ZAP Digital Design Academy
- Roman Technologies Pvt. Ltd.
- RIT
- CIM Technologies
- Computer Point