Chapter 3: Information Technology
3. Information Technology

3.1 Introduction

The rapid advancements in the field of Information Technologies and the resultant growth of the information intensive service sector have radically changed the world economy. These changes have given rise to a new society based on knowledge. This has further resulted in the new avenues of development, employment, productivity, efficiency, and enhanced factors of growth.

Information Technology seeks to understand the complex process that involves and requires a number of information-related activities: human information seeking and retrieving behaviours; organization of a collection of texts, and more recently images, sounds or multimedia, that bear some cognitive content; an intellectual representation of such texts, be it derived by humans directly or indirectly by a variety of algorithms; intellectual ways and means of searching and retrieval by users; and the systems and techniques to accomplish all of these (Spink, 2000). The complexity of human information seeking and retrieving is derived not only from these very difficult processes, but from the direct involvement of human agents as generators and users of texts in information systems, bringing in cognitive, affective, social and situational (problem, task) variables.

In other words, Information Technology is not only a technical but also a cognitive, social, and situational process. With the integration of computers and telecommunications, Information Technology is based on facilitating interactive information processes, involving information feedback and human information coordinating behaviour.
The last half of the 1900s has been characterized by the increasing importance of information technology in social and organizational life. Computers, both on the desktop and embedded in automobiles, appliances, cellular phones, and satellite dishes have become part of the fabric of our work and social lives (Sawyer, Steve and Rosenbaum, Howard, 2000). In three decades, the Internet has grown from a network connecting four American universities and research labs to a global communications network. The evolving roles and increasing importance of the World Wide Web (WWW), electronic commerce, digital libraries and computer-mediated distance education are all examples of phenomena that both rely on computing and are becoming commonplace.

Information Technology (IT) is a term that encompasses all forms of technology used to create, store, exchange, and use information in its various forms - business data, voice conversations, still images, motion pictures, multimedia presentations and other forms, including those not yet conceived. It's a convenient term for including both telephony and computer technology in the same word. It is the technology that is driving what has often been called "the information revolution" (Ahuja, 2000).

Policy makers for the G7 (now G8) group of nations recognised, only a few years ago, that:

"Progress in information technologies and communication is changing the way we live: how we work and do business, how we educate our children, study and do research, train ourselves, and how we are entertained. The information society is not only affecting the way people interact but it is also
requiring the traditional organisational structures to be more flexible, more participatory and more decentralised" (G-7, 1995).

3.2 **Features of Information Technology**

Given the importance of the software industry in global economic growth, it would be constructive to understand the key elements which are driving this industry. This would help one understand the future prospects of this industry.

**Rapid growth:** Demand for software and related services comes primarily from two segments viz the business segment and the home segment. Information technology, particularly software has become a vital ingredient of every business/ economy. Information needs have increased dramatically across all segments, which has made software one of the fastest growing industries in the world. The sharp reduction in PC prices has formed a new market segment - the home or the individual segment.

**Demand Driven:** Information technology, particularly software has become a vital ingredient of every business/ economy. Information needs have increased dramatically across all segments, which has made information technology - both hardware and software - one of the fastest growing industries in the world. The share of IT spending in capital expenditure according to Nasscom reports (Nasscom, 2000) has been increasing rapidly since 1980, the year in which PCs came on the scene. In 1980 IT spending formed 17% of incremental capital expenditure, while in 1997 it formed about 48%. Within total IT spending which includes computers and sophisticated telecom equipment, spending on software and support services is estimated to have grown at a faster pace. As percentage of revenues IT spending comprises about 2-2.2%. On the low-end, retail business which is
highly labor intensive about 1% is spent on IT and at the higher end telecommunications
which is critically dependent on IT, about 5-7% is spent.

**Home segment:** With the advent of Internet and cheaper net centric computers or set top
boxes and multimedia capabilities, the home segment is expected to grow further and much
faster. The popular software for the home segment are word-processing, spreadsheets,
personal finance management and games.

**Manpower intensive:** Being predominantly a service industry software sector is manpower
intensive. This makes issues of availability, cost, turnover and productivity of manpower
critical to the functioning of an organization. The limited availability of software
professionals with specific skills increases compensation packages, as companies try to
attract and retain talent. Manpower turnover is one issue which most software companies
have to deal with. Manpower turnover causes disruptions in project implementation and loss
of skills inculcated through training and hands-on experience. Though some turnover is
inevitable and even healthy (at times), a high level of turnover could be detrimental to a
company's business in a people-driven industry like software. Productivity of manpower
depends on the skill levels and motivation. Companies try to offer excellent work
environment with satisfying job responsibilities to keep employee morale high.

**Availability:** IT being the fastest growing industry in most countries manpower
requirements are increasing rapidly. Of the total IT manpower requirement, about 75-80% is
estimated to be in software. Many positions remain unfilled for a long time for want of
software professionals with specific skills. The situation as described by most companies
ranges from somewhat serious to very serious. Ability of universities to meet the growing
demand is limited. An indication of the mismatch in demand-supply is evident from the fact that, almost all computer science graduates get employed within three months of completing their graduation.

Cost: As per the "National Association of Software and Service Companies" reports (Nascom, 2001), salary levels had raised significantly as staffing requirements were peak in 1999 and 2000 due to the Year 2000 (Y2K) problem. After September 11, 2001 the salary increments have stopped increasing rapidly due to recession in the industry.

**Turnover:** Manpower turnover causes disruptions in project implementation and loss of skills inculcated through training and hands-on experience. Many a time, companies end up recruiting professionals from each other as they compete to attract the same pool of talent. Most software companies try to stem manpower turnover by offering Stock Option Plans. These schemes work in a fashion where longer the duration of employment, more the stock (number of shares) received, providing a disincentive to change jobs frequently.

**Productivity:** Productivity of manpower depends on the skill levels and motivation. Companies try to offer excellent work environment with satisfying job responsibilities to keep employee morale high. They also offer recreational facilities such as golf course, tennis, swimming pool, gymnasium and other sports facilities. As the number of employees grows, one of the key tasks of top management is to 'manage egos' of senior level professionals. Management also keeps adequate peer pressure through incentive schemes or awards with a view to maintain high level of productivity.

**Skill intensive:** Software industry is driven by technology and hence tends to be skill intensive. Most functions require thorough technical skills coupled with some business
knowledge required to interact with business counterparts. While at lower levels the blend required is more of technical skills, at higher level it is more of business skills. Imbibing these skills requires considerable effort on the part of the incumbent. Skills are also varied for example - development of systems software requires different skills and understanding of business systems, than do development of applications software. Most CEOs cite lack of skilled professionals as one of the biggest hindrance to growth.

University courses provide some exposure to these technical/ business skills, but companies find in most cases falling short of their requirements. Almost invariably candidates need to undergo further training and hands-on experience before being assigned to live projects. One of the reasons is that changes in university syllabus tends to lag behind compared to the latest technology changes in the market place. Continuous education and skill upgradation is also of prime importance to mitigate the rapid obsolescence of IT skills. This is being addressed by providing technology based instruction (TBI), multimedia training through multiple platforms etc.

Since business skills are also an important aspect, many companies are opting for non-computer professionals and offer them three-six month training, in the initial part of their job. To some extent this tries to solve the availability problem also.

**High capital output ratio:** Formation of value webs which fosters innovation, allows 'supporters' to set up fairly profitable businesses with little capital. Being manpower and skill intensive critical inputs are more in terms of intangibles, which do not cost much upfront for a closely knit entrepreneurial, run small business. Typically, small assembly shops for
hardware or consultancy and programming services in software require limited capital. This lowers the entry barriers and lets small innovative companies flourish.

Entry into the bigger league or expanding market reach requires high capital investment. Investment requirements are huge as organizations need to invest in infrastructure, research & development, meeting the fixed costs associated with product development, marketing etc. As seen earlier in the higher stages of the value chain, where rewards are high, investment requirements are also high.

However once the infrastructure has been created and the fixed costs incurred to develop a successful product, revenue streams generate huge cash flows, which can be easily used for further expansion. The situation is similar in the case of a company evolving from a small sized outfit to a large organization. During the period of evolution, the company would require very little infusion of capital to sustain growth. Cash profits generated out of successful products and even consultancy or service assignments are large enough to take care of investment requirements. This makes software one of the few industries with a high capital output ratio.

**Rapidly changing technology:** Most software products have a limited life span. As technological changes sweep the industry, software originally developed for one platform fails to meet user requirements on the changed platform. For instance software written for DOS will not meet requirements of users working on Windows. Modifying the original software to enable it work on the new platform may not be the right solution. In fact this runs the risk of losing market share to a competing product developed specifically for and exploiting the features of the new platform.
Once every 10-15 years the technology changes so radically that software requirements also change dramatically. For instance, software required for mainframes is quite different from software required for PCs. Similarly in the new internet era, software requirements change radically. Even in the case of consultancy and services this holds good, as the organization’s technical skills need to be upgraded to suit the changing environment. Companies therefore need to continuously adapt themselves to the changing technology, keep investing in the latest hardware/software and reorient their strategies in order to remain on top.

**Project management:** Most software projects encompass various aspects and functions of the business, making them typically large sized projects. This makes it imperative to have proper project management skills and a well-defined approach to software development. The importance of project management assumes more significance when one considers that more and more companies are outsourcing their programming requirements. Software languages have also evolved gradually around this key feature. Fourth generation languages (4GLs) like GUI (Graphical User Interface) based system software has made programming more interactive by providing for easier monitoring of progress. Interconnectivity of desktop systems through e-mail and high speed data communication links also help the project leader in administering the project well. Several 'easy-to-use' project management software are also available off-the-shelf. Nevertheless the job of the project leader has become more important for slippages in deadlines tend to be very costly for software companies.

**Infrastructure dependent:** Use of IT in business has moved away from simply automating manual tasks to a powerful analysis and communication tool. This requires computers to be
interconnected. To keep networking costs down, existing telecommunication infrastructure is used. Share of voice traffic on telecom lines has reduced dramatically and it is estimated that it currently constitutes only 50% of telecom traffic. Increased outsourcing places further emphasis on communication channels. IT industry therefore is dependent on availability of telecommunication links.

3.3 Structure of Information Technology

IT industry can be segmented into hardware, software and training. Hardware has little synergy with software and very few companies are engaged in both activities. Even where hardware companies provide 'total solutions', software is typically off the shelf - software developed by specialized software companies. Characteristics and market requirements of both the segments are vastly different.

Software and training have a unique, but limited synergy between themselves. Training provides software development activity with the required programmers, while hands on experience gained in software development helps to develop better training inputs. It is therefore quite common to find a single company offering software services/ products and training.

The following is the structure of Information Technology:

1. **Software**
   1.1 **Systems Software**
      1.1.1 Operating System for Client, Workstations, and Server.
      1.1.2 System Management and Utilities:
         - Storage Management
         - Security Management
         - Automated Operations
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- Performance Management

1.1.3 Hardware & Network communication / interface programs, interface / communication with other systems programs, etc.

1.1.4 Databases: including Relational Database Management Systems (RDBMS)

1.2 Application Software

1.2.1 Enterprise

1.2.2 SOHO - Small Office & Home Office

1.2.3 Consumer — Entertainment, Education, etc.

1.2.4 Vertical Industry:

- Banking / Finance
- CAD/CAM
- GIS
- Telecom
- Manufacturing
- Services
- Government / PSUs
- Energy / Oil.

Note: Services include: Hospitality, Entertainment, Health, Courier & Cargo, Media, Transportation, etc.

1.3 Web & Internet Based

1.3.1 E-commerce

1.3.2 E-Business

- Enterprise-wide
- Customer Relationship Management (CRM)
- Supply Chain Management (SCM)
- Data Warehousing & Mining

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- Decision Support Systems (DSS)
- Enterprise Application Integration (EAI)

1.3.3 Security


1.4.1 Cross Industry Applications: include Accounting, Data Warehousing, Enterprise Resource Planning, Office Suits, Groupware, Messaging, Web Based Applications, etc.

1.4.2 Vertical Industry Applications: include Banking, Finance, GIS, CAD/CAM, EDA, etc.

1.4.3 Development Tools: for developing business applications including Case Tools, 3GL, 4GL, GUI, Builder, etc.

1.5 Multi-media Software

1.5.1 Graphics
1.5.2 2D Animation
1.5.3 3D Animation

2. Hardware

2.1 Systems: Servers, Workstations, PC Servers, Desktops, Portables.

2.2 Peripherals: Impact Printers, Non-Impact Printers, Monitors, Keyboards, Pointing Devices, HDD/FDD/CD-ROM Drive

2.3 Networking: LAN Products, WAN Products, VSATs, Structured Cabling.

3. Services

3.1 Software:
  - Software Maintenance
  - Upgrades & Patches
  - Anti-Virus, etc.
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3.2 Hardware -

- Maintenance of Own-brand systems
- Third-party Maintenance
- Facilities Maintenance
- Network maintenance

4. Training

4.1 Institute Training
4.2 Computer Based Training (CBTs)
4.3 Corporate Training
4.3.1 In-House Training
4.3.2 Sponsored Training

5. Information Technology Enabled Services

5.1 Customer Care Services (Call Centers)
5.2 Back-office Services
   - Data Entry
   - Claim Processing
   - Technical Transcription
   - Accounting
   - Legal processing
   - Insurance
5.3 Conversions - Databases, GIS, CAD/CAM, HTML, etc
5.4 Medical Transcription

1.4 Information Technology in India

As the world moves from the industrial era to the knowledge era, the factors of production are changing. Industrial society was built around materials and machines as the
key factors, with people being pushed into a dispensable category. In the knowledge society
the key factors are people and the human resources are the significant factors of production.
The West created wealth through the Industrial Revolution and Middle-East through oil. Where as in India, wealth is being created through knowledge with the help of which it is emerging as a major IT center in the world.

India has great potential to contribute to the development of information technology in general and software in particular. Realising this potential government of India announced a policy in 1986 making "Software Exports, Software Development and Training" as a major thrust area. Also identified were some of the factors impeding the growth of the software industry and formulated the "Software Technology Park" (STP) scheme that facilitate overcoming the impediments and boosting software exports from the country. The scheme had considered aspects like simplifications/rationalisation of procedures, providing single-point-contact services to the industry, providing basic common amenities needed for export operations within a very short gestation period and share infrastructure facilities like computing resources and data communication services in a cost effective manner.

The scheme was designed especially to help Small and Medium Enterprises (SMEs) involved in software exports and it enables them to remain competitive in the global market. The government of India on May 22, 1998 also constituted a "National Task Force on Information Technology and Software Development" to recommend steps to remove bottlenecks in the path of rapid development of information technology and to give a boost to Information Technology and Software Industry. Later the recommendations of the same have been formulated as IT policy and was passed as an act in the year 2001. In India, there
has been a gradual shift towards usage of IT in government, public sector, private sector as well as public services and education. However, usage of computers is yet to reach many homes in the country. Undoubtedly, it was the computerisation of railway passenger reservation system in 1986- that brought computers closer to masses. And, in the last two years - it is the power of internet, E-Commerce as well as the government of India's thrust - which is bringing IT in to the daily life of a common man in India.

Pioneering work done by Indian software companies using the high speed datacom links brought in new paradigm of offshore software development. In fact, Indian software industry has been recognised as representing one of the most successful business models that can help to sustain high growth and competitiveness. Thus, with software as the driving engine, since early 90's, the Indian IT industry has been growing at a phenomenal rate. Also, India's software industry is torch bearer for not only India's IT industry but even Indian economy's global ambitions. It is a way to build competitiveness in technology-driven service economy.

India has many advantages to become an important player in the global IT industry. By marshalling its vast human, industrial and technological resources, especially with expansion of its software sector, India can raise productivity of domestic manufacturing and services. Obviously, this will lead to IT in governance, IT in industry and IT for every citizen of the country. There are even plans of infusing tangible productivity gains amongst various sectors and communities through use of IT.
1.5 **Evolution and Growth** of IT in India

The potential of information technology to generate wealth, foreign exchange and employment has already caught the imagination of India's businessmen, citizens, economists, bureaucracy and politicians. There has been a gradual shift towards the usage of IT in the Government, public sector and private sector as also in public services and education. There has been a major paradigm shift in the information technology area in India and the transformation is as follows *(Ahuja, 2000)*:

- From information technology "as a sector" to "as an industry"
- From "providing services to existing users" to "adding value to sustain growth"
- From "government controller of infrastructure & technology" to a "facilitator role"
- From IT "for specialists" to "for masses"
- From "fulfilling external demand" to "creating internal demand"
- From "anti-labour intensive" to "pro-productive & efficient" phenomenon
- From "capital intensive" to "human intensive"
- From "brain drain" to "brain gain"

Information technology has evolved over a period of time since 1970s and its evolution can be studied in five stages as follows:

**First Stage: (Prior to 1970)**

The industry got a start in the early 1960s when software and maintenance cost of software were either equal to or exceeded hardware costs. Till then software was combined
along with the hardware (mainframes) supplied. It was the hardware firms which were producing most of the software. Neither information technology nor software was the focus or priority area for the government. There was no public or private initiative to take up software or hardware development. The main use of computers was only restricted to few critical areas like - defense, advanced scientific research, etc.

**Second Stage: (1971 to 1980)**

From 1970s there was a boom in the industry globally with the outsourcing of software production to specialised software firms located in India. This was prompted by the standardisation of the software development process, programming languages and hardware. Projects were of the fixed price turn-key type. India entered the software industry at this juncture. Tata Consultancy Services (TCS), the first Indian software company was set up in 1974 to take advantage of the emerging opportunities and the competence of Indian human resources. IBM's departure in 1978 resulted in some of the former employees starting their own software firms in India. Since the domestic market was too small in the late 1970s and early 1980s these firms had to export to remain in business. The Indian Government had a computer policy since the 1970s when the department of electronics (DOE) was first established. The government polices in the 1970s and early 1980s were oriented towards self-reliance and nurturing the domestic software and hardware industries.

India was the first developing country to target software as a thrust area. While export of software was encouraged, the import of software and hardware were allowed with severe restrictions and high import duties. Since import duties were considerably lower for firms engaged in hardware and software training, some domestic companies used this route
to get into the software industry. The Indian government's purchase of software gave priority to Indian firms and the public sector Computer Maintenance Corporation (CMC) was formed in 1976. As the computerisation of Indian industry accelerated from the late 1970s, software development became important. Some large firms developed their own software. This period saw the incorporation of domestic software firms like TCS and NUT.

Third Stage: (1981 to 1990)

The early 1980s led to the era of 'shrink-wrapped' (ready to use) software products. These were mass-produced offering economies of scale. Customer service and technical services became very important activities. The shift was triggered of by scarcity of human resources for custom development software projects. Marketing was an important activity of software companies in this area. Even today, quite a few of the shrink-wrapped products developed in India are marketed by foreign firms under their brands.

Hardware imports were restricted till mid 1980s and the local hardware industry produced mini computers and personal computers. This made Indian software professionals export in non-mainframe operating systems like Unix and MS DOS. This proved to be a great asset for the industry when in late 1980s the world market started moving away from mainframes to personal and mini computers.

Fourth Stage: (1991 to 2000)

The 1990s saw a resurgence of project driven software services. Software systems integration became a big market. Most of the low value activities like data entry, programming and testing were outsourced to India that did the job well and were
inexpensive. This ignited the high growth rates in the Indian software industry. Soon the local industry established itself and multinationals set up their development centres, starting with Texas Instruments in 1986 or subsidiaries like Citicorp Overseas Limited by Citibank in 1985. Body shopping by now was not attractive since the competition had driven margins down.

The software policy that was formulated by the government in 1986 was more supportive in the sense that software and hardware imports were made easier and import duties in these were reduced to facilitate software exports. Texas Instruments in 1986 was set up as the first 100% export oriented foreign owned subsidiary. The STPI scheme came in 1988. The government provided building, electricity and telecommunications infrastructure in the STPIs. Many successful Indian software firms had their genesis in the STPIs. The National Association of Software and Service Companies (Nasscom) was established in 1988 to liaison with the government in the formulation of policy. The Nasscom was instrumental in making India one of the first countries to grant copyright protection to software. In 1987 the government decided to impose tax on travel expenditure. This tax coupled with US government Visa restrictions and modifications in the wages and tax laws for Indian programmers in 1989 and 1993 led to declining of body shopping.

The post 1991 era saw the economy wide liberalization programme influencing policy in the software industry. Import duties on software and hardware were further reduced. This along with the funding options accelerated the industry's growth. Both the governments at Centre and States were found to have become proactive about the IT and more specifically the software sector. In 1998 the Prime Minister formed a National Taskforce on
Information Technology and Software Development to formulate a long term IT policy for the country.

The ministry of information technology was formed in 1999 to be the nodal institutional mechanism for facilitating all the initiatives in the central government, the stage governments, academia and the private sector. At least 19 state governments have announced the IT policies and have been proactively attracting investments in the IT sector.

Fifth Stage: (2000 onwards)

This stage has started consolidating the electronic revolution that swept the world in the previous stage. The new IT policy 2001 has been passed and this has paved way for implementation of e-business and e-governance initiatives in the country.

### 4.6 Nature & Scope of Services by Indian Software Industry

With the wide array of services which the various software companies in India are offering, it is imperative that one understands the monetary value these different kinds of services offer.

Most software companies in India act as outsourcing partners, executing assignments either onsite at client's premises or offshore at development centers in the country. A few of them who have ventured into products are also into niche segments, which do not generate huge volumes. Many Indian companies have rushed into the highly lucrative applications or generic products segment as the risk of failure is quite low. Based on the risk reward trade-off a value chain can be generated - at the lower end of the value chain the risk of failure is the least and so also are the rewards, at the higher end both risk and rewards are high.

The following is the scope of services that are offered by Indian software companies:
**3ody Shopping**

This refers to the placing of bodies (programmers) at positions in foreign companies. The local company acts like a placement agency. It selects appropriate candidates and sends them abroad and collects a fee from the overseas company for this service. In some cases it also collects a percentage of the candidate's salary from the candidate. Body shopping has low revenue growth potential and risk of failure is also low.

**Onsite Contracts**

Onsite contracting is similar to body shopping, except that the overseas company pays the contractor and not the programmer. The contractor retains some margin and passes on the rest to the programmer. The margins in this business are relatively high and the limited annuity factor also provides high return. However, the risk is also higher in terms of erosion of margins. As the cost advantage diminishes the risk also increases.

**Offshore contracts**

In this type of contract the software development work is transferred to a local location. The overseas vendor maintains control on the project through high-speed data communication links. The offshore contractor has to invest considerably in these kinds of assignments. He has to provide for infrastructure in terms of data communication links, office space (typically software development center for a large team of software professionals), hardware and software. Returns are also high as the offshore contractor pays local costs for programmers as well as for maintaining assets. An offshore contractor faces project implementation risk as he has to deliver on the due date and the consequences for not delivering by the due date can be quite stiff.
Productized services

Typically services rendered can be classified into categories where activities are similar. For example, porting code from legacy machines to client-server environment would be similar for most of the clients. In such cases the service provider would gain by productizing his services so that he only needs to 'customize' it to client requirements. This has benefits for the client also, as it reduces project time and associated cost. Productization of services is a step forward from offshore programming. The learning acquired from handling an offshore project is applied to future projects of similar nature by automating several tasks. In the risk reward profile along the value chain, productized services offers the best trade off. Margins in this form of business are higher than in offshore contracts, while the risk is similar. However the potential of revenue generation is not very high as the concept has limited application.

Products

Products are generic software programs, which can be picked off the shelf and put to immediate use. Products leverage on volumes to maximize profits - higher the volumes higher the profits. Developing products involves huge fixed costs in terms of product identification, software development, testing, debugging and marketing. Niche products are products which cater to some specific segments of IT users, like the products for the banking industry. Niche products are built around a company's core competence, either acquired through offshore contracting experience or the experience of the personnel behind the development. This considerably reduces uncertainties, though huge volumes are not generated.
Mass products generate higher volumes. Consequently higher profits can be generated only if the products target the masses and not the elite. Mass product marketing is the last stage in the value chain, where profits generated are the maximum. But so is the risk. Though most of the Indian companies started off as body shoppers only a few small companies are still in this stage. Others have moved up the value chain, to offer a mix of onsite and offshore contracting services. These services offered by Indian companies can be classified as low-end services and high-end services. Data entry jobs, re-engineering of legacy applications, porting of applications from one platform to another etc. constitute low-end offshore services. Many companies have gradually moved from low-end to high-end as they built expertise and goodwill. Very few companies have moved to the products segment. As of now Indian companies offer only niche products.

3.7 The Present Status

The growth of information technology (IT) industry in general and software exports in specific has led to significant changes in the Indian economy and society. According to Nasscom report (Nasscom, 2001) the global ICT industry was estimated at USD2.4 trillion in 1999 and is currently valued at USD 2.4 trillion. This industry is expected to cross the USD 3 trillion mark by 2003. The report says that the expansion indicates a prospective compounded annual growth rate of seven per cent.

Of late, India, Brazil and China have emerged as strong IT markets on the world stage. Most countries have begun understanding the value addition that IT is bringing to economies and are now committed to creating and supporting the policy frameworks,
infrastructure, capital pools, partnerships, skill bases and applications necessary to facilitate the growth of the IT industry.

In India, the growth of the IT industry is predominantly encouraged by the exports of software industry. This has not only led to generation of wealth through foreign exchange in the society but has also been breeding entrepreneurial tendencies among different social and economic classes of the society. Many citizens including civil servants and politicians have started investing in software industry.

There has been an increase in the usage of IT in the government, public sector, private sector as well as public services and education. The year 1999-2000 also witnessed a concerted effort to trickle the benefits of IT to the masses in the country.

Table No 3.1: Indian IT Software and Services Industry (1995-2000)

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Source: Nasscom, 2001

According to Nasscom report (Nasscom, 2001), Indian software industry has grown from a mere Rs. 85 crores in 1985 to Rs. 38,000 crores in 2000-01. This industry has been growing at the rate of 50 % over the past 10 years and has recorded 56 % growth in the year 2000-01. This Rs. 38,000 crores industry is divided into two segments - export and domestic sector with 75 % and 25 % contribution respectively. From this it is clear that the software
industry survives on software exports and the domestic segment has comedown from 40% in the year 1995-96 to 25% in the year 2000-01. Similarly the export sector has grown from 60% to 75% for the same period (Nasscom, 2001).

According to Nasscom report (Nasscom, 2001), the domestic software market recorded a turnover of Rs.7,200 crore in 1999-2000 as against Rs.4,950 crore in 1998-99, a growth of over 45 per cent. Despite a sluggish market, achieving growth at this level is mainly due to increased computerisation of government departments, implementation of e-governance and e-banking, elimination of import duty on software, increased enforcement of anti-piracy laws as well as increased maturity in the end-user organisations.

An important highlight of the year was the focus towards e-governance by state governments in India. As mentioned earlier, 19 of the 26 state governments have already announced their IT policy and many others have formed high-level task forces. The maximum growth in the domestic software market is expected by the state from banking e-governance, defence, Small Office Home Office (SOHO), e-commerce, etc.

According to Nasscom (Nasscom, 2001), the industry exported software and services worth Rs. 30 crore in 1985. In 1999-2000, the total exports amounted to Rs. 17,150 crore.
Table No 3.2: Domestic Software Market Activity Break-up

<table>
<thead>
<tr>
<th>Activity</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support &amp; Maintenance</td>
<td>4.01%</td>
</tr>
<tr>
<td>Professional Services</td>
<td>8.30%</td>
</tr>
<tr>
<td>Products &amp; Packages</td>
<td>41.00%</td>
</tr>
<tr>
<td>Training</td>
<td>4.00%</td>
</tr>
<tr>
<td>IT Enabled Services</td>
<td>10.00%</td>
</tr>
<tr>
<td>Projects</td>
<td>32.60%</td>
</tr>
</tbody>
</table>

Source: Nasscom, 2001

Table No 3.3: Software Export Industry Activity Break-up

<table>
<thead>
<tr>
<th>Activity</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support &amp; Maintenance</td>
<td>3.50%</td>
</tr>
<tr>
<td>Professional Services</td>
<td>40.20%</td>
</tr>
<tr>
<td>Products &amp; Packages</td>
<td>8.05%</td>
</tr>
<tr>
<td>Training</td>
<td>1.75%</td>
</tr>
<tr>
<td>IT Enabled Services</td>
<td>9.75%</td>
</tr>
<tr>
<td>Projects</td>
<td>36.75%</td>
</tr>
</tbody>
</table>

Source: Nasscom, 2001

1.8 Information Technology in Andhra Pradesh

Though the information technology (IT) industry in Andhra Pradesh is in its infancy compared to its counterparts in the states of Maharashtra and Karnataka, it has carved a niche for itself in the global market in less than a decade. The state turned its late entry into an advantage by leapfrogging several decades of technological advancements and positioning itself as a premier provider of IT solutions to major software giants across the world. In order to act as a facilitator and an enabler, the state government announced its IT policy in
1996. The policy outlined a clear strategy to be adopted for taking the benefits of IT to the common man and thus initiated several IT related projects which resulted in efficient and quicker delivery of services to its citizens. The Twin Cities Network services (TWINS) is an example of such initiatives. Under this project, around 30 services from 18 departments are being offered at nine specially established e-Seva centres across the twin cities.

The state promotes not only the software industry but also the hardware. Andhra Pradesh earned the distinction of being the first state in the country to formulate a hardware policy. The electronic hardware policy offers incentives to the new units in Andhra Pradesh. Presently, there are over 1,300 IT companies in Andhra Pradesh, of which around 1,200 are registered with the Software Technology Part of India (STPI), Hyderabad (STPH, 2001).

Table No 3.4: Growth of STP units in Andhra Pradesh

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Units</td>
<td>31</td>
<td>46</td>
<td>71</td>
<td>106</td>
<td>359</td>
<td>674</td>
</tr>
<tr>
<td>Approved Units</td>
<td>60</td>
<td>88</td>
<td>112</td>
<td>194</td>
<td>977</td>
<td>1206</td>
</tr>
</tbody>
</table>

Source: Software Technology Park, Hyderabad (STPH) 2001

Table No 3.5: Software Exports in AP

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Indian Exports</td>
<td>2520</td>
<td>3900</td>
<td>6530</td>
<td>10940</td>
<td>17150</td>
<td>28500</td>
</tr>
<tr>
<td>Growth %</td>
<td>0</td>
<td>54.76</td>
<td>67.44</td>
<td>67.53</td>
<td>56.76</td>
<td>66.18</td>
</tr>
<tr>
<td>AP</td>
<td>60</td>
<td>134</td>
<td>284</td>
<td>574</td>
<td>1059</td>
<td>1917</td>
</tr>
<tr>
<td>As % of India</td>
<td>2.38</td>
<td>3.44</td>
<td>4.35</td>
<td>5.25</td>
<td>6.17</td>
<td>6.73</td>
</tr>
<tr>
<td>AP growth</td>
<td>0.00</td>
<td>123.33</td>
<td>111.94</td>
<td>102.11</td>
<td>84.49</td>
<td>81.02</td>
</tr>
</tbody>
</table>

Interorganisational Collaboration and Software Development
Source: Nasscom, 2001 and Software Technology Park, Hyderabad (STPH) 2001

According to STPI (2001), during the year 2000-01, the export turnover generated by the software companies in the state was around Rs.2000 crores, out of which the STPI registered units accounted for Rs.1,917 crores, recording a growth of 81 percent over Rs.1,059 crores made during the previous year. Towards the end of the year 2000, the IT industry in the US suffered a set-back with many companies implementing cost cutting measures and reducing their IT budgets considerably. The Indian IT industry was heavily dependent on the US market and the slowdown had an adverse effect on the industry in Andhra Pradesh, forcing many small companies to close.

Table No 3.6: Global Reach (2000-2001)

<table>
<thead>
<tr>
<th>Region</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA &amp; Canada</td>
<td>69.15%</td>
</tr>
<tr>
<td>Europe</td>
<td>11.80%</td>
</tr>
<tr>
<td>Middle East &amp; Asia</td>
<td>6.39%</td>
</tr>
<tr>
<td>Netherlands</td>
<td>5.67%</td>
</tr>
<tr>
<td>Japan</td>
<td>4.28%</td>
</tr>
<tr>
<td>Australia</td>
<td>1.02%</td>
</tr>
<tr>
<td>Others</td>
<td>1.69%</td>
</tr>
</tbody>
</table>

Source: Software Technology Park, Hyderabad (STPH) 2001

The exports made from the state during 2000-2001 were predominantly to the US and Canada, accounting to 69.15 percent of the total exports. Software exports were also made to countries like the UK, the Netherlands, Japan, Europe, Australia, Middle East and other Asian countries etc. Realising the slowdown in the US market, many companies implemented a de-risking strategy of diversifying to various markets. The focus was on
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Europe and the Middle East. This is expected to alter the global reach ratios with only around 50 percent exports to the US.

Out of the total exports, e-commerce and web applications contributed to around 29.14 percent closely followed by application software contributing 25.65 percent. Enterprise Resource Planning (ERP) and client server application accounted for 11.15 percent and system software 8.91 percent of the exports. Computer-aided design, manufacturing and geographical information systems (GIS) contributed around 4.38 percent of the exports. Solutions in very Large Scale Integration (VLSI) and embedded software accounted for 2.64 percent.

Table No 3.7: Area-wise Exports (2000-2001)

<table>
<thead>
<tr>
<th>Area</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-commerce / Web App</td>
<td>29.14%</td>
</tr>
<tr>
<td>Application Software</td>
<td>25.65%</td>
</tr>
<tr>
<td>ERP / Client Server</td>
<td>11.15%</td>
</tr>
<tr>
<td>System Software</td>
<td>8.91%</td>
</tr>
<tr>
<td>IT Enabled Services</td>
<td>8.15%</td>
</tr>
<tr>
<td>Consultancy Services</td>
<td>6.51%</td>
</tr>
<tr>
<td>CAD / CAM / GIS</td>
<td>4.38%</td>
</tr>
<tr>
<td>Communication Software</td>
<td>3.47%</td>
</tr>
<tr>
<td>VLSI &amp; Embedded SW</td>
<td>2.64%</td>
</tr>
</tbody>
</table>

Source: Software Technology Park, Hyderabad (STPH) 2001

19 **India's Position in IT Industry**

Indian software sector has several advantages, which enable it to grow at a faster pace.
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Location

Though for software companies location is seemingly not a material advantage, India enjoys a location advantage. The advantage it enjoys over other countries, is a 12-hour difference with the world's largest market - the USA. This enables US companies to establish round the clock software factories by subcontracting to Indian companies. The 12-hour difference enables almost continuous working on software projects.

Manpower Availability

As has been aptly put 'What Middle East is to oil, India is to software professionals'. There is a tremendous latent potential of manpower supply in India. India has the second largest pool of technically qualified English speaking manpower (second only to the United States) available at a comparatively lower cost. In the last ten years the growth in manpower availability has been tremendous, considering that India had barely 6,800 professionals in 1985. In the coming years manpower availability is estimated to grow at a much faster pace. (Nasscom, 2001)

Manpower cost

Much of India's strong growth in software in the past is attributable to the low cost of Indian programmers. Indian programmers are paid only about 15-20% of their counterparts in developed nations (Mehta, 1999). Even among competing countries Indian software professionals are paid the least. This provided domestic software companies a cutting edge in pricing software projects. However, the low cost edge has now been considerably eroded with most software professionals getting remuneration on par with
global standards. Nevertheless in terms of cost-quality, India continues to offer significant
Value for money.

Gamut of services

India's advantage was that it could offer a wide range of software services from clerical support/ data processing to sophisticated software systems. The low cost, faster learning curve, technical education and easy availability of manpower at all levels enabled it to offer labor intensive support services, while the technically qualified and skilled personnel enabled it to offer quality solutions involving sophisticated software systems.

Technology advantage

India due to its late entry in to IT industry, had avoided the problem of obsolescence of technologies which the other countries like Japan have been facing. Indian companies started investing in IT significantly, only since mid-eighties, coinciding with the advent of PC in the West. Since then PC segment (including software for PCs) has been the fastest growing segment, enabling India to ride the growth wave.

Project Experience

Indian companies have a rich experience of working with large global software companies. The subcontracting of large Y2K projects has also provided Indian companies with substantial experience in handling and executing large sized projects. Indian companies seem to have high credibility amongst other West European nations and US on the reliability index, which is indicated by the increasing contract sizes.
Skills on Learning curve

Indian companies have over the last decade built expertise on a variety of platforms - from legacy systems to the latest state-of-the-art systems. Indian software professionals have faster learning curve when compared with their counterparts in other countries (Mehta, 2001). Most of the companies have expertise on PC, mainframe, UNIX and midrange platforms with varied operating systems, RDBMS and programming language skills.

Infrastructure facilities

India has more than 500 high-speed datacom links of 32-256 kbps, connecting Indian software companies with their clients abroad. A majority of this infrastructure and communication links are provided by Software Technology Parks of India (STPI). These facilities include floor space, EPABX, fax, Internet, teleconferencing, backup power etc. Local software companies outside the STPI zone are also assisted by STPIs using a network of receivers and microwave/ radio-wave links. Despite this, the current infrastructure fails to meet the growing needs of the Indian software industry.

Leading domestic software exporters have built world class software facilities of their own which include - dedicated telecom links like leased lines, dedicated satellite time and development centers with adequate hardware, own power generation, recreation facilities for staff, etc.

Regulatory framework

The Indian government with its provision of tax and duty benefits to software exporters has facilitated an apparently conducive regulatory framework for IT industry development.