TFYP WORKING GROUP Sr. No. **73/2001**

REPORT OF
THE WORKING GROUP ON

INFORMATION TECHNOLOGY

FOR
THE FORMULATION OF THE TENTH FIVE YEAR PLAN

GOVERNMENT OF INDIA
PLANNING COMMISSION
November, 2001

Foreword

The advancement in information technology has a profound impact in country's economy, thus the quality of human life. The convergence of computer, communications and content creates tremendous opportunities as well as challenges. The IT revolution will be of much greater significance than the Industrial Revolution of 17th century. This revolution has opened up new possibilities of economic and social transformations from which both developed and developing countries can potentially benefit.
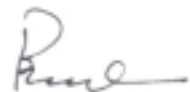
In the context of preparation of the Tenth Five Year Plan (2002-07), the Government has constituted a Working Group on Information Technology sector to make recommendations on the various policy matters to enable to formulate the Tenth Five Year Plan for Communication and Information sector.

This report is the result of efforts of the Members of the Working Group drawn from a cross section of the IT community and seven specialized, subject specific Study Teams.

India does have enormous opportunities emerging from globalization and consequent lowering of tariff barriers. These need to be consolidated through brand equity, marketing contacts, upgrading of manpower skill base, moving up the value chain, better infrastructure and economies of scale through larger domestic market base, R&D especially on e-Security aspects and strengthening of hardware sector. There is urgent need to strengthen IT infrastructure both for software exports and citizen centric interface. Distance learning is the need of the hour to spread education and regular upgradation of skills. This will need interconnecting all schools and colleges in the country (60,000 approx.) through a network with initial support from the Government. This will promote IT among masses and minimize digital divide.

If Indian manufacturing companies have to compete globally, we need to have a clear and comprehensive national policy for hardware manufacturing industry. The basic philosophy to induce manufacturing of electronics and IT products in India should be to provide world-class environment.

I would like to thank all members of the Working Group and Study Teams for their valuable inputs and Shri Y.S. Bhave, Member Convenor and his team (S/Shri R.S. Buttoo, Rajiv Rastogi, R.K. Marwah, T. Santosh) for preparing this Report.

Rajeeva Ratna Shah
Chairman - Tenth Plan Working Group on
Information Technology &
Secretary, Ministry of Information Technology

Preface

As a part of the exercise relating to the formulation of the Tenth Five Year Plan (2002-07) for Communication and Information Sector, the Planning Commission had constituted a Working Group on Information Technology under the Chairmanship of Secretary, Ministry of Information Technology. The Working Group had 32 Members drawn from various Government Department and Organizations, State Governments, Industry Associations, R&D Institutions and Industry.

The Terms of Reference of the Working Group are given in the Appendices. For getting a wider participation from different Industry Sectors, Industry Associations, R&D Laboratories, Experts and other Intellectuals, the following seven Study Teams were constituted:

1. Computer Software and Services,

2. Application Development,

3. Infrastructure,

4. Manufacturing Sector,

5. Electronics and IT Policy & Procedures,

6. Human Resource Development, and

7. Research & Development.

The Terms of Reference and Composition of various Study Teams are given in the Appendices of the Report. The reports of the Study Teams in abridged form are included in this Report. However, full reports will be brought out separately.

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Executive Summary

Global IT products and services market is at an estimated size of $ 1.5 trillion today. It is estimated that the share of IT in the GDP of nations will exceed that of any other industry in the next ten years. There is a great deal of inter-dependency even as fiercer competition emerges in a rapidly growing market. It is increasingly a border less world, thanks to the interactivity provided by the Internet and telecom infrastructure. India has to recognize this reality and make use of the best brains that exist in the NRI community. Foreign companies are being acquired by software companies in the country even while global MNCs are setting up their shop here. All these need to be encouraged. We need to ensure that India is a net gainer in the process and substantial foreign exchange, jobs and productivity gains are achieved through IT. Competitors and collaborators have to be identified and suitable strategy evolved. On one side, India has a unique opportunity to emerge as an IT leader among developing nations. On the other side, India has the opportunity to increase its share in the trade with advanced countries substantially. Sectors of IT which do not recognize this will perish.

Prime Minister has observed that Information Technology is an area where India can quickly establish global dominance in terms of wealth creation and generation of high quality employment. Ambitious targets have been laid down by Nation IT Task Force, as well as by industry. To realize these targets, Ministry of Information Technology is of the view that beside providing proactive support to industry in terms of WTO compatible custom duty and import policy frame work for attracting investment and providing competition, it is also necessary to enhance domestic consumption of IT products and services by taking IT to masses. In this regard, it is proposed to:

i)   spread computer literacy at various levels,
ii)   develop products and services needed by masses,
iii)   expand the network of Computer Information Centres (CIC) through-out the country and also utilize existing base of PCO's into internet kiosks,
iv)   facilitate industry to go global through e-commerce,
v)   develop tools to enable multilingual usage of computers, and
vi)   provide thrust to e-governance at both centre and state levels.

Software

For the past decade, Indian software industry has been growing at a consistently high rate of over 50% annually. During the IX Plan, the overall software industry is estimated to grow at a CAGR of 52%. The software export industry grew at a CAGR of 57%. Indian IT software and services of US $ 6.2 billion exports accounted for 14 % of India's total exports of US $ 44 billion during 2000-01. It is expected that by the year 2008, Indian IT software and services exports targeted at US $ 50 billion, which would account for 35 % of India's total exports. The IT industry in India is estimated to be over US $ 87 billion (Rs.3,91,500 crores) by 2008. By 2008, it is expected to become single largest contributor to the GDP of the country.

India, being a large country, has a domestic market with a vast potential. By the end of Tenth Plan, the software export and domestic software turnover is estimated to be Rs. 200,000 crores and Rs. 67,000 crores per annum respectively. There are huge opportunities available throughout the globe. India has the potential to become IT superpower; it will require cohesive concerted efforts from Government and IT Industry to achieve the ambitious plans and multi-pronged targets.

India's rise to fame in the international software and services marketplace is commendable. Through an orientation and adherence to high quality processes, a vast English speaking manpower base, expertise on state-of-the-art hardware and software platforms, and cost competitiveness, the software industry has established itself in the global segment.

For the software industry, the issues of concern are related to Telecom infrastructure, Bandwidth availability, access to international gateways, inter-connectivity across networks, Venture Capital, Labour Laws, physical bonding, depreciation on PCs, legality of electronic contracts, taxation and security aspects of e-Commerce, IT Focus in technical education and promotion of e-Governance in Government.

IT infrastructure is very important for Defence Services. All the services are having their own independent network which is not interconnected. Defence being highly sensitive to security. Network must provide end-to-end security with the implementation of PKI technology, COTs equipment need to be evaluated and authenticated for security. There is need to build up an interface between Defence Forces, the IT R&D organisation and IT industry for fullest exploitation of IT in various fields.

HRD

The major segments contributing to software industry are Software Products, IT Enabled Services and E-Business. One of the key issues in achieving and sustaining this level of growth will be the availability of high quality IT professionals in adequate numbers. As per a study, it would require 22 lakh IT professionals by 2008 – 11 lakh in the *hard core IT sector* and another 11 lakh for the *IT enabled service*s.

India needs to maintain and enhance its competitive advantage of abundant, high quality and cost effective human resources. The country has to ensure the right mix of technical, business and functional skills of the workforce to meet the needs of individual business segments and customer markets.

In Human Resource development, MIT's role is more of promotional in nature and of a facilitator to bridge the gaps that exist between *'what is supplied by the educational & training institutions in the formal sector'* and *'what is required or demanded by the industry'*. There is a need to address the issue of contemporary IT skills that are required by IT industry vis-à-vis the turnout from the formal sector institutions. The importance of Bridge Courses for IT professionals and the role of non-formal educational institutions to impart training in the emerging skills to deliver a quality software professional has to be realized. The in-house training provided by some large industrial houses to suit their tailor made requirements is an important link.

Manufacturing Sector

The performance of Manufacturing sector (Consumer Electronics, Computer Hardware, Communication and Broadcasting Equipment, Industrial Electronics, Strategic Electronics, and Components) during the Ninth Plan has been well below the targets. The targets were based on achieving 2% of the expected world production in the terminal year of Plan. Computers and Communication & Broadcasting sectors have witnessed negative growth. Industrial Electronics, Strategic Electronics and Components, while performing below the targets, have been showing steady but low rates of growth. The Consumer Electronics has shown good performance during the first three years but is showing signs of stagnation. Infrastructural handicaps, high cost of finance coupled with low availability, rigid labour laws, low volumes of production, low velocity of business, high tariffs and invested tariff structure, non availability of indigenous capital goods, lack of new investments both domestic as well as FDI etc. are some of the known weaknesses of the Indian manufacturing sector.

Fulfillment of our obligations under the WTO/ITA-1 is slowly but surely leading to globalisation of trade and consumption. A strong pro-active approach by the Government is required for the manufacturing sector. Otherwise this sector, which is already under pressure in light of the handicaps mentioned above as well as competition from the MNCs, is in danger of becoming extinct. Notwithstanding the above, there are successful examples such as Samtel, Tandon, Moser-Baer worthy of emulation by other domestic players. A four-pronged strategy is suggested for this sector. This consists of setting up of a high level Institutional framework for addressing the policy and procedural issues on a regular basis; supporting focussed R&D in the thrust areas identified for the different sub-sectors; creation of a manufacturing infrastructure development fund to compensate for the infrastructural handicaps as also providing incremental support for QA, prototyping etc.; and initiating a manufacturing sector promotion programme to address issues such as Improvement in the manufacturing technology, International marketing and business development, support for "Greening" of manufacturing technology, setting up of technology incubators, setting up an Electronic Component Development Fund etc. with built in flexibility and a strong pro-active approach to enable quick response to the fast changing global scenario with the objective of making the manufacturing sector in India globally competitive.

Policy and Procedures

Global business must be conducted in a manner which respects the global concerns, be it technology, quality, delivery, service price etc. This in turn requires a competitive business environment as an enabler. The policy framework alongwith the procedures should be such that they enable the industry to grow in the fastest possible manner.

During the first four years of the 9th Five Year Plan, the Electronics and IT industry have achieved 73.5 % of the target set out for the period. While the growth of software sector has been supported through the natural advantage India has in terms of scientific/engineering manpower, the Electronics/IT Hardware manufacturing units have faced a number of constraints with many discontinuing their operation. Imports, trading and grey market operations have shown a tendency to increase.

Amongst the major problems faced by Electronics/IT Hardware manufacturers are-inverted duty structure, high import duty on Capital Goods, problems arising out of dual usage on inputs, high incidence of overall taxes/duties, high cost of finance, infrastructure etc.

Instead of attempting to correct the anomalies in duties and taxes through amending notifications - (an approach which has been followed in the past), the problems of industry should be addressed by making a radical review of the policy framework especially in the context of the impending zero duty regime under ITA-WTO.

The Electronics and IT Hardware manufacturing units should be given an option to convert themselves into an EHTP unit and the EHTP scheme may be modified in terms of domestic market access, NFEP condition etc.. This approach would help industry in facilitating production for exports and domestic market access from the same unit.

As in the coming years, competitiveness of the industry would be governed by its ability to leverage technology, R&D capability, creativity and engineering skills, it is recommended that products commercialised based on indigenous Design and Development/R&D efforts, a 50% relief in excise duty be given.

Keeping in view the global efforts in movement towards green products and the impending EU directives on Waste from Electronic and Electronic Equipment and restriction of use of hazardous substances encouragement to the industry is required for implementation of Environmental Management Systems (EMS). Units implementing ISO 14001 be given certain relief in excise duty/income tax.

R&D

The growth achieved by the software industry during last decade cannot be maintained due to low end work and resulting low per capita productivity, building up competition from other countries like China, Philippines and limited IPR ownership by Indian companies. Besides these, the poor performance of hardware sector and decreasing number of young and bright research scholars are other concerns. In WTO regime of liberalized industrial and trade policies, it is essential to develop technologies, products and services of international quality and cost.

A focussed R&D is likely to provide a solution to these issues. Setting up of institutions on the lines of ISRO would help in taking up sustained and focussed research in areas of long term research such as nano-technologies. For the medium term, focus being on current technologies, an integrated approach for developing manpower and products in mission mode by utilising contract R&D to reduce cost and time of development is suggested. A lead agency with end to end responsibility including research, product development, field trial, pilot deployment as well as to represent India in the international organisations of standards is suggested to make India a major supplier of products and services. For short term R&D, the focus is on Indian solutions for Indian needs, technology absorption, product improvement and cost reduction. The free-wheeling R&D model is suggested to take care of broad based research on algorithms, techniques and technologies. We should consider setting up of the national incubation network and R&D cooperatives to enable Indian industry to move up the value chain.

The programme for IPR brings out measures to generate and protect our intellectual property as this would enhance our competitiveness and would enable India to position itself as a global design destination. The research in academic institutions is important for achieving Tenth Plan goals. Centres of Excellence for research and policy changes may be considered to attract bright young people and for making researchers as partners and stake

holders in research in order to enhance collaboration with industry as well as to increase effectiveness of R&D funding.

IT for Masses

To develop and promote various IT applications for domestic users. To connect more than 6 lakhs villages through state of art networks and improve accessibility in the process (through public and private investments) towards usage of IT by expanding Community Information Centre (CIC) Scheme, and other measures like converting existing base of PCOs into Internet kiosks.

It is proposed to connect every school and educational institution in the country during Tenth Plan through a programme called "Vidya Vahini".

Performance of Indian Electronics and IT Industry During Ninth Plan

Introduction

In recent times, 'software development and IT enabled services' have emerged as a niche opportunity for India in the global context. The Government is taking all necessary steps to make India, a Global Information Technology Superpower and a front-runner in the age of Information Revolution. The Government has announced promotion of Information Technology as one of the five top priorities of the country and constituted a National Task Force on Information Technology and Software Development.

The Government set-up a new Ministry of Information Technology in October 1999. The Ministry would be the nodal agency for facilitating all the initiatives in the IT sector. The erstwhile Department of Electronics was amalgamated in the new Ministry.

Government policy is to encourage software development in the country by creating the necessary environment and appropriate infrastructure. Various measures are being taken from time to time in this regard so that there is stimulation to creation of wealth and economic growth leading to better employment opportunities within the country. The Government has also recommended that each Ministry must allocate 2-3 per cent of its Budget on IT promotion. This is a step for development of domestic software industry and move towards Electronic Governance. It would result in delivering better services to the citizen by improving citizen-Government interface and larger transparency in decesion-making.

The software industry has emerged as one of the fastest growing sectors in the economy with a CAGR exceeding 50% over the last decade and with a turnover of US$ 8.3 billion and exports of US$ 6.2 billion during 2000-01. The Government has targeted an export of US $ 50 billion by the year 2008 for the Indian software industry.

The consistent growth in export of software can be largely attributed to the comparative cost advantage to the developed world in outsourcing from India. Indian software companies have a unique distinction of providing efficient software solutions with cost and quality as an advantage by using state-of-the-art technologies.

The Indian software professionals have already created their brand image in the global market. Today, more than 260 of the Fortune 1000 companies, i.e. almost one out of every four global giants, outsource their software requirements to India. This clearly establishes that more and more global companies are outsourcing their software requirements to India and are gaining competitive advantage.

The Indian software industry has not only been growing exponentially but has been moving up the value chain as well. The industry has evolved from manpower provider to software development to integration and IT business consulting. The Indian software industry is required to move faster on the value chain ladder and get more involved in strategic consulting, brand management, Research & Development and providing more web based and e-commerce kind of interactive services to the customers. For playing a larger role in domestic sector.

Production

The Indian electronics & IT industry is the fastest growing sector of Indian industry. It has recorded a production of Rs. 68,450 crores during the year 2000-01, and is likely to achieve a production of Rs. 86,900 crores during 2001-02. The production and growth trends during Seventh, Eight and Ninth Plan are given in Table 1.

The software industry, which was worth only Rs. 645 crores in 1991-92 and accounted for only 9% of total electronics & IT production, has recorded a production turnover of Rs. 37,750 crores in 2000-01 and has surpassed electronics hardware production.

Table 1

Production Performance of Electronics Industry and IT during Seventh, Eighth and Ninth Plan

	Year	Production Rs. Crores	Growth (%)	
			Annual	Cumulative
Seventh Plan	1985-86	2880	38.4	
	1986-87	3855	33.9	
	1987-88	5285	37.1	34
	1988-89	7030	31.0	
	1989-90	9010	28.2	
Annual Plans	1990-91	9540	5.9	
	1991-92	10950	14.8	
Eighth Plan	1992-93	13200	20.5	
	1993-94	15785	19.6	
	1994-95	18830	19.3	20
	1995-96	22340	18.6	
	1996-97	26640	19.2	
Ninth Plan	1997-98	32070	20.4	
	1998-99	41140	28.3	
	1999-2000	52450	27.5	27
	2000-01	68450	30.5	
	2001-02	86900	27.0	

Hardware Production

Today, all the renowned global brands have either established production facilities in the country or are present in the market through technical/financial collaborations, thus giving consumer a wider choice in terms of product features, technology quality and competitive prices.

The overall targets for the terminal year of the Ninth Plan were based on achieving 2% of the expected world production. The growth rate of the manufacturing sector from 1999-2000 to 2000-01 has been about 9 %.

The actual performance of the manufacturing sector during the Ninth Plan has been well below the targets. Computers and Communication & Broadcasting sectors have witnessed negative growths in some years. Industrial Electronics, Strategic Electronics, and Components sectors, while performing below the targets, have been showing steady but low rates of growth. The consumer electronics sector has shown better than targeted performance during the first three years but is showing signs of stagnation. It has registered a production
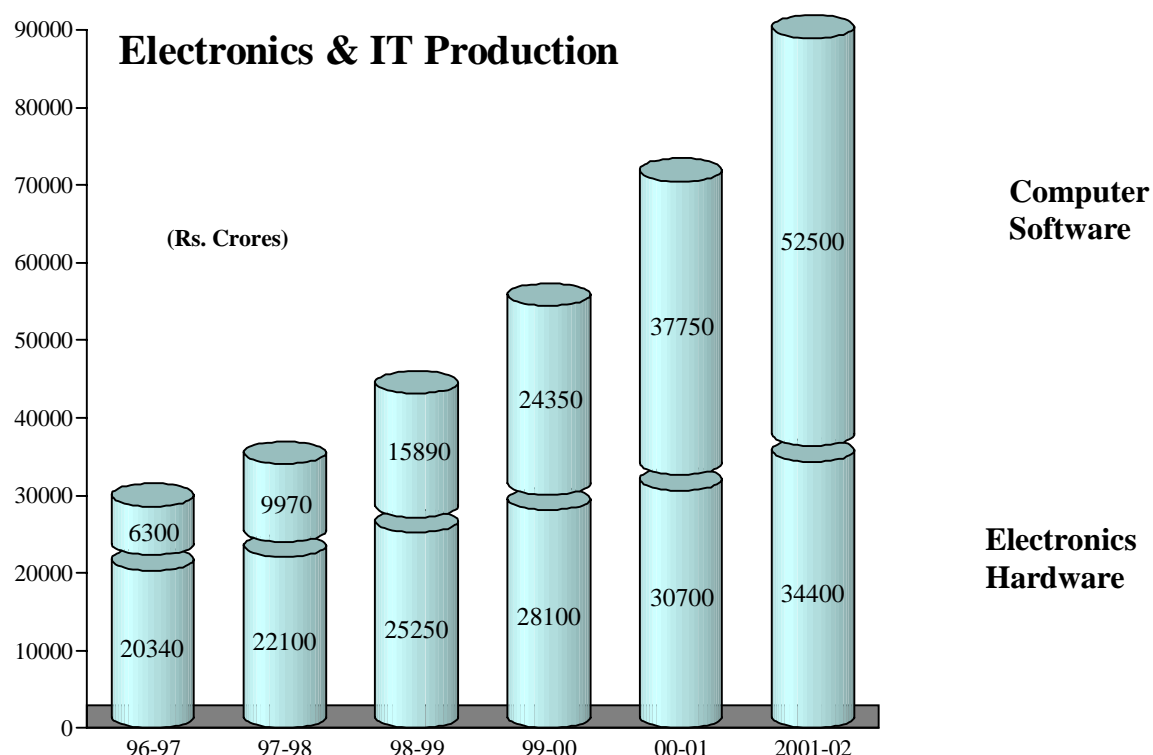
level of Rs. 11,550 crores during 2000-01, and is likely to be Rs. 13,000 crores during 2001-02. The color TV production has stagnated at 5.7 - 6 million during the last 3 years of the Plan, while B/W TV production is on decline.

The sale of personal computers has continued to increase substantially, estimated to be over 1.6 million in numbers. However, the production in computer, instrumentation and communication sector is not matching growth in demand. Prices of colour TV, computers and other products have also come down in consonance with the worldwide trend. The strategic electronics sector has shown a cumulative growth of about 8 per cent during Ninth Plan.

While electronics hardware sector recorded a CAGR of about 25% during Sixth Plan, and 34% in Seventh Plan, it is not able to sustain this growth pattern during the last decade. It has achieved a CAGR of 15% during Eight Plan which further declined to 11% in the Ninth Plan (Table 1A).

Table 1A
Production Performance of Electronics Hardware Industry during Eighth and Ninth Plan

	Year	Production Rs. Crores	Growth (%) Annual	Growth (%) Cumulative
Eighth Plan	1992-93	12035	18	
	1993-94	14070	17	
	1994-95	16225	15	15
	1995-96	18100	12	
	1996-97	20340	12	
Ninth Plan	1997-98	22100	9	
	1998-99	25250	14	
	1999-2000	28100	11	11
	2000-01	30700	9	
	2001-02	34400	12	

Electronics & IT Production (Rs. Crores) — bar chart showing Computer Software and Electronics Hardware:

Year	Electronics Hardware	Computer Software
96-97	20340	6300
97-98	22100	9970
98-99	25250	15890
99-00	28100	24350
00-01	30700	37750
2001-02	34400	52500

During the **Ninth Plan, computer software industry is likely to witness a cumulative growth of over 52% and hardware industry 11%.** While Software is doing well in the country, there is a **problem in hardware production**. It may be attributed to :

− Distorted Tariff Structure
− Poor Infrastructure
− High Cost of Finance
− Industrial, Fiscal and EXIM policy, Labour laws and Inspector Raj
− East imports and low import duty
− Low volumes of production
− Low technology level/upgradation of technology and high rate of obsolescence
− Inadequate investments in R&D

Very low investment is taking place in Hardware Industry and foreign investment is going to Taiwan, China, Brazil, Malaysia, etc.

No action has been taken to provide for a conducive manufacturing environment for Electronics and IT hardware companies which is at par with the competing nations. The Action Plan II Report of National Task Force on IT and Software Development has not been implemented including the much awaited SBIT scheme.

Computer Software

In export as well as domestic sector, computer software remains a thrust area and the fastest growing sector. Software export has jumped to Rs. 28,350 crores during 2000-01, and is likely to be Rs. 40,000 crores during 2001-02, as compared to Rs. 3,700 crores during 1996-97, a cumulative growth rate of over 61% during Ninth Plan. Domestic Software Industry is likely to go up to Rs. 15,200 crores during 2001-02 from Rs. 2,600 crores during 1996-97.

Table 1B

Production Performance of Software Industry during, Eighth and Ninth Plan

	Year	Production Rs. Crores	Growth (%)	
			Annual	Cumulative
Eighth Plan	1992-93	1165	56	
	1993-94	1715	47	
	1994-95	2605	52	54
	1995-96	4240	63	
	1996-97	6300	49	
Ninth Plan	1997-98	9970	58	
	1998-99	15890	59	
	1999-2000	24350	53	53
	2000-01	37750	55	
	2001-02	52500	39	

Emerging sectors in the IT software and service industry

The Indian software industry has not only been growing exponentially but has been moving up the value chain as well. The industry has evolved from staffing to software development to integration and IT business consulting. India's success in the software arena can largely be attributed to the industry's knowledge and expertise of cutting edge technologies. Indian software companies have constantly striven to stay abreast of global technology trends by embracing technologies that are gaining pre-eminence globally. The Indian IT Enabled Services sector has emerged as a key driver of growth for the Indian IT Industry. The IT Enabled industry currently employs 70,000 people and accounts for 10.6% of the total IT software and services industry revenues.

Quality

The Indian software industry continued to get international recognition for its quality in software development. A large number of Indian software companies have acquired international quality certification. Out of top 400 companies, more than 250 have already acquired ISO 9000 certification. More importantly, 27 Indian companies have acquired SEI CMM (Software Engineering Institute Capability Maturity Model) Level 5 certification (the highest quality standard for software practices). Majority of the multi-national companies operating in the area of Information Technology have either Software Development Centre or Research Development Centre in India.

Research & Development (R&D) spending in the software industry in India increased from 2.5% of total spending in 1997-98 to over 4% during 2000-01. It is expected that in the years ahead, spending on R&D would increase to 10% of the total spending.

Software Export Destinations

Out of the total software exports of Rs 28,350 crores during 2000-01, almost 62% was to North America (USA and Canada); 24% to Europe; 4% to Japan; and 10% to Rest of the World. With the backdrop of slowdown in the US economy, Indian companies are actively expanding into newer markets, increasing their presence in Europe and setting up alliances in Asia. However, contrary to popular belief, in the last few months, many US companies have shown increased interest in the Indian software industry. Also, companies in Europe and Japan are increasing their outsourcing to India.

Offshore Software Development

The off-shore services strengthened its dominance in the software exports sector. The offshore services increased to about 44% of total exports in 2000-01 (compared to 10% in 1996-97), whereas on-site services contributed to about 56% of export revenues. This was possible due to high speed (64 Kbps, 2 Mpbs) data communication links provided to the industry by STPI and VSNL. As of 31 March 2001, there are more than 1400 leased lines from Indian software companies providing 64 Kbps and higher speed data communication links for offshore software development.

Domestic Market

Although the domestic software market has been registering a healthy growth rate, but has still not been able to catch up with the revenues of the software export markets. In fact, in the year 2000-01, the domestic software market was unable to meet the growth targets and registered revenues of Rs. 9,410 crores over its performance of Rs. 7,200 crores in 1999-2000.

In the year 2000-01 the domestic software market grew at rate of 31 percent as opposed to 45% in the year 1999-2000. However, the proliferation of internet, e-business, WAP enabled technologies and growth in the SOHO market will result in higher growth rates in the domestic market in the years ahead.

An important highlight of the year was the focus towards e-governance by state governments in India. The government is working in close association with various state governments to proliferate the software and IT Enabled services industry in their respective states.

A break-up of growth rates achieved by different sectors during Eighth and Ninth Plan is given in Table 2.

Table 2
Cumulative Growth Rates Achieved by different Sectors during Eighth and Ninth Plan

Sectors	VIII Plan (1992-97) Cumulative Growth Rate (%) Achieved	IX Plan (1997-2002) Cumulative Growth Rate (%)	
		Targetted	Anticipated
Electronics Hardware			
1. Consumer Electronics	15.6	21.2	15.0
2. Industrial Electronics	15.5	20	7.8
3. Computer Systems	21.5	46	7.8
4. Communication and Broadcast Equipment	7.1	48	10.8
5. Strategic Electronics	22.8	13	7.9
6. Components	13.6	33	10.2
Sub Total	14.8	32	11.1
Software			
1. Software for Exports	54	58	61
2. Domestic Software	22	50	37
Total Electronics & IT	19.5	39	27

Table 3
Comparison of Ninth Plan Targets and Actual/Anticipated Achievements

(Rs. Crores)

Year	IX Plan Target		Actual Production	
	Value	Growth (%)	Value	Growth (%)
1996-97	--Base Year--		26,640	19,2
1997-98	39,900	50	32,070	20.4
1998-99	53,300	34	41,140	28.3
1999-2000	72,100	35	52,450	27.5
2000-01	99,150	38	68,450	30.5
2001-02	138,350	40	86,900	27.0
Cum. Growth		39		27

Table 4
Sectorwise Plan Targets and likely Achievements for 2001-02

(Rs. Crores)

Sectors	Plan Targets	Likely Achievements	% Fulfillment
Electronics Hardware			
1. Consumer Electronics	17,000	13,000	76
2. Industrial Electronics	7700	4,500	58
3. Computer Systems	17,850	4,000	22
4. Communication and Broadcast Equipment	21,650	5,000	23
5. Strategic Electronics	2,250	1,900	84
6. Components	15,600	6,000	38
Sub Total	82,050	34,400	42
Software			
1. Software for Exports	36,500	40,000	110
2. Domestic Software	19,800	12,500	63
Total	1,38,350	86,900	63

Table 5
Production of Electronics and IT during the Ninth Five Year Plan

(Rs. Crores)

Sectors	BaseYear 1996-97	IX Plan (1997-2002)				
		1997-98	1998-99	1999-2000	2000-01	2001-02
Electronics Hardware						
1. Consumer Electronics	6500	7600	9200	11,200	11,550	13,000
2. Industrial Electronics	3100	3150	3300	3750	4000	4500
3. Computer Systems	2740	2800	2300	2500	3400	4000
4. Communication and Broadcast Equipment	3000	3250	4400	4000	4500	5000
5. Strategic Electronics	1300	900	1300	1450	1750	1900
6. Components	3700	4400	4750	5200	5500	6000
Sub Total	20,340	22,100	25,250	28,100	30,700	34,400
Software						
1. Software for Exports	3700	6500	10,940	17,150	28,350	40,000
2. Domestic Software	2600	3470	4950	7200	9400	12,500
Software Sub Total	6,300	9,470	15,890	24,350	37,750	52,500
Total	26,640	32,070	41,140	52,450	68,450	86,900

Electronics Exports

A fairly good measure of success has been achieved on export front. Electronics hardware and computer software exports jumped to Rs. 33,138 crores in 2000-01 from Rs. 6287 crores during the year 1996-97 and is likely to be Rs.48,500 crores during 2001-02, achieving a cumulative growth of over 50% during the Ninth plan period. The computer software and services exports are among the fastest growing exports in the Indian economy. Even globally, India is recognized as a major software player. Indian software exports are estimated to rise from Rs. 3,700 crores during 1996-97 to Rs. 40,000 crores during 2001-02, implying a cumulative growth of 61 per cent (see Table 6 & 7).

Table 6
Export Performance of Electronics and IT Industry

(Rs. Crores)

Plan	Year	Electronics & IT Export	Growth (%) Annual	Cumulative
Eighth Plan	1992-93	1454	28..3	
	1993-94	2128	46.4	
	1994-95	3032	42.5	41
	1995-96	4585	51.2	
	1996-97	6287	37.1	
Ninth Plan	1997-98	9500	51.1	
	1998-99	12,740	34.1	
	1999-2000	18,550	45.6	50
	2000-01	33,138	78.6	
	2001-02	48,500	46.3	

Table 7
Yearwise Exports for Electronics and IT Industry during Ninth Plan

(Rs. Crores)

	Base Year 1996-97	1997-98	1998-99	1999-2000	2000-01	2001-02	% Cumu. Growth
1. Electronics Hardware	2587	3,000	1,800	1,400	4,788	8,500	27
2. Computer Software	3700	6,500	10,940	17,150	28,350	40,000	61
Total	6287	9,500	12,740	18,550	33,138	48,500	50

Major New Initiatives taken during Ninth Plan

Media Lab Asia

The Ministry signed an Agreement with Massechussets Institute of Technology, USA on 24th June, 2001 establishing Media Lab Asia in the Mumbai, Pune corridor. The Institute will focus on developing futuristic technologies in the field of IT such as Internet and Multimedia. Based on village level field projects, Media Lab Asia would support and facilitate IT enabled technologies that are people-friendly and have mass applicability. The Project is expected to usher a new level of partnership between the Government and the corporate and non-corporate sector by bringing ICT benefits to the neediest section of our society.

Information Technology Act

The Information Technology Bill drafted by Ministry of Information Technology was passed by the Parliament and the Information Technology Act, 2000, received the assent of the President on 9th June, 2000. The Act is to provide legal recognition for transactions carried out by means of electronics data interchange and other means of electronic communication, commonly referred to as 'electronic commerce'., which involve use of alternatives to paper-based methods of communications and storage of information, to facilitate electronic filing of documents with the Government agencies and further to amend the Indian Penal Code, the Indian Evidence Act, 1872, the Banker's Book Evidence Act, 1891 and the Reserve Bank of India Act, 1934 and for matters connected therewith or incidental thereto. The mechanism of digital signature would be needed for authentication of electronic record by a subscriber by affixing his digital signature. The private key and the public key are unique to a subscriber and any person by the use of a public key of the subscriber would be able to verify the electronic record. The Act also has provision for various related issues like e-governance, security, penalties and adjudication, offences. Rules for implementing the Act have been notified and the Act came into force on 17th October 2000. The Controller of Certifying Authority has also been appointed by the Government.

Semiconductor Integrated Circuits Layout-Design Act

The Semiconductor Integrated Circuits Layout-Design Act protects Intellectual Property embedded in the integrated circuits i.e. the layout design of the integrated circuit. The Act is in line with the TRIPS Agreement to which India is a signatory.

The National Task Force on Information Technology and Software Development

One of the agenda under the Special Action Plan (SAP) of the Prime Minister is to make India a Global Information Technology Superpower and one of the largest generators and exporters of software by the year 2008. The Government constituted a National Task Force on Information Technology and Software Development in May, 1998. The Task Force submitted the reports in three parts in 1998-1999. The First Report of 108 recommendations was accepted by the Government and a Gazette Notification was issued on 25th July, 1998. These recommendations relate to telecommunication policies and procedures, cyber laws, labour laws for IT industry, fiscal incentives and financial matters, promotion of IT in schools and rural areas, increase in computer literacy and computer penetration in the country. Many

of the recommendations have already been implemented and related notifications/circulars issued. Some of the key recommendations of the First Report are:

- Opening of Internet Gateway access to private Internet Service Providers (ISPs).
- Encouraging private Software Technology Parks.
- Zero customs and excise duty on IT software.
- Income tax exemption to software and services exports.
- Encouragement to set up venture capital funds.
- Create a fund to handle Y2K problem.
- Promoting e-commerce.
- Framing cyber laws.
- Strengthening manpower base.
- Updating various databases over NICNET.
- Sharing information with users/ public.
- Earmarking 1-3 per cent of budget of every Ministry/ Department for IT applications.
- Networking all Universities and research institutions.
- Dollar Linked Stock Option to employees of Indian Software Companies.
- Sweat Equity.
- Financial package for buying computer; etc.

Part II of IT Task Force Report mainly focuses on revival of the Hardware Industry including SBIT scheme. The Part III of IT Task Force Report concentrated on Long Term IT Policies. The Government has not accepted Part II and III of the Task Force Report.

Community Information Centres

Government has taken up an ambitious project for setting up of Community Information Centres (CICs) in 486 blocks in the North-East and Sikkim as part of the PM's Agenda for the socio-economic development of the region at an estimated cost of Rs. 220 crores to provide connectivity at the block level and to be completed within 2 years. A pilot project in 30 blocks had been initiated and completed. VSATs are being used to provide Internet connectivity under the scheme. The centres will be managed with the assistance of Central Government for five years and after that State Government should take them over. Through this scheme, the Government has a goal to reach out to 95 percent of the people who are outside the digital world particularly in the application of IT in the healthcare, education, e-governance, data transmission, documentation, connectivity for management of national calamities, disaster management, etc. The States proposed to be covered include Jammu & Kashmir, Himachal Pradesh, Uttaranchal, Chattisgarh and Jharkhand, Andaman & Nicobar Islands and Lakshadweep Islands.

e-Commerce & e-Governance initiatives

A series of initiatives have been taken initiatives in e-Commerce. These include – Information & Communication technology infrastructure, Legal and Regulatory framework, Technology for e-commerce including test-beds, IPR, issues related to international domain names.

Ministry of IT has set up a Centre for E-Governance (CEG) at its premises-Electronics Niketan, New Delhi. The Centre, first of its kind in the country, would showcase several e-governance applications & solutions that have been implemented besides offering

such other services like technical consultation, proof of concept and technical presentations. Conducting programmes for creating awareness among decision makers in the Centre and State Governments and help them in defining and implementing process & policy changes are other important objectives of the Centre. The Centre would draw upon leading companies, technical institutes and business partners in India & abroad and help initiate projects to address specific needs.

Task Force on Human Resource Development in Information Technology

A Task Force on human resource development in IT was set-up to prepare long-term strategy for significantly increasing the number of well-trained IT professionals. The Task Force emphasized on critical infrastructure like computer and networking facilities, faculty, curriculum, courseware, promotion of innovations and initiatives throughout the system by an open exchange of ideas, and a system of recognition through awards and rewards.

The recommendations relate to monitoring of the capacities of institutions (both intake and out-turn) periodically with 1999-2000 as the base year. Objective shall be to double intake in IT/IT related programmes by 2001-2002 and triple it by 2003-2004 for the system as a whole with strategic use of various institutions for different purposes. A multi-pronged approach for increasing availability, improving quality and retaining quality faculty in IT is proposed. These initiatives would form the 'IT Faculty Development Initiative'.

Information Technology for Masses

The Ministry of Information Technology had set up a Working Group on Information Technology for Masses. The Working Group has submitted its report and have made a number of important recommendations. The Working Group set an ambitious target of at least 100 million Internet connections by the year 2008 and 1 million Internet enabled IT Kiosks/Cyber Cafes to be established covering the entire length and breath of the country.

The main recommendations of the Working Group are as below:-

- Establish IT infrastructure in 60,000 schools over a period of five years.
- Web enabled citizen oriented Government services
- Hundred million Internet connection and one million IT Kiosks by 2008 to enable a common man to have access to Internet/IT Services.
- No licences and controls for setting up IT infrastructure and services.
- Promote development of Indian Language content over Internet.
- To launch mass awareness campaign through IT Yatras and other program.
- To set up a IT Mission for 5 years to carry out the program recommended in the report and follow up other recommendations of the report.
- Compulsory IT literacy for Government recruitment.
- Earmarking upto 5% budget for IT induction in Government.
- State Government Portals to help rural artisans and entrepreneurs.
- Internet Portal for one point Government information and services.
- All Government information to be on Internet.
- All Government Payment on Internet.
- Results of Public examination to be made available on Internet.

Telecommunication

- Internet Service Providers (ISP) have been permitted to set up international gateways and Submarine Landing Station in the country. ISPs have also been allowed to hire bandwidth on foreign satellites. This will enable increased availability of Internet bandwidth and facilitate Internet expansion in the country.
- National Long Distance and ISD Telecommunication Service have been opened up
- Wiring the country by Fibre Optic Cable
- VSNL monopoly to end in March 2002.

Institutional Initiatives

Software Technology Parks of India was established by MIT to provide state-of-the-art reliable data communication infrastructure and industry friendly Single Window approach.The export revenue of the STP units is showing consistent growth of more than 100% every year. The STP units have exported Rs.20,051 crores worth of software during the year 2000-2001 which is more than 70% of the national export. There are more than 6,500 units registered with STPI out of which 826 units were registered during the year 2000-2001.

A project on National Resource Centre for online learning at National Centre for Software Technology (NCST) Mumbai, has been initiated. This Centre will enable to develop a vision and supporting infrastructure for academic and non-formal institutions to understand the opportunity, issues and technology trends relating to "Online Learning" and thus contribute to the emergence of India as IT super power.

Number of initiatives have been taken under the TDIL (Technology Development for Indian Languages) programme of the MIT. To promote information processing in Indian languages a project has been taken up at 13 Educational and R&D Institutions spread across the country.

National Informatics Centres provides computer support to Central Government Departments, State Government Departments, District Administrations (540 districts) and new districts being created by the State Governments. NIC has set up a satellite based computer communication network for providing EMAIL, INTERNET, File Transfer, access to National and International data-bases (including Bio Medical, Land records, etc), Electronic Data Interchange (EDI), Videoconferencing facility etc. NIC has set up a local area networks in Central Government Departments and State Government Secretaries. NIC has computerised Supreme Court, 18 High Courts and 430 lower Courts in the country to streamline functioning and providing transparency to the litigants and legal databases.

Advisory Committee in IT sector

An Advisory Committee comprising of well known IT professionals from the industry was set up on 17th January, 2000 under the Chairmanship of Minister(IT) for Ministry of Information Technology. The Advisory Committee would assist Ministry of Information Technology to identify thrust/emerging technology areas and will suggest measures/policies/actions for making Indian IT industry a Global Superpower.

A Select Group comprising of successful and well known IT professionals based at Silicon Valley was formed under the Chairmanship of Minister(IT). The Group will interact through internet, email, video conferencing and may meet once in a year and advise the Government on various issues relating to development of IT, telecommunication infrastructure and software export from the country.

Financial Sector Reforms

- Some financial sector reforms in IT in the last 2 years have been as follows:- Limit on issue of ADR/GDR through automatic route without reference to DEA by stock swap has now been raised from US$50Mn to US$100Mn or up to 10 times export earnings by the company in the previous year (notification of DEA dt. 23.3.2000) Indian employees of an Indian subsidiary abroad are allowed to be issued stock options of this company incorporated abroad. The stock options issued to employees were earlier taxed twice – once at the time of issue and secondly during exercise of capital gains. Now they would be taxed only once which is at the time of exercise of capital gains.

- There would be single point registration of venture capital funds (VCF)/venture capital companies (VCC) with the SEBI. The provision of dual registration with DEA has been removed. 100% FDI is now permitted through the automatic route for IT and E-Commerce In case of E-Commerce, there is however a need of divestment to the extent of 26% in a period of 5 years from the 100% level

- Basic Customs duty reduced from 20% to 15% on computers, motherboards, floppy diskettes, memory storage devices and integrated circuits. Complete exemption from customs duty on microprocessors, CD ROMs etc. Specified varieties of capital goods to be charged to basic customs duty of 5%. Basic customs duty on raw materials for fiber optic cables reduced to 5%.Cell phone imports to be charged to basic customs duty of 5% as against present basic customs duty of 25%. Specified telecom equipment imports by Internet Service Providers (ISPs) will also be chargeable to basic customs duty of 5%, as currently applicable to imports by telecom operators.

Chapter 2: Tenth Five Year Plan for Electronics and Information Technology – A Perspective

Vision driving the IT sector

"IT is one area where, India can quickly establish global dominance. India can be fully competitive in this area with tremendous pay-offs in terms of wealth creation and generation of high quality employment"– Hon'ble Prime Minister, 1998.

The advancement in information technology has a profound impact in country's economy, thus the quality of human life. The convergence of computer, communications and content creates tremendous opportunities as well as challenges. The IT revolution will be of much greater significance than the Industrial Revolution of 17th century. This revolution has opened up new possibilities of economic and social transformations from which both developed and developing countries can potentially benefit.

The IT software and services industry in India accounts for almost 2% of India's GDP. It is expected that the Indian software industry will account for 7.7% of India's GDP by 2008. Indian IT software and services exports accounted for 14% of India's total exports of US$ 44 billion during 2000-01. It is expected that by the year 2008, Indian IT software and services exports will account for 35% of India's total exports.

India's vibrant IT software and services industry, represents around 2% of the overall global software market. The Government and software industry however have set an ambitious goal for the software sector amounting to around $50 billion of software exports by 2008. This implies a share of 6% of the relevant global market. Despite the existing economic downturn in the US economy, which is the largest market for Indian software vendors, the projections made by Indian industry are not being revised.

The consistent growth in export of software can be largely attributed to the comparative cost advantage to the developed world in outsourcing from India. Indian software companies have a unique distinction of providing efficient software solution with cost and quality as an advantage by using state-of-the-art technologies.

India's success in the software arena can largely be attributed to the industry's knowledge and expertise of cutting edge technologies. Indian software companies have constantly striven to stay abreast of global technology trends by embracing technologies that are gaining pre-eminence globally.

India's rise to fame in the international software and services marketplace is commendable. Through an orientation and adherence to high quality processes, a vast English speaking manpower base, expertise on state-of-the-art hardware and software platforms, and cost competitiveness, the software industry has established itself in the global segment.

India's expertise in emerging technologies actually helped the country to get new customers and the slowdown in the US economy did not show any major adverse impact on the Indian software industry. On the contrary, it is expected to provide large opportunity which would help India get more customers and expand its base; in the last few months, many US companies have shown increased interest in the Indian software industry. Also, companies in Europe and Japan are increasing their outsourcing to India. In addition, the

technology companies like Intel, Hewlett Packard, etc., have also announced an increase in IT investment in India. Opportunities in e-commerce software solutions are emerging as a major area of growth for the Indian IT software and services industry.

IT Enabled Services or "Remote Processing" has emerged as the next major driver of technology led services industry. This covers a wide gamut of services including Customer Interaction Services, Help Desks, Medical Transcription/Translation Localisation Services, Data Digitisation, Legal Databases, Data Processing, Back Office Operations, Digital content development, Animation, Remote Network Management, Specialised Knowledge Services, etc.

Domestic consumption of IT has also been steadily rising. Since the rapid emergence of minicomputers and microcomputers in the late 70s and the domination of PCs and PC LANs in late eighties, the Indian market has kept pace with technological developments. Uses for IT spread to various sectors with applications such as Passenger Reservation Systems (PRS) of Railways publicly demonstrated the benefits of computerization to the common man. However, the penetration of computers, appliances or internet connections are still too low even by the yardstick of many newly industrialized countries such as China, Malaysia, Singapore, Korea etc. The fall out of such a poor penetration is that IT is still largely confined to the urban areas and the market size is still too small for software producers. Applications as well as content are still not mature and innovative enough to make the utility of computer impressive to the common man. Besides, volumes also drive prices down in a dramatic way in this industry. Thus anything short of mass marketing commensurate to the Indian size of population would be a double handicap.

Government push to software

The Government of India has accorded "thrust area" status to the software sector. The Government has amended the Copyright Law to make it one of the toughest in the world; eliminated import duty on computer software; exempted profits derived from software exports from Income-Tax etc. Recent initiatives on rationalizing ESOPs, improving the Venture Capital environment, allowing 100 percent FDIs, etc. have given a further boost to the software market. The Government of India has also set up innovative schemes for strengthening infrastructure like Software Technology Parks, etc., for promoting software exports.

Convergence

As a result of the technology drivers of microelectronics, digitalization and software, technologies of computers (hardware and software), telecommunications, broadcasting (including entertainment) and allied appliances such as telephones, personal digital assistants and a host of household gadgets have been converging rapidly. The result is that at the infrastructure, services and industry level there has been a tremendous up-surge in relatively new products and consolidation in the underlying industries through acquisitions and mergers. Consequent shift has been from monopoly Govt. service provider to private entry into telecom, competition and a neutral regulatory agency. The essence of the convergence spirit and the vitality of the changes have led to rapidly lowering tariff, plentiful availability of bandwidth at increasingly lower per bit transport cost, competition and growth in technology, especially fiber optics and wireless technologies. Internet is clearly surging ahead laying another major milestone that promises to re-write global and national

economies. India has been seized of the issue during the last decade, successfully promoting reforms in all the constituents of the ICE sector. For instance, in the broadcasting arena, cable TV has grown rapidly offering a host of satellite channels. Besides, cable TV industry has demonstrated the relevance of de-regulated market place for rapid growth and entrepreneurship. It can only be compared with the success of STD/ISD PCOs that have emerged in every corner of the urban and rural landscape offering a high level of accessibility where the penetration levels are still low.

Taking into account the increasing convergence between telecommunication and information technology, a Communications Bill has been drafted by the Government in conjunction with the finance ministry, the ministry of information technology, the ministry of information and broadcasting and the communications ministry. The Convergence Bill is expected to become an Act in the winter session of Parliament in 2001. It proposes the creation of a regulatory body called the CCI (Communications Commission of India) which will take on the role hitherto performed by the TRAI. This commission will undertake the following:

- regulate various communication services including telecommunication, broadcasting and other electronic communications
- facilitate their development in an environment of convergence in order to unleash the power of new technologies.

Strengths and Weaknesses

India has today the advantages of skilled manpower base envied by a number of nations, strong government-industry-academia user-collaborative relationship for high level R&D, active and healthy competition among states in attracting investment in infrastructure as well as framing IT applications in areas such as e-governance, e learning, e-commerce and promoting entrepreneurship etc., growing software exports and a large potential domestic market.

Against the above, India has a rapidly growing yet inadequate infrastructure base, still inconclusive structural reforms in telecom to match the band width demand, a hardware industry yet to come to terms with lack of global production skills, standards, technologies, inability to attract foreign investment and consequent erosion of competitiveness in price and quality for domestic and export markets and poor penetration beyond urban areas in terms of IT appliances, infrastructure and services.

Infrastructure, especially telecom, is another major area where future of IT industry would significantly depend on. National backbone, international bandwidth, local access, cost of all these and competitive provision of services have all to develop fully in series of evolutionary steps being undertaken the telecom area. Data is increasingly becoming the dominating component in the telecom infrastructure all over the world. While this issue has been addressed for software exports through Software Technology Parks and VSNL thus demonstrating great success in the fortune of software export industry during the 90s – the prices, quality and availability of infrastructure is still not competitive for the main-stream Indian user.

Electronics & IT Hardware

India is a signatory to the Information Technology Agreement and is committed to ensure penetration of Information Technology at all levels in the society and has also agreed to gradually reduce tariff for Information Technology products to zero by the year 2003. Being part of the WTO also requires a gradual reduction in the overall duty regime, especially the peak rate of duty. Physical controls for import have by and large been dispensed with. Thus, India is slowly but surely integrating with the global marketplace as a consumer of electronics and IT products under a free trade regime. Globalization of manufacturing, however, has not happened in as deliberate a manner as in the case of globalization of consumption. This has largely been due to a domestic-centric approach of the Indian manufacturing sector coupled with a protected environment. Infra-structural handicaps, high cost of finance, rigid labor laws, low volumes of production, low velocity of business etc. high tariffs and invented tariff structure, non-availability of indigenous capital goods, lack of new investments, are some of the known weaknesses of the Indian Manufacturing Sector.

Thrust Areas in Tenth Plan Period

India does have enormous opportunities emerging from globalization and consequent lowering of tariff barriers. These need to be consolidated through brand equity, marketing contacts, upgrading of manpower skill base, moving up the value chain, better infrastructure and economies of scale through larger domestic market base, R&D especially on e-Security aspects and strengthening of hardware sector. There is urgent need to strengthen IT infrastructure both for software exports and citizen centric interface. Distance learning is the need of the hour to spread education and regular upgradation of skills. This will need interconnecting all schools and colleges in the country (60,000 approx.) through a network with initial support from the Government. This will promote IT among masses and minimize digital divide.

1. **Software and Services export**

   This is an important area given the comparative advantages, demonstrated performance, brand equity developed and expanding opportunities in the global market. Both government and industry are fully seized of the issue. The major issues needs to be addressed are - continuation of market development and brand equity, datacom infrastructure support, ready availability of capital and increasingly competitive financial packages comparable to those available in advanced countries, venture capital and entrepreneurship development fund, enlargement of the pool of manpower with adequate level of quality education and constant skill up-gradation.

2. **Domestic Software Promotion**

   - To promote e-governance in both Central and State Governments and take steps towards transparent and efficient administration.
   - To promote e-commerce towards realizing its potential for enhancing export of other conventional products and also take adequate steps for safe and secure transactions.
   - To promote setting up of call centres, medical transcription centres, content creation centres with a view to realize export as well as create employment avenues.

3. Boot-strapping Indian IT industry to higher levels

Indian IT industry has come of age. It has cleared the first major step of establishing itself as a serious player in the global market place especially in the software and service segments. It is appropriate that the next logical steps are also taken. These include promotion of entrepreneurship and associated venture capital availability of a variety of fiscal incentives to software industry to move up in the global IT markets through acquisitions, product development, marketing etc. At the other end, comparatively lower skills demanding but high employment oriented IT Enabled Services have also to be addressed.

3. IT for Masses - thrust areas

- Promotion of Internet accessibility
- Content creation: - in local languages, with multimedia techniques
- Content creation and TeleMedicine application for Community Information Centres
- IT applications for various disabilities.
- Mass IT campaigns /Public Awareness Programs with IT application
- Empowerment of the Masses with special thrust for women and children
- Rural Healthcare System
- Technology development with Multimedia, Digital Library etc. for preserving cultural heritage and social identity.

4. Indian languages interfaces to computers

India is in an advantageous position when it comes to boasting of one of the largest English speaking population in the world. Yet it has the challenge of handling a diversity of languages when it comes to usage of computers and their applications within the country. Suitable software have to be developed to enable the people to interact and use computers in local Indian languages.

5. IT Security

As India moves towards a vibrant information society with complex infrastructures, appliances, applications and consequent transport, processing and storage of data and information of vital relevance to organizations and individuals, care and attention to protection of resources both from hostile threats within the nation and outside assumes tremendous significance. Indian corporate, Govt. agencies etc. have to be trained in IT security and specialized institutions have to be developed to address this issue. Also research has to be undertaken in the area of cryptography etc.

6. Human Resource Development

- To develop trained manpower in adequate numbers for IT needs at various levels to act as human resource pool which has expertise in both English and IT related tools and software to meet the requirements of export and domestic markets.
- To promote distance education and online learning for spreading education and also evolve models for acquiring leadership position in this field.

- To educate masses, initiate various elementary levels IT courses towards reducing digital divide.

7. Infrastructure

- **Create world class telecom infrastructure:** While overall telecom infrastructure has improved, there is still an urgent need to provide reliable communications infrastructure in India at globally competitive rates. Affordable and on-demand connectivity with 100 percent uptime and reliability is required.
- **Provide inter-connectivity of International Call Centers/IT-enabled Services:** There is a strong need to permit inter-connectivity between call centers or other units of IT Enabled Services.
- **Allow PSTN Connectivity:** To promote tele-networking, the Government of India should allow Internet leased circuits to be connected to PSTN at the Indian end, so that tele-working in its true form can take place.
- **Create ITES Habitat Parks:** "IT-enabled Services Habitat Parks" in various parts of the country will give a boost to this industry. These parks would offer a state-of-the-art infrastructure facilities such as office space, communications, single window approvals, incubation, consultancy, venture capital etc.To create new technology parks and also strengthen existing technology park infrastructures for promoting IT exports.
- Strengthen test and quality infrastructure towards promoting export and establishing brand image.

8. Research and Development (R&D)

- To promote strategically relevant R&D for developing high value added products and services though both sponsored programs and also by setting up world class R&D centres. Government has to take a lead role through long term investments as well as to encourage leading companies world over to set up their R&D centres in India.
- To take initiatives for developing products and services for handicapped.
- To promote knowledge-based industries and also develop efficient production technologies for cost reduction.
- Technology development in emerging areas such as bio-informatics & nano-technology, etc., as well as continuous up-gradation of technologies.
- Continuous up-gradation of technology and manufacturing process is essential for surviving in a global manufacturing environment.

9. Vidya Vahini Programme

Networking and Internet are being used as cost effective tools for improving learning opportunities for students, supporting professional development, increasing productivity of members of the learning community and improving the efficiency of schools.

Today there are more than 9 lakhs schools and over 1200 higher learning institutions in the category of Universities, Engineering Colleges and Medical Colleges in the country. These institutions caters to more than 25 crores students and one crore teachers. Most of these educational institutions are still resource deprived and majority of the students and teachers have little or no access to the networking tools of the information age.

It is proposed to carry the benefits of IT technology to students in their formative years. It is proposed to connect every school and educational institution in the country during tenth plan through a network called "Vidya Vahini". A two-phase programme is proposed. In phase-I (first 2 years), 60,000 school and 1200 higher learning institutes are proposed to be connected with an integrated voice, data, and video network.

10. Establishment of E-Infrastructure upto the Block Level

To improve administrative efficiency of internal government systems and procedures and facilitate effective implementation and monitoring of development programmes launched by the central/ state governments in the country, it is proposed to establish/ strengthen E-Infrastructure upto Block level. This infrastructure will also facilitate association of private sector with the government in delivery of citizen oriented government services on a revenue sharing basis.

The E-Infrastructure to be established will include:

- Strengthening the existing E-Infrastructure in central government of around 9,000 networked PCs by another 6,000 PCs to take IT-Infrastructure upto level of every Section in central government secretariat with NICNET/ Internet connectivity on each PCs.
- Strengthening the existing E-Infrastructure in state government secretariats with additional 100 PCs along with networking infrastructure
- A network of 10 PCs at district headquarter along with networking infrastructure. Every district will have a 2 Mbps network connectivity to State secretariat.
- Each one of the 6000 Blocks to have a network of 10 PCs with associated networking infrastructure.

11. Media Lab Asia

Media Lab Asia is a realisation of a vision developed as a result of meeting of the minds of the world renowned Massachusetts Institute of Technology (MIT) Media Lab, Cambridge, USA and Ministry of Information Technology, Government of India. The Media Lab Asia has been incorporated as a non-profit organization under section 25 of the Companies Law.

Media Lab Asia is proposed to be a network of national as well as overseas people, projects, and laboratories dedicated to bringing the benefits of the most advanced information technologies to the neediest people. The role of the Media Lab Asia is to facilitate the invention, refinement, and deployment of innovations that benefit the masses. The Media Lab Asia would work with industry, NGOs, government, and most importantly ordinary people, to bring these innovations to every village in India. The key to success for the Media Lab Asia would be combining the creativity of Indian entrepreneurship with the technical know-how of seats of learning to grow sustainable, culturally appropriate solutions. Particular challenges include the need to operate in many different languages and the need to support product innovation using local culture and tradition.

The Media Lab Asia would be based around village-level field projects, supported by research for technology development and partnership; the goal over the lifetime of the project is to have a sustainable presence in a majority of India's villages.

Projects in rural villages would be supported by clusters of researchers. These clusters are not designed around bricks and mortar, indeed, no new construction is anticipated. These activities are about a community of researchers working with rural villages and urban slum areas, and helping partner organizations deploy sustainable services such as healthcare, public health monitoring, one-room computer schoolhouses, public and postal services, micro-banking, handicraft trading, informal sector manufacturing, and public entertainment and communications.

12. Electronics Hardware

If Indian manufacturing companies have to compete globally, we need to have a clear and comprehensive national policy for hardware manufacturing industry. Such a policy should also aim at simplifying regulatory procedures and offer a hassle free environment for manufacturing as offered in competing countries. **The basic philosophy to induce manufacturing of electronics and IT products in India should be to provide world-class environment.** In order to attract investors and customers to India, planners should address some of their perceptions and concern.

- A national hardware manufacturing policy as in the case of software identifying thrust areas.
- To take policy measures for attracting FDI investments in Hardware sector and also take other initiatives, including institutional, fiscal and marketing arrangements to promote globally viable production and export.
- Considering the WTO commitments of nil duty for finished goods by 2003, customs duty on sub assembly and components also to be abolished in order to, create a level playing field. Similarly, domestic excise duty on components and finished goods to be rationalized.
- Manufacturing at the level of SKD/CKD to be encouraged.
- A single window clearance mechanism has to be implemented to provide Central and State level regulatory clearance with in a reasonable period of 15 days.
- Power, water and telephone connections to manufacturing units shall be available on demand.
- Import, export, excise, Sales tax formalities to be simplified to be operated on a self certified basis subject to random audit by regulating agencies.
- There is an urgent need to reform labour laws to enable "Exit" policy.
- Procedures at seaports and airports to be simplified and provide world-class, road infrastructure to major industrial areas.
- Value Added Tax (VAT) should be introduced at the earliest.
- R&D on low cost PC : There should be a strong focus on R&D. PC should be made affordable by cost reduction through duties, bulk purchase of components etc.

Chapter 3: Computer Software and IT Services

1. Introduction

Background

The IT software and services market is the pivot of a trillion-dollar information technology industry, an indispensable component of commerce and government worldwide. It is software applications that led to the proliferation of computers, resulted in e-commerce and catalyzed the use of mobile telephony. Software applications have become indispensable to governance and the operations of large corporations.

Pervasive computing and Application Service Provision (ASP) are two internal trends, which will make indelible marks on the software industry over the next five years. These would bring substantial change in the industry's structure over a period of time.

The rise of the wireless Internet and pervasive computing will cause major changes in the computing landscape. This is expected to be more far-reaching than the client-server revolution. Applications will be built from cooperating services, communicating over the Net, to deliver on the pervasive computing promise: any service to any device over any network.

The influence of the IT software and services industry is today felt in every facet of global life. The evolving software industry is in fact one of the key drivers of the global economy. According to global research and analysis major, International Data Corporation, while the global hardware market is growing at around 9% annually, the software products and services segments are growing at 14 % annually.

India's vibrant IT software and services industry, represents around 2% of the overall global software market. The Government and software industry have set an ambitious goal for the software sector amounting to around USD 50 billion of software exports by 2008. This implies a share of 6% of the relevant global market. This would be 35% of our total export.

The IT Software and Services Market

Global Scenario

The global IT software industry has witnessed a few upheavals like a sky rocketing growth followed by a slight slowdown. According to analysts the recessive trends in the US market would not have a significant impact on the IT software and services industry in India.

Global IT Market by Region

	USA	Western Europe	Asia Pacific	Others
■Series1	46%	29%	17%	8%
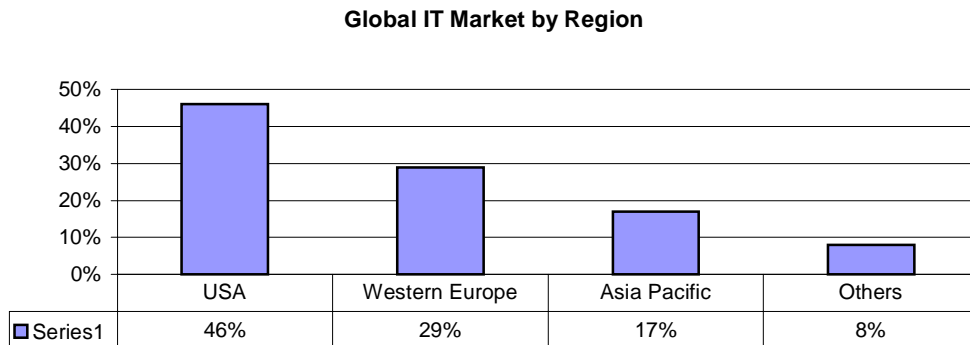
Base: Global IT Market of $ 976 B, Year 2000

Chart 1

According to International Data Corporation, USA, a leading business intelligence and research organization, the US market will lead in terms of IT spending, accounting for USD 634 billion by 2004. Western Europe is expected to account for IT spending of USD 424 billion by 2004 (*see Chart-1*), up from USD 253 billion in 1999. Finally, the third largest region—Asia Pacific—will account for IT spending worth USD 240 billion. IT spending will grow from USD 152 billion in 1999 and USD 199 billion in 2002.

Analyzing the trends during year 2000, IDC states that of the global IT market of USD 976 billion, the US market accounted for 46 % of the revenues. While Western European countries contributed around 29 % to overall totals, the Asia Pacific region accounted for 17 % of the total global IT market (*see Chart-2*).

USA	1999	2004
$ B	405	634
Packaged Software	18.5%	24.4%
IT Services	39.6%	42.3%

Western Europe	1999	2004
$ B	253	424
Packaged Software	19.2%	23.1%
IT Services	41.9%	43.3%

Asia Pacific	1999	2002	2004
$ B	152	199	240
Packaged Software	12.3%	13.1%	14.0%
IT Services	35.9%	34.3%	34.1%

Spending on IT Services

Spending is hardware dominated with services component coming down

Chart 2

The Asia Pacific Region

A study undertaken by Gartner Inc. indicates that the Asia Pacific region will show continued growth, although some countries are still in the developing stage, a general opening of economies and deregulation is occurring. Governments remain, however, not only significant buyers of IT products and services, they are often still going beyond setting policy environments to being major participants in leading some IT related investment projects.

The Asia Pacific market is characterized by strong demand growth, strong economies, IT services orientation, significant Government spending on IT and continuing multinational vendor investments.

- Chart-3 indicates that as of March 2001, the market in China for IT services touched USD 3,426 million, while the software market accounted for USD 4,212 million of revenues.

Asia/Pacific IT Market Size and Growth

	e USD m	are CAGR	S $ m	CAGR	US $ m	CAGR	US $ m	CAGR	al m	AGR
Australia	7906	4.9	8599	21.5	3273	20.5	17233	1.4	**37011**	**8.6**
China	16953	17.8	3426	32.6	4212	32.1	86605	19.1	**111196**	**19.9**
Hong Kong	1612	3.4	1290	14.6	735	16.3	7473	1.2	**11110**	**4.0**
India	2223	6.0	5920	56.3	992	22.5	13959	25.	**23094**	**31.6**
Indonesia	609	19.2	146	38.6	276	50.4	5472	19.2	**6503**	**20.7**
Japan	47150	7.9	51427	10.0	25589	17.7	156346	19.2	**6503**	**20.7**

Korea	5120	11.3	2960	19.4	2039	27.7	25020	6.8	35139	9.9
Malaysia	1207	9.8	701	21.4	370	27.7	6749	10.8	9027	12.3
New Zealand	1402	4.8	654	8.3	392	20.4	2203	15.6	4651	11.7
Singapore	1829	9.7	1891	28.7	706	24.5	3986	4.9	8412	13.6
Taiwan	3239	4.1	1511	13.7	1227	19.8	12813	13.8	18790	12.5
Thailand	883	11.9	414	17.1	312	31.9	5206	10.5	6815	12.3
N. America	184207	5.8	224163	14.0	88108	18.1	438093	6.2	934571	9.1

As of March 2001

- Australia's services market notched up revenues of USD 8,599 million, while the software sector accounted for a turnover of USD 3,273 million.
- Japan showed services revenues of USD 51,427 million and a software revenue of USD 25,589 million

According to IDC survey 1999-2000, the Indian IT services market is split into the following services.
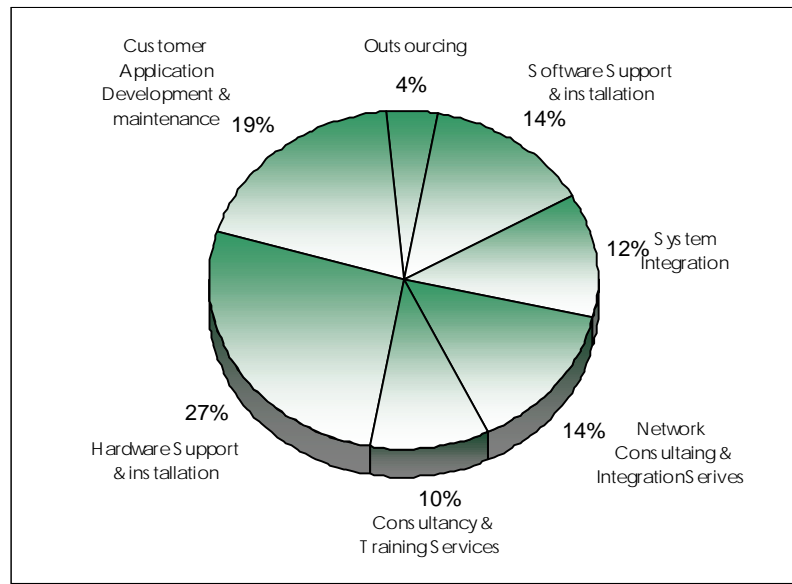

Chart 3

2. Status and review of Ninth Plan

Indian software and services industry

The country has come a long way since the mid-80s in its quest to become a software power of consequence. According to analysts India's software industry—thanks to its widespread experience with global customers, vast skill sets, high quality orientation and manpower expertise—has the necessary strengths to become a global superpower within this sector.

Already a good number of key global *Fortune 500* customers are banking on Indian software companies for their outsourced software solution and services requirements. The country's software majors are gradually moving up the software value chain, from staffing to software development to integration and IT business consulting. There is also a marked shift in focus from onsite services to the more lucrative offshore development model.

The software and services industry is in fact spearheading India's assault on the global markets. Not only this sector is driving the overall IT segment, it currently accounts for almost 2% of India's GDP. This

figure is expected to go up to around 7.7 % by 2008, according to a NASSCOM-McKinsey Study. The study also indicates that the export led industry will achieve revenue targets of around USD 50 billion from the overseas markets

This confidence rests in large part on the phenomenal performance achieved by the sector over the past few years. In fact for the past decade, the Indian software industry has been growing at a consistently high rate of over 50 % annually.

The dramatic growth of the software and services industry is encapsulated in the chart below:

Figures in Rs. Crore

Year	Domestic Software Market	Software Export	Total IT Software and Services Industry
1990-91	225	250	475
1991-92	320	430	750
1992-93	490	675	1165
1993-94	695	1020	1715
1994-95	1070	1535	2605
1995-96	1670	2520	4190
1996-97	2410	3900	6310
1997-98	3510	6530	10040
1998-99	4950	10940	15890
1999-2000	7200	17150	24350
2000-01	9410	28350	37760

During the IX Plan period from 1997-2000, the software industry grew at a CAGR of 52%. The industry upped its revenues from Rs. 6310 Crores in 1996-97 to Rs. 37,760 crores in 2001-01. This figure is expected to touch Rs. 52,500 Crores in 2001-02.
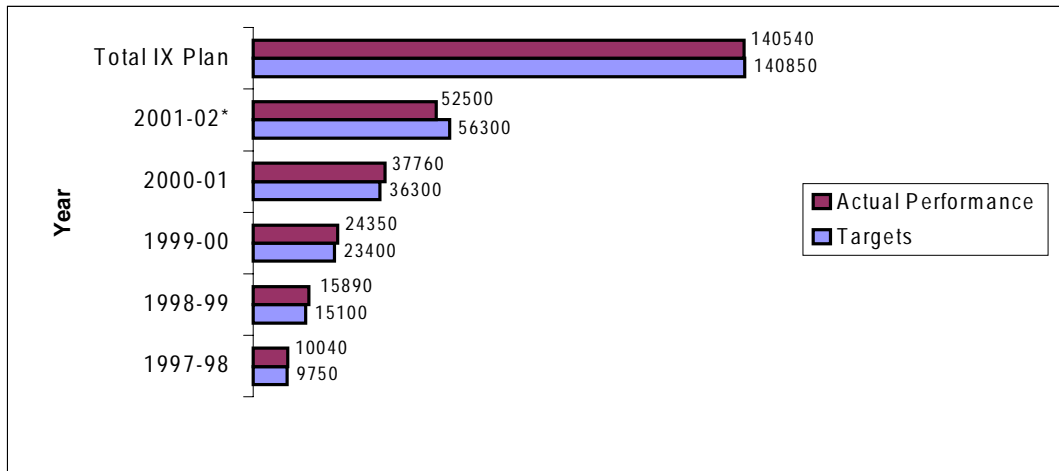
Indian Software & Service Industry – Performance

The above chart indicates that as against the total software industry performance of Rs.1,40,850 Crores during the NINTH FYP, the industry aggregated export revenues of Rs.1,40,540 Crores nearly achieving the project targets.

Maintaining Momentum

During 2000-01 the industry maintained its momentum and notched up revenues of Rs. 37,760 Crore, up from Rs. 24,350 Crores in 1999-2000. While software exports took the lead with a contribution of Rs. 28,350 crores to the overall software and services kitty, domestic market sales remained at Rs. 9,410 Crores .

Some of the developments in the software and services market during 2000-01 are highlighted below. These are pointers to the pre-eminence the sector has achieved over the past few years, particularly in the international markets.

- Software exports during 2000-01 experienced a growth of 65 % in rupee terms and 55 % in dollar terms.
- During 2000-01 around 30 software companies exported more than Rs. 200 crores worth of IT software and services.
- Sectors such as e-commerce and IT enabled service emerged as sunrise markets for the software industry. The IT Enabled Services industry employed 70,000 personnel and accounted for 10.6 % of the total IT software and services revenues.
- IT software and services has emerged at the forefront of the national agenda. More than 19 State Governments in India have implemented IT policies.
- The software sector created over 4,10,000 direct jobs in the last ten years. The IT industry potential is to provide more than 2.2 million jobs by 2008.

Domestic IT software and services industry

During the Ninth Plan period from 1997-2000, the domestic software market has grown at a CAGR of 39%, from Rs.2410 Crores in 1996-97 to Rs.9,410 Crores in 2000-01 and is expected to achieve Rs.12,500 Crores in 2001-02 against the target of Rs.19,800 Crores .
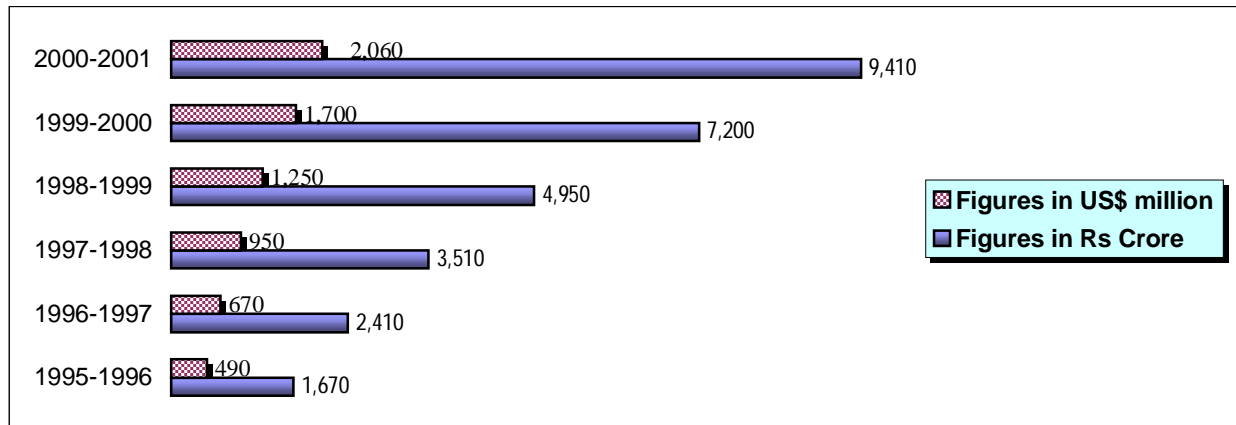
Domestic Software & Service Industry
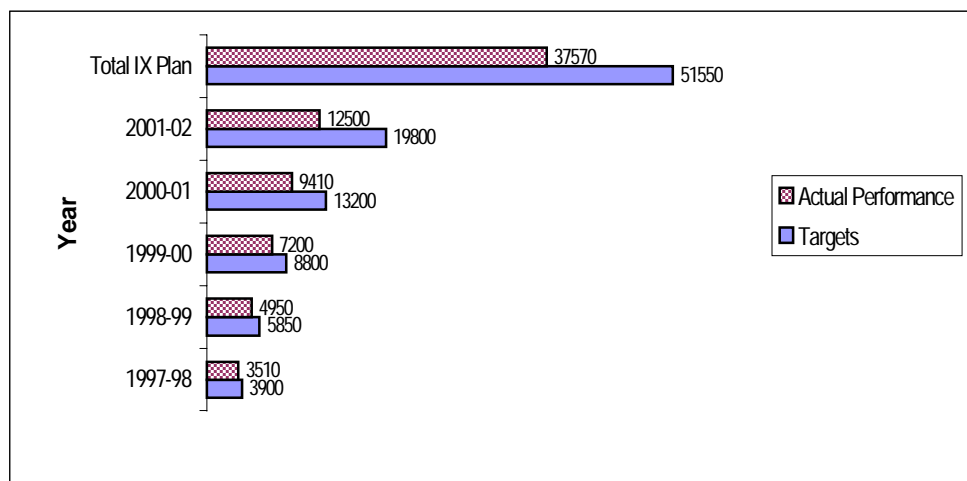
Therefore, as against the total domestic software market performance of Rs.51,550 Crores during the IX FYP, the domestic software market aggregated revenues of only Rs.37,570 Crore, a shortfall of almost Rs.14,000 Crore, from the targets.

The Indian domestic market has recorded a smaller base and lower growth rate as compared to the export segment. The slower performance of the software industry in the domestic market has slackened the pace of the sector on a year basis.

The domestic market has grown significantly since 1993 and gradually, the industry has shown an upward trend in growth. The year 1999-2000 was a boom year for the domestic software market, with revenues aggregating to Rs.7,200 Crores or USD 1.7 billion, over a performance of Rs. 4,950 Crores or US $ 1.25 billion in 1998-99. For the first time the domestic software sector kept pace with the export market, maintaining a heady growth of 45 % during that period. The domestic software market showed a CAGR of 46.8% during 1999-00, which has been steadily improving in the last few years.

Domestic IT Software and Services Market – Year-wise

A strong domestic sector is always an asset. It fuels growth for industries in the global markets, helps them compete effectively, supports rapid accumulation of skills, affords better ongoing information and offers an insight into product and process needs. It stimulates companies to upgrade and broaden advantages and the goals of various stakeholders having very large population base support intense commitment and sustained investment.

India, being a large country, has a domestic market with a vast potential. This potential has to be tapped in order for the software industry to maintain its momentum and achieve the targets set that is USD 18 billion to be generated by the domestic market by 2008.

The Indian Government and industry have to look for ways and means of building up the home base and spurring growth in the domestic software market during the X FYP period (2002-07) and beyond. In order to understand the prevailing status of the Indian domestic software and services market, its strengths and weaknesses, it is important to study some of the highlights of this market during 2000-01.

Highlights of domestic software market

- The domestic software market fell short of its growth targets for 2000-01 which were pegged at Rs.11,000 Crore, achieving instead a revenue of Rs.9,410 Crores . This represented a modest growth of 31 % over the previous year's revenues of Rs.7,300 Crores .

- Computerization and e-governance initiatives by Central and State Governments alongside automation by the banking sector played a part in pushing the domestic software market.

- The desktop PC market crossed the 1.88 million units mark registering a growth of 34 % over the previous year. After a slow take off in the first half of the year, PC sales picked up in the second half, exceeding industry expectations. Internet penetration in the country touched about three million subscribers by March 31, 2001. The number of users who have access to Internet in India is stated to be around 5.7 million. The proliferation of PCs and the Internet has further helped to push the domestic software segment.

The software industry's strengths in the domestic market

The Indian software sector with its following strength is well geared up to fulfill the requirements of the domestic market.

- Vast, untapped domestic market comprised of Government departments, PSUs, Banking & Insurance, Railways, Postal Operations, GIS (Geographical Information Systems), Large Corporate and SOHO segments, which needs to be tapped.

- Unlike the export market, the application packages segment is a very strong contender in the domestic sector. The demand for application packages far exceeds the demand for software services. This demand can be further built up, provided piracy levels are brought down.

- Focus on the quality by local software companies is also hiking the demand for these solutions by end users.

**Reasons for deviation from IX FYP targets**

The inability of the domestic software market to live up to expectations has resulted in a shortfall of Rs.310 Crores from the software industry projections in the IX FYP. While the software export sector has exceeded expectations by 15 %, the domestic software market has witnessed a significant revenue shortfall of a Rs. 14,000 Crores .
The sluggish growth of the domestic market is attributed to the following factors:

- Low PC and Internet penetration in the country
- Inadequate availability of software in local languages
- Low absorption and slow pace of IT utilization in the Government sector
- Low computer literacy rate
- Inadequate telecom infrastructure

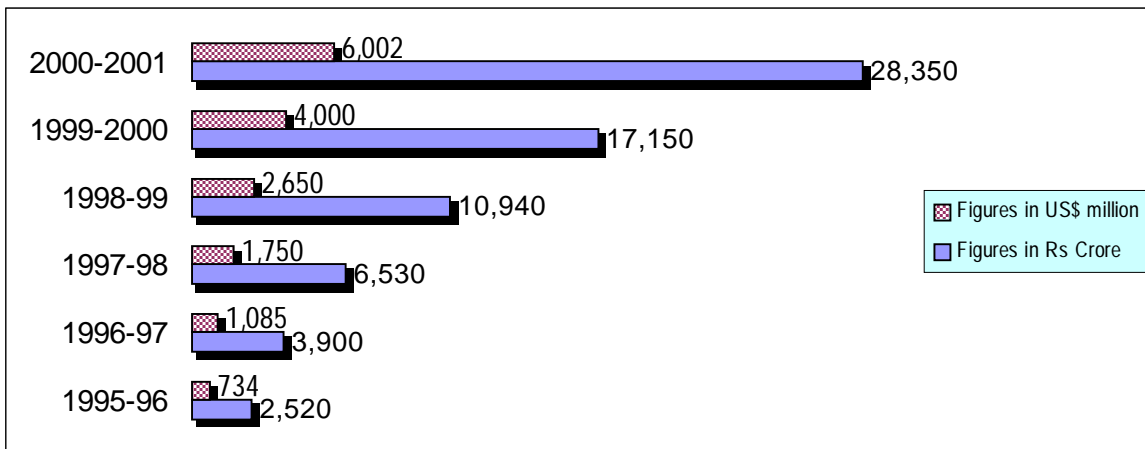**Software and services export market**

During the IX FYP period from 1997-2000, the software export industry has grown at a CAGR of 57%. Software exports jumped from Rs.3,900 Crores in 1996-97 to a hefty Rs.28,350 Crores in 2000-01. The statistics for 2001-02 have been pegged at Rs.40,000 Crores as against a target of Rs.36,500 Crores .
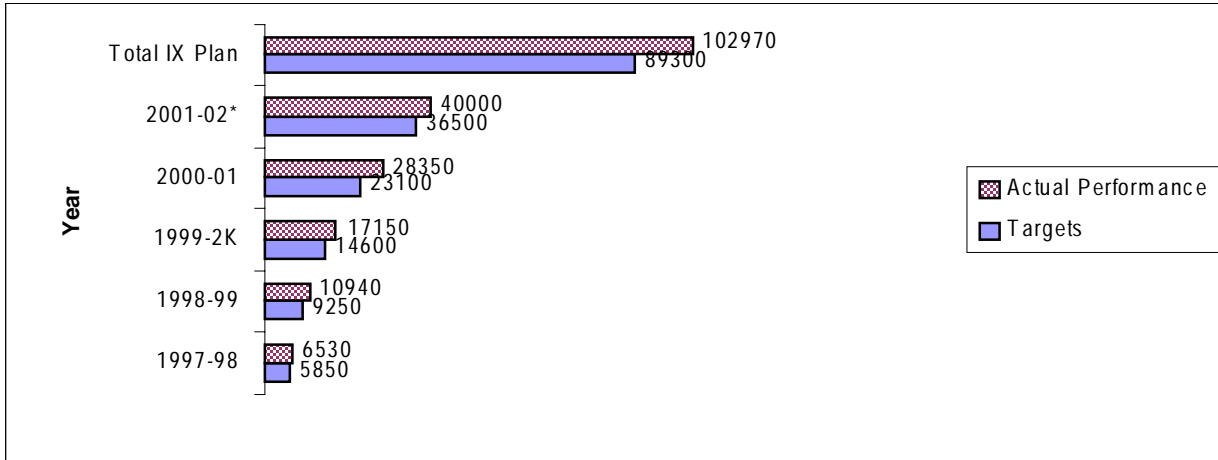
Software Export Performance

Indications are that as against the total software export performance of Rs.89,300 Crores during the IX FYP, the industry aggregated export revenues of Rs.1,02,970 Crore, a excess of about 15% over the projections.

India looks increasingly well positioned for what is turning out to be the 21st century favorite industry-Information Technology (IT). The country, thanks to its enormous arsenal of software talent-its skilled software engineers, is making waves in the overseas markets. Today, an increasing number of global majors are relying on India's manpower talent to implement complex IT solutions.

Software Export – Year-wise

Indian software export industry – Highlights

- Software and services exports earned foreign exchange worth Rs.28,350 Crores or US $6.2 billion during 2000-01. This represented a growth of 65 % in rupee terms and 55 % in dollar terms over last year's software exports of Rs. 17,150 Crores or US $ 4 billion.

- Indian IT software and services exports accounted for 14 % of India's total exports of USD 44 million during 2000-01. It is expected that by the year 2008, Indian IT software and services exports will account for 35 % of India's total exports.

- India's expertise in emerging technologies and legacy systems has helped to get many new customers. In the past few months, many US companies showed increased interest in the Indian software industry.

- Companies from Europe and Japan are also now turning to Indian software majors for their software requirements. The Asia Pacific region is also emerging as a key playground for India's software export talent.

- E-commerce and remote processing services emerged as key drivers of the Indian software & IT industry during 2000-01. In fact these segments will continue to remain in the driving seat, creating major opportunities for Indian software companies. The IT enabled sector in fact grew from Rs.2,400 Crores in 1999-2000 to Rs.4,100 in 2000-01. It currently employs 70,000 people and accounts for 10.6 % of the total IT software and services industry revenues. This segment is expected to witness a strong growth of 54 % with revenues estimated to touch Rs.6,300 Crores in the year 2001-02.

- Quality remained the hallmark of the Indian software and services industry. India currently has 27 companies that have received the famed SEI CMM Level 5 certification. It is not worthy that worldwide only 48-organizations have acquired such certification that means about 55% companies are Indians, to achieve this status.

- During 2000-01, Offshore services dominated the software exports sector. Offshore services increased to about 44% of total exports, whereas onsite services contributed about 56 %. STPI and VSNL played a key role in providing high-speed data communication links, which in turn helped the cause of offshore software development by Indian software companies.

- During the year, one out of every four global giants outsourced their software requirements to India.

For achieving this velocity of business, both the industry and Government of India are currently taking some bold and purposeful steps. Amongst others, this exercise includes path-breaking measures by the government to further liberate the economy, simplification of procedures, deployment of additional resources for technical manpower development, new marketing channels, enhancing global brand equity and providing state-of-the-art infrastructure for software development. E-commerce solutions, software development, interactive integration services, Application Service Providers (ASP) and IT Enabled Services are leading the way.

Shift towards Offshore Services

Until almost 1995, the bulk of Indian software exports were in the form of professional services. However, since the last few years, there has been a visible shift towards offshore project development, which also includes offshore package development. It must be noted that offshore means, software developed on Indian land. The factors that has caused this shift in focus are as follows:

- With Software Technology Parks proliferating, reliable High-Speed-Data-Communications (HSDC) services becoming available from the STPI and VSNL, a liberalized economic policy coming into play, offshore development has increased and is expected to grow further.

- While currently, the degree of onsite development is still very high, with about 56% of the work being done at the client's site, it is expected to decrease in the coming years with improved data communication links. In 1988, the percentage of onsite development was almost as high as 90 %. During 2000-01, the offshore component (i.e. services transmitted from India plus products and packages) increased to about 44% of total software exports.

- Despite an average 12-hour time difference with India, a state-of-the-art infrastructure and high-speed datacom link can provide a client in the US with a virtual 24-hour office environment. This concept has worked wonders lately for large projects, as well as for projects involving remote software maintenance using video conferencing. The virtual 24-hour office almost cuts the development life cycle by half, thus ensuring speedy deliveries with high quality.

Break-Up of Software Activity

An analysis of the break-up of software activity of the export industry for the year 2000-01 demonstrates that IT services still command a share of almost 92 % in the export market.

In the export market, India's expertise in "professional services" and "projects" is expected to continue its dominance as a major part of Indian software export activity. Some Indian software companies have developed innovative software products and are now marketing the same globally.
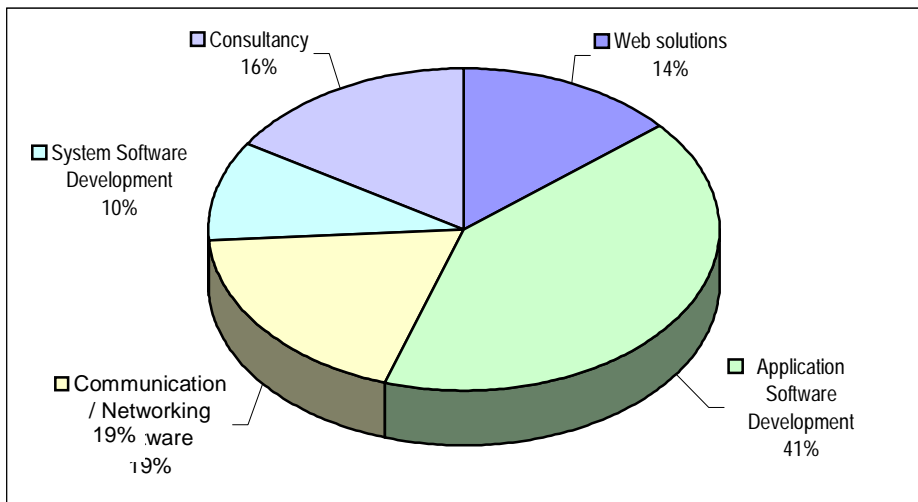
Software Export Destinations
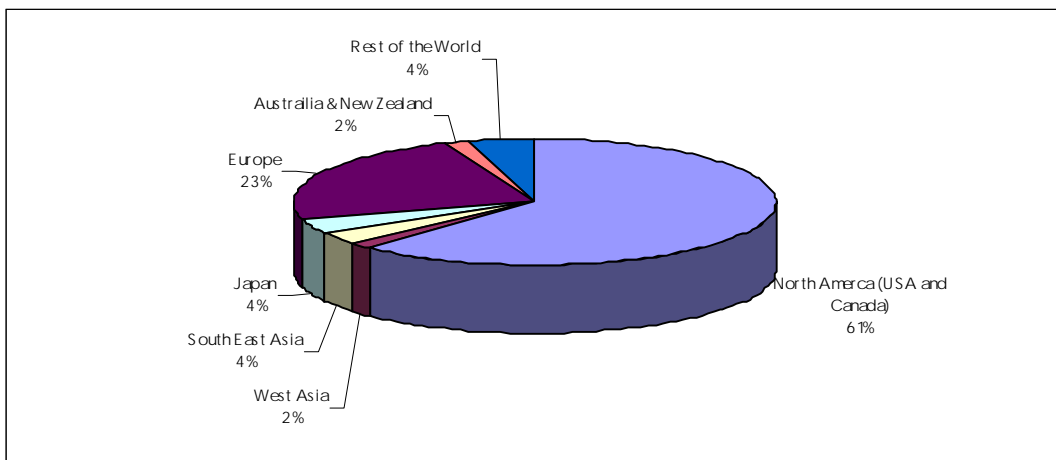
Marketing Channels for Overseas Business

Marketing is the most critical issue for the development of the Indian software industry. To emerge as a major player in the export market, in the earlier years, Indian companies traditionally depended upon direct marketing to end-users. However in the last few years, many software companies have set up their own offices in various countries. By 31, December 2000, Indian IT software and services companies had about 600 offices overseas including subsidiaries, branches and agents. Lately, marketing through the Internet is also emerging as a major marketing channel.

Overseas Offices of Indian IT Software and Service Companies

Year	Overseas Offices
1995	167
1996	221
1997	383
1998	466
1999	509
2000	582

Country	No. of Offices
North America	286
Europe	131
Africa	34
Asia	72
Australia/ New Zealand	45
Latin America	14

A segment-wise break-up of the software industry's focus on vertical segments demonstrated the following statistics:

Sectors	Percentage of companies
Manufacturing	72%
Banking/Financial Services	77%
Hospitality	35%
Airlines/Transportation	65%
Defense	35%

Sectors	Percentage of companies
Utilities	28%
Telecom	54%
Education	45%
Government/Public Sector	71%
SOHO	45%
Others	34%

3. Initiatives for the Growth of the Indian Software and Services Industry during Ninth Plan

The Government of India has provided a nurturing environment for the growth of the software sector. Its policies include: thrust on improving the physical and infrastructure facilities; cost effective and reliable bandwidth; income tax exemption to projects from software export, massive liberalization of the Indian economy, simplification of policies and procedures; setting up of STPs; initiatives for attracting venture capital etc.

A robust and reliable infrastructure comprising high quality data-com connectivity, an IT positive policy environment, excellent roads, airways and rail network, availability of power, real estate and financial are important prerequisite for the growth of the IT software and services marketplace. The Government of India has been working on some of these areas to create a conducive climate for the proliferation of the software sector.

The Indian telecom sector has undergone a major process of transformation through significant policy reforms, particularly beginning with the announcement of the National Telecom Policy (NTP) 1994. The key landmark in telecom reforms however, came with the NTP 1999. IX FYP (1997-2002): a review

National IT task force recommendations on telecom infrastructure

The National Task Force setup by Hon. PM, with cabinet approval, created in 1998 to formulate the draft of a National Informatics Policy made over 108 recommendations as part of the IT Action Plan. Only 56 of these have been implemented that includes initiatives related to creating datacom infrastructure across the country.

Voice and data communication has bee permitted for IT software development and services on dedicated or leased circuits

Requests by public or private sector STPs for release of bandwidth accepted: Requests made by STP and IT promotional organizations approved by the Government for release of bandwidth are now acted upon by the VSNL by intimating INTELSAT within two weeks of receipt. This request was cleared on May, 2000. The Software Technology Park of India and Government network service providers were given the status of Direct Access Provider Category III to enable them to send their bandwidth requirements directly to INTELSAT.

Setting up of central call centers by IT service providers permitted: Call centers are permitted on a non-exclusive basis for which DTS, MTNL and VSNL can provide bandwidth. It was also decided by the Telecom Commission that bandwidth can be provided by STPI subject to it following the terms and conditions/plenty clause as of VSNL, for use of voice in the contract with the end user.

Intelligent Network (IN) services introduced: IN Services made operational in a number of cities in the country on December 31, 1998. Access codes 1-1600 (instead of 1-800) used for dialing free phone services and 0-900 (instead of 1-900) for premium rate services have been introduced.

Internet Service Providers (ISPs) Policy introduced

ISPs allowed to set up international gateways for Internet

Last mile linkages freely permitted

Promotion of hi-tech habitats

Introduction of the Communications Bill 2000: Taking into account the increasing convergence between telecommunication and information technology, a Communications Bill has been drafted by the Government in conjunction with the finance ministry, the ministry of information technology, the ministry of information and broadcasting and the communications ministry. The Convergence Bill is expected to become an Act in the next winter session of Parliament. The Convergence Bill disbands the Indian Telegraphs Act and all previous policies. It proposes the creation of a regulatory body called the CCI (Communications Commission of India) which will take on the role hitherto performed by the TRAI. This commission will undertake the following:
- regulate various communication services including telecommunication, broadcasting and other electronic communications
- facilitate their development in an environment of convergence in order to unleash the power of new technologies.

The Communications Bill, allowing the convergence of different media will catalyze the development of numerous "converged applications" including multimedia software, streaming media, video conferencing solutions, among others by software and services companies.

Ensuring bandwidth availability: According to the software industry, a major aim of the Government of India should be to provide 2Mbps of bandwidth for every Indian citizen by 2008. The private sector too is taking initiatives to make bandwidth available for specific software applications such as streaming video, video conferencing, etc. Companies such as the Reliance Group are setting up countrywide Fiber Optic networks, which will bring high bandwidth networks to business and individual users.

Government Policies - creating the necessary regulatory environment

STPI: The Government liberalized and simplified procedures and policies, thereby making it easier for foreign companies to do business with software players. This also helped attract foreign investment in the software field. One stop solution through nodal agency STPI was provided by giving sufficient statutory powers.

Amendments made to Section 80 HHE: Section 80 HHE of the Income Tax Act provides for income tax exemption to profits derived from software and services exports. This section was amended as follows: the existing formula was changed so that tax on profits had no relation to domestic turnover; the definition of software and export turnover changed so as to include IT services exports and the benefits of this section for income tax exemption to profits from exports extended to supporting IT software and IT services developers.

Guidelines for sanction of working capital finance to IT and software industry: A differential and flexible approach has been adopted by giving special dispensation towards working capital requirements of the IT and software sector. Accordingly, RBI has issued guidelines in August, 1998 with regard to working capital requirements for the IT software and services which are based on simple criteria such as turnover.

Income tax holiday to EOU/EPZ/STP units under Section 10A/10B of the Income Tax Act till 2009-10
Employees Stock Option Plan: In the cases of ESOP/ESOS, the Government has declared that the beneficiary will be taxed only at the time of sale and that also as capital gains. However ESOP will attract capital gain tax if it is given in the form of a gift. This became applicable from April, 2000.

Schemes for setting up IT software and services operations: No permission of the Government of India is required to set up IT/software units in the country.

- Various schemes such as Domestic Tariff Areas, Export Processing Zones, 100 percent Export Oriented Units, Software Technology Park (STC) have been introduced.
- Foreign companies too can set up business operations in India and even take a JV Indian partner.
- These announcements have led to the flow of investments of foreign capital into India in the software and services segment.
- A number of global software players are operating in India. In the area of IT enabled services and R&D in particular, leading international majors have set up facilities and centers in the major Indian metros.

100 percent FDI in IT sectors: The Government allowed 100 percent FDI in the IT sector in 2000, thereby fulfilling a long standing demand of the hardware and software industries.

Intellectual Property Rights regime set up: India became a signatory to the Berne Convention, UCC and TRIPS at WTO. The Government during the 9th Plan ensured that India had one of the toughest Copyright Laws in the world. Attempts were also made to ensure that these laws were implemented stringently. This initiative helped bring down piracy levels from an all time high of 89 percent to 59 percent in 2000. During 2001, piracy levels rose marginally to 61 percent.

Cyber laws: One of the most significant steps taken by the Government of India is the introduction of the Information Technology Act, 2000 which aims to provide for the legal framework so that legal sanctity is accorded to all electronic records and other activities carried out by electronic means. In India, Cyber laws are contained in this act.

Financing : To make available adequate financing for the proliferation of the large and SME sector in the software segment the Government of India has already taken several initiatives to promote the VC environment.

Growth of VC and Angel Investments: In India, the venture capital creation process has started taking off with all four stages including idea generation, start up, growth ramp up and exit processes receiving attention. However, more needs to be done.

The following table indicates the growth of venture capital and angel investments in India's IT software and services sector:

Year	Rupees (In Crore)	US Dollars (In Million)
1996-97	70	20
1997-98	320	80
1998-99	610	150
1999-2000	1,600	370
2000-01*	3,200	700
2001-02*	6,500	1,400
2007-08*	50,000	10,000

* Projections

During 1999, approximately worth 80 percent of the estimated US$ 30 billion worth of venture capital invested in United States, went to technology firms. India too, with its strengths in innovation and IT technology has attracted several Venture Capital firms. In 2000 alone, 18 new venture capital funds have registered with SEBI, taking the total number to 28. In fact, VC or Angel investments in high tech firms in India have grown by over 5,000 percent from Rs. 70 crores to Rs. 3,200 crores between 1996 and 2000. This figure is expected to grow to Rs. 50,000 crores by 2008.

Setting up of National Venture Capital Fund for Software and Information Technology:

Small Industries Development Bank of India (SIDBI), in association with Ministry of Information Technology, Govt. of India, has set up a 10 year close ended venture capital fund called the "National Venture Fund for Software and IT industry" (NFSIT). NFSIT has a fund corpus of Rs. 100 crores and is a dedicated IT Fund with a focus on small-scale sector.

- A Portion of the Fund is earmarked for incubation projects, which are high risk in nature and may involve development of software products. Andhra Pradesh, Karnataka, Delhi, Kerala, Gujarat and Tamil Nadu state governments have already set up venture capital funds for the IT sector in partnership with local state financial institutions and SIDBI.

Incentives for Venture Capital: Recognizing the importance of venture capital, the government has introduced major liberalization of tax treatment for venture capital funds and simplification of procedures. These include the following:

- SEBI has been recognized as the nodal agency

- A new clause (23FB) in Section 10 of Income Tax Act has been introduced to provide that any income of a venture capital company or a venture capital fund from any investments made in venture capital undertaking will not be included in computing the total income.

- Section 115U has been introduced with effect from the assessment year 2001-02 to establish pass through.

- The Regulations earlier required a VCF to exit from investments made in a venture capital undertaking (VCU) within twelve months of the VCU obtaining a listing, if a VCF wished to avail certain tax benefits. This requirement has now been done away with.

4. SWOT Analysis

India's rise to fame in the international software and services marketplace is commendable. Through an orientation and adherence to high quality processes, a vast English speaking manpower base, expertise on state-of-the-art hardware and software platforms, and cost competitiveness, the software industry has established itself in the global segment. Our existing exports generate revenues that are a bare 2% percent of the overall global marketplace.

In order to understand India's standing in the global software and services scenario, it is important to appreciate the strengths, weaknesses, opportunities and threat the software industry faces in its quest for international supremacy.

Strengths

India's vast base of skilled, English-speaking manpower
India's base of educated manpower (the country ranks second only to the US) continues to create an edge for the country. According to Stepstone, a leading European career portal, demand for Indian IT manpower, exists not only in the US, but Europe as well. In fact, by 2003 the number of unfilled IT jobs in Europe is expected to touch the 1.6 million mark. Countries such as Germany, France, Austria and Norway are offering major opportunities for Indian software professionals. These countries are in fact liberalizing their immigration norms in order to enable Indian software talent to work in their regions.

High pace of growth
Compared to the software sectors of other countries, India's industry has been logging extremely healthy growth rates over the last decade. The software and services segment has been growing at over 50 % year on year--a significant achievement for the industry. Despite the overall global

economic slowdown, the growth estimates for the Indian software and services sector haven't been revised and in the export segment, the pace is expected to be maintained at around 40-45 %.

Indian brand equity
The India Inc. brand is gaining its popularity all over the world. In fact one out of every four global customer of consequence outsourced its mission critical software requirements to the Indian software industry during 2000-01.

High quality software solutions
High quality remains the hallmark of India's software offerings. Indian software majors are focusing on acquiring quality certifications to refine their processes in accordance with global standards. Out of the top 400 companies, more than 250 have already acquired ISO 9000 certification. However, it is India's lead in the SEI CMM (Software Engineering Institute Capability Maturity Model) Level 5 segment that has given companies the real edge. India presently has 27 companies that have received SEI CMM Level 5 certification.

State-of-the-art technology experience
The expertise of Indian software and services companies on cutting edge technologies and hardware and software platforms has helped the software industry gain an edge over competitors. Indian companies today are well versed in Internet/Web, communications, and e-commerce based solutions, ASP offerings and the evolving e-CRM, ERP sectors. This experience is making Indian software manpower one of the most sought after in the world today.

Wide exposure to large and diversified projects
Indian software and services companies are accustomed to working with global customers—internationally spread out, large enterprises, with complex software requirements. Today, key software and services players are supplying virtually everything---from animation work for Hollywood films such as The King and I, to 3D imagery used in flight simulators by Airbus industries. On the networking products side, Indian companies are creating products for foreign companies--from browsers used in wireless phones to e-commerce Web sites. Projects—spanning more than 500-700 men-years are being undertaken by Indian companies.

A prestigious customer base
The Indian software industry boasts a client list including well known international players such as General Motors, British Airways, Wal-Mart, Coke, General Electric, Ford, Sony, Nokia, Siemens, United Airways, Pepsi, Boeing, Citibank, among hundreds of other big wigs.

Offshore development
India's strengths as an offshore developer are well known today and this segment accounted for around 44 % of India's overall software export revenues. The increasing percentage of offshore revenues, and India's move towards the offshore model of software development, stand testimony to the software industry's improving quality, evolving high speed satellite-based communications infrastructure and the creation of reliable, and international class solutions.

Appropriate training and educating base
Owing to India's strong base of educational institutions such as the country's English oriented schools, colleges, Regional Engineering Colleges, Indian Institutes of Technology (IITs), IIITs and private sector IT training schools, the country is creating in plenty the basic raw material for any software development activity--quality knowledge workers. As of December 2000, the annual output of graduate engineers for India were 1,75,000. Out of these, about 96,000 were IT related engineers. The IT software and services industry in India today employs more than 400,000 professionals (as of

December 31, 2000). This is the second largest English speaking IT work force in the world. Recently, the Government of India has committed to providing computer education in every school by year 2003. Plans are also afoot to expand the number of IIT and IIITs across the country, to further augment the base of skilled, software industry ready professionals.

Government push to software and service industry
The Government of India has accorded "thrust area" status to the software sector. The Government has amended the Copyright Law to make it one of the toughest in the world; eliminated import duty on computer software; exempted profits derived from software exports from Income-Tax etc. In the last year initiatives on rationalizing ESOPs, improving the Venture Capital environment, allowing 100 % FDIs, etc. have given a further boost to the software market. The Government of India has also set up innovative schemes like Software Technology Parks, etc., for promoting software exports.

Weaknesses

Inadequate focus on brand/ packaged development
India has managed to make a breakthrough with projects and services, but there is virtually no orientation in the area of packaged software products. With a few exceptions, Indian shrink-wrapped software products have not made any impact on the international markets. Thus, the industry has not able to take advantage of a multiplier effect for growth in revenues.

Low revenue realized per person
India needs to enhance per person productivity to contain costs. Higher usage of software engineering tools and prototyping needs to be encouraged to avoid rework, which is expensive and inefficient.

Range of expertise limited to a few organizations
Over the years one fact has become clear. It is the top 25 software development companies that are generating over 60 % of the revenues. Even as the number of software and services companies is expanding, the real power, experiences and value creating expertise lies only among the top few in the industry.

Lack of localized software for the Indian market
The majority of software and solutions created by Indian software leaders are in the English language. There is very little work being done in the localized, regional languages. In fact, this is one of the key reasons for the slow growth of the domestic software market and for the poor penetration of IT across India's vast terrain. Hence another barrier to the diffusion of information technology is that commercially available software packages for various business applications are not adapted to local conditions, which differ in accounting rules, business culture and language. Local capability to adapt software applications to the local business environment is a precondition for exploiting the power of technology and of knowledge embedded in these software packages.

Weak domestic base
Most industries grow on the basis of a strong home base. This is not the case with the Indian software industry. The domestic market has traditionally grown slower than the export segment and while revenues jumped by 45 % during 1999-2000, they dropped severely to 31 % during 2000-01. A strong domestic industry is vital to the growth and expansion of the software sector. Companies gain an advantage when their home base allows and supports rapid accumulation of skills, affords better ongoing information and insight into product and process needs, stimulates them to upgrade and broaden advantages and the goals of various stakeholders support intense commitment and sustained investment. Low PC and Internet penetrations are also contributing towards the slow off take of the domestic software market.

Lack of adequate telecom infrastructure
The immediate need of the hour in India is to have a world class telecom infrastructure at globally competitive tariffs. The erstwhile Department of Telecommunications (DoT), BSNL has taken a number of initiatives including the National Telecommunication Backbone, National Internet Backbone (NIB), and plans for providing high bandwidth Internet connectivity to remote corners of India. However, lack of reliable and access network, last mile connectivity, slow speed of change and adherence to archaic telecommunication rules and regulations can prove to be a major threat to the industry.

Project management skills
As the Indian software industry has been growing at a fast rate, most of the project managers are becoming entrepreneurs, thus creating a gap in demand and supply of project management skills.

Opportunities

According to Stepstone, a leading European portal there will be a demand for over 1.6 million unfilled jobs across Europe by 2003. Of this Germany alone accounts for 400,000, France for 100,000, Austria for 30,000 and Norway for 15,000. These countries are opening their doors for Indian IT professionals creating a significant opportunity outside of the US. Japan is another market that has a major requirement for skilled IT knowledge workers.

Availability of talent
While the IT industry employs around 4 lakh knowledge workers, this number is expected to go up to 2.2 million by 2008. The country's IITs, IIITs, and private sector institutes are helping to create a vast pool of English speaking manpower which is readily available for export markets.

A recent Gartner Inc. study has revealed that global customers are unlikely to scale up their IT spending during 2001-02. In fact, while hardware spending is coming down, spending on manpower and services will escalate, the Gartner study indicates. Trained manpower thus is required for the new technologies being purchased. It is also needed to run and maintain the existing applications within companies. The demand-supply gap in the US and European market for IT professionals is still acute and this market will continue to absorb Indian talent.

Global market
The market is large and rapidly changing-from a mix of legacy/client server to Web/package-based services. Market openings are merging across IT services, software projects, IT enabled services and e-businesses, and creating a number of new opportunities for Indian companies. As per the Nasscom-Mckinsey Report, India can aspire to take its own share in the global multi billion opportunity in this sector by 2008. While a growth in IT services will continue to offer the biggest opportunity, India companies can also make a large thrust into IT enabled services and build e-commerce.

IT Enabled Services
Remote processing, along with e-commerce is emerging as a major exports opportunity for the Indian software and services marketplace. This segment covers a vast gamut of services including customer interaction services, help desks, medical transcription/translation localization services, data digitization, digital content development, animation & remote network management. This sector employs around 70,000 people and accounts for 10.6 % of the total revenue of the software industry. IT Enabled Services is expected to grow at a very healthy 54 % with revenues estimated to touch Rs. 6,300 Crores during 2001-02.

E-commerce
E-commerce is the other big opportunity segment for the Indians software and services industry. In fact, strong levels of investment are being planned in B2C and B2B sales and marketing software, business intelligence, supply management and in particular, customer relationship management solutions. During 2000-01, e-commerce software solutions worth USD 1,200 million were exported. This figure is expected to go up to US $ 1,800 million in 2001-02. According to the NASSCOM-McKinsey Study 1999, e-business solutions will touch revenues of US $ 10 billion by 2008, creating a vast opportunity for Indian software majors in this sector.

Outsourcing
Despite the global economic downturn and contrary to expectations; global customers, especially in the US are turning to India for their software requirements. In fact, some customers have even scaled up their outsourced activity to India. Companies in Europe and Japan are also increasing their outsourcing to India.

Government, banking and other industry sectors in the domestic market
A major domestic market demand can be generated for the Indian software sector, provided the Government (both at the center and states) goes for significant e-governance implementation. If, in accordance with Government guidelines, key departments, ministries and PSUs utilize 3-4 % of their allocated budgets on IT purchases (including software) a major spur can be provided to software vendors. Segments such as banking and telecommunications are expected to be other big IT spenders over the next few years, creating an opportunity for the Indian software industry.

Threats

Non availability of mass scale, cross section of operations like applications on embedded systems
India is yet to tap into the emerging market for embedded applications, which cover such as consumer electronics, SOHO and home networking, industrial automation, automotive, real time operations systems, and mobile computing.

Projectionist policies followed by some countries
Some countries in North America and Western Europe are creating protective and non-tariff trade barriers, especially with regard to the movement of skilled manpower. Visa issues and non-tariff trade barrier may prove to be a threat. India should insist for removal of non-trade tariff barriers as part of I.T.A-2 (Information Technology Agreement) at WTO.

The emergence of China, Philippines, Korea and CIS countries as centers of software excellence
A number of countries are waking up to the reality of global software opportunities and taking necessary, strategic steps to gain a competitive edge in this sector. These include countries such as Korea, Israel, Ireland and China that are also moving neck and neck with India in the race for cost competitive, high quality solutions. India's advantage over countries such as China on account of the English speaking manpower, could get eroded as the former is making a major effort to create capability in that direction. Strong telecom infrastructure in these countries is also enabling them to get into offshore development and IT Enabled Services. This development poses a threat to Indian software companies in the very near future.

Inherent language advantage to China, Japan and Korea
Certain countries enjoy the inherent advantage of their languages in their regions.

Competence Review - India and its competitors

The following observations have been made when comparing India with its competitors such as China, Israel and Malaysia

- In a benchmark against China it has been revealed that the country has a high PC penetration. China manufactured over 7 million PCs last year as against 1.88 million units assembled and marketed in India.

- Telecommunications infrastructure in China and Ireland is more strong economic and better in terms of bandwidth availability. China in terms of telecommunications links offers connectivity of 55 Gbps as compared to India's 1 Gbps.

- China has a smaller software industry as compared to India in revenue terms, but it is essentially directed towards meeting its indigenous needs of IT based productivity and improving China's competitiveness. However, it is expected to lead to strong domestic market base, which is grossly lacking in the case of India.

- China's gross revenue from IT services in 1990 was USD 90 million. In 1997 it reached USD 3 billion. In year 2000 it has touched USD 7 Billion, with a rate of growth more than that of India.

- Use of Internet and development of electronic services are growing in China. Internet entered China in 1994 and at the end of 1998, total Internet connections reached 2.1 million. Number of computers connected to the Internet touched the 744,000 figure. The number of Web sites cross the 5,000 mark. By 1999, the number of Internet users touched 8.9 million, the number of connected computers rose to 3.5 million and Web sites to 15,153. In year 2000, the above figures changed to 22.5 million subscribers, 8.92 million PCs connected to the Internet and over 265,405 Web sites.

- While India is ahead of China in software development and exports, in terms of production, China's pace of software production has overtaken India. In 2000, China's software sales and IT services amounted USD 7 Billion against USD 5.7 billion that of India.

- India's IT spending is about 0.7 % of GDP as compared to Malaysia 1.3 % and Singapore 2.5 %. China has earmarked at IT budget USD 5 billion to develop advanced software skills and communications infrastructure requirement for advanced software and hardware development.

- Countries such as Israel have moved up the software value chain and are offering solutions in the areas of embedded software, visual computing, simulation and prototyping. India should try and emulate this example. It has much higher productivity than Indian.

5. Tenth Plan Targets and Recommendations

Targets for the Tenth Five Year Plan

For the past decade, Indian software industry has been growing at a consistently high rate of over 50% annually. As per the reports of various agencies also endorsed by study team and industry,

India's IT industry would achieve a revenue target of over USD 80 billion, of which USD 50 billion from the software export led industry by year 2008.

In the first two years of Tenth FYP, a growth of about 40% has been projected against a growth of 20 - 25% in the last two years, as subsequent growth has to be achieved in the face of stiffer competition, more complexity in operations and the significantly larger base.

Following are the targets for the Tenth FYP.

Year	Software Export		Domestic Software	Total
	In Rs Crores	In USD million	In Rs Crores	
2002-03	54,000	11,250	17,000	71,000
2003-04	73,000	15,210	23,000	96,000
2004-05	98,000	20,420	30,000	128,000
2005-06	128,000	26,670	40,000	168,000
2006-07	160,000	33,340	53,000	213,000
2007-08	200,000	41,670	67,000	267,000
2008	240,000	50,000	84,000	324,000

1 US D = Rs.48/-

There are huge opportunities available throughout the globe. India has the potential to become IT superpower; it will require cohesive concerted efforts from Government and IT Industry to achieve the ambitious plans and targets.

Government needs to accelerate and expand the scope of its planned initiatives-building up an ideal regulatory environment, pushing e-governance and boosting the domestic market.

Execution against seven "growth enablers" – supply base of knowledge workers, ideal regulatory environment, anchor MNCs, India Inc. brand, country specific initiatives, telecom infrastructure and venture creation will be necessary for Indian companies for successful capture of the opportunities.

Recommendations

Multi-pronged strategy is required to make India a global leader. Looking at the opportunities and challenges, the "study team" has made certain recommendations that would envisage rapid growth for the Indian software industry and to realize the vision for India's software and service sector and to achieve the targets.

Infrastructure
An appropriate and efficient infrastructure is requisite for the growth of any industry as it economizes the business by saving time and cost significantly.

Telecommunications infrastructure

Reliable, easily accessible and affordable telecom infrastructure across the country in a highly planned and phased manner is essential for holistic growth of the industry. Integration of various networks with a supersonic vision is essential for achieving the targets. The deregulation process of the Indian telecom sector has encouraged huge investments from industry players in the recent past.

This move needs to be supplemented by well-laid down criteria for the geographical spread and coverage of the telecom network to remote areas.

Low cost and high performance telecommunication infrastructure plays a vital role in the development of any nation, especially in the information age it has been a major contributor to the software export success of nations such as Ireland. Extensive spread of various networks based on Fiber Optic, Satellite and Wireless for seamlessly interconnecting the Local Information Infrastructure (LII), National Internet Backbone (NIB), National Information Infrastructure (NII) and Global Information Infrastructure (GII) have to be undertaken to ensure a fast nation wide onset of the Internet, extranets and intranets.

There has been a significant shift in the telecom traffic from voice to data resulting in bandwidth becoming a major driver in today's market scenario. The National Internet Backbone (NIB) a very crucial requirement for the proliferation of the domestic software industry needs to be rapidly spread out across the country including remote areas within a time bound manner.

The real problem lies in the last mile access between the network's point of presence and the subscriber's premises. There is no focused and organized approach to meet the last mile connectivity challenges. To address these problems, Study Team strongly recommends -

- Induction of wireless technologies in the last mile can provide a reliable and speedy connectivity not only in urban but in rural areas as well. Pilot projects, indigenous technologies especially in the area of wireless technologies should be encouraged.

- A hybrid network of optical fiber and wireless systems – Wireless in Local Loop (WiLL), Local Multi-point Distribution System (LMDS) would offer the flexibility and fast deployment solutions.

- Effective spectrum management is essential for the organised growth of the wireless industries. Frequency band allocation and the monitoring mechanism need to be enhanced.

- Promote xDSL technologies to enhance speed, throughput on existing last mile connectivity.

Enhancing infrastructure services for software export industry

Infrastructure plays a vital role for the growth of any industry. Appropriate government policies along with the telecom infrastructure are the backbone of software export industry. STPI is a nodal agency for execution of STP schemes and to promote software exports by providing infrastructure facilities including High-Speed Data Communication (HSDC) links.

STPI centers act as a "single window clearance" in providing services to the software exporters. Some of the STP Centres provide incubation infrastructure to SMEs, enabling the startup companies to commence their operations without any delay. At present they are located in metros, state capitals and some of the big cities. HSDC services are being provided to software & IT industry through International Gateways.

- In order to enhance its (STPI) infrastructure, expand its reach to all potential locations in hinterland of India, to provide incubation facilities to SMEs, and to strengthen its network with international optical fiber connectivity, a fund allocation of Rs. 250 Crores would be needed.

Enhance PC/ set top box and Internet penetration

- The single biggest stumbling block for PC penetration to increase remains the cost of a PC. There have been several unsuccessful attempts to introduce low cost or limited functionality PCs. India is perhaps the only country in the world with an insignificant market for second hand PCs due to non-availability of fairly contemporary second hand PCs at low costs. This can be addressed by allowing 100% depreciation on PC purchases in the year of purchase itself. This will result in a faster replacement cycle and availability of good second hand PCs at low prices. This proposal is likely to be revenue neutral for the Governments as it would bring a large percentage of the gray market in the excise net boosting revenues and compensation for the national corporate tax loss.

Facilitate setting up of Public Tele-info centers

- To realize the ambitious plan and targets, conversion of the existing over 600,000 public telephones/ public call offices (PCOs), into public tele-info-centers, offering a variety of multimedia information services such as tele-banking, tele-medicine, tele-education, tele-documents transfer & e-commerce need to be expedited. This should be further extended to the hinterlands of India

Create hi-tech habitats

Strong domestic base, vast and geographically spread infrastructure is necessary to bring all regions into mainstream to contribute to IT mission.

- Infrastructurally, self contained, self financed hi-tech habitats of high quality need to be created in the satellite township, as per a Cabinet decision in July 1998 for the setting up of 50 HTAs. This needs to be accomplished on a priority basis.

Make IT incubation a priority

Business and Technology incubation catalyzes the process of starting and growing companies. Basically it is a dynamic process of business enterprise development to nurture young firms, help them to survive and grow during the startup period, when they are most vulnerable.

IT incubation provides the entrepreneurial firm a shared office services, access to equipment, flexible lease and expandable space, all under one roof. IT incubation facility would help to make strong foundation necessary to build a strong IT nation.

- The Government should nucleate this activity and offer around 1 million square feet of incubation space for encouraging new entrepreneurs, startup companies to go for software exports.

- The Government should encourage and promote incubation through tax incentives and by treating incubation centers at par with other STP Units.

- In remote locations such as the North East, Government agencies may also need to set up infrastructure and provide active support.

- Around Rs. 100 Crores should be allocated for this project.

Research & Development

Promote long term frontier research and mission mode projects

- Some of the frontier areas in which open ended/long research is being undertaken globally are quantum computing, molecular computing, bio-technologies, bio-informatics, soft computing, human computer interfaces, knowledge discovery, high end computing, high speed networking, evolutionary information systems, online and network security, robust software, bio-elements for computers, etc.

- In order to promote R&D efforts in futuristic, cutting edge technologies, the Government should support open-ended research in these frontier areas with long term benefits in view and also nucleate research groups in institutions like TIFR, IISc, IITs, etc. It is also necessary to support Ph.D. and post doctoral research activities in these areas.

Create an allocation for R&D

In order to give India a cutting edge, move up the value chain to gain stronger bargaining potential in the global market and to develop its own technologies, IPRs, it is essential to promote basic research as well as applied research with mid-term and long term benefits in view.

- The Government should fund basic research to keep Indian academicians internationally competitive. This will serve the dual purpose of getting trained manpower that can work in the industry on projects where the industry has to compete globally.

- The global trend in R&D spending in developed nations is around 3-4 % of total organizational turnover. India should set to achieve a 2 % target with 0.5 % going towards fundamental research and 1.5 % flowing into applied research.

- Around Rs.12,000 Crores should be allocated for research over the next five years of which about Rs.3,000 Crores should be contributed by Government.

Manpower development

India currently produces more than 1,22,000 knowledge workers and this number is growing at a phenomenal rate but because of demand and supply gap, there would be massive requirement for more quality and skilled in high end areas professionals both at home and for the overseas markets.

It is recommended that the Government and industry take the following steps to redress the situation:

Emphasize on post graduate education and research

If Indian software companies have to move up the value chain and undertake product and technology development, they will need manpower to the level of masters (M.E./M.Tech) and doctoral level programs.

While the USA produces 10,000 masters degree holders and 800 Ph.D degree holders in Computer Science every year, India produces merely 100 Ph.Ds and 2800 ME/M.Tech degree holders.

- An adequate number of Ph.Ds (100/year) and M. Techs (3000/year) in Computer Sciences and Microelectronics each, as well as post doctoral level manpower is required for promotion of open ended research for IT, especially for hardware design and manufacturing industry revival.

- Estimated funds required for promotion of research manpower for the X FYP period is approximately Rs. 50 Crores .

Encourage Distance Mode Learning

Technological revolution has dragged industries into global competition, as a result of this, expectation of clients and employers are growing day by day. To tune themselves according to the situation, higher education and improved technical qualification skills by part time course or distance mode learning is the boon for today's executives.

- To perforate the huge export and domestic market potential, support R & D activity in online learning in the areas like courseware engineering, pedagogical models, instructional design, delivery mechanism, quality systems, market dynamics etc.

- Lecturers in engineering/ university colleges should be allowed to work for higher degrees like M.Tech and Ph.D in the distance mode. Using DVDs, CD ROMs or video-tapes of live courses on the Web, IITs and other select institutions can make available their learning to students for a fee. These methods will not only make available high quality programs to students at a distance, it will also keep the pressure off the trained faculty at the IITs and other premier institutions. The five IITs and IISc will be able to enroll an additional 300 to 400 students every year from the industry in the distance mode.

- Virtual universities for producing quality manpower in the area of IT should be encouraged. These institutions can tie up with other institutions of higher learning such as IITs/ IISc to bring professors/teacher to offer courses in online mode.

- Support educational institutions to offer courses in online mode for the corporate sector, secondary level education, for rural and literacy programs.

- Evolve standards, practices and certification mechanisms for recognition/ accreditation of online learning courses. Attempts should be made to establish standards, methods and practices for courseware development and online learning. Encourage experienced, established faculty members to develop courseware.

- It is suggested that Government may provide backing to about 100 leading IT Institutions in the country to help such facilities. On an average, a capital investment of Rs. 5 Crores may be needed, thus an initial funding of about Rs. 500 Crores is required for infrastructure development over a three-year period.

Academia-industry Interface

- Industry-academic linkages should be encouraged where the IT/software and services industry can guide the educational institutions on the specific skills that they require and possibly even jointly train students for the same.

- The Government should emphasize on adoption of software institutions by industry and promote it by providing tax relief schemes, create most revered status etc.

- Industry sponsorships of academia such as the TCS IIT Chennai tie up, IITD and Bharti Collaboration or the IIS Bangalore collaboration with MNC for projects needs to be encouraged.

- Compulsory periodic corporate training and orientation should be a part of the "up-gradation module" for teachers/instructors.

- A three-way channel should be created between the industry, academia and the Government for taking up R&D for online learning.

Retraining industry professionals

- In order to create manpower to support IT projects in state-of-the-art segments such as CRM, e-CRM and to provide IT Enabled Services in areas such as finance and accounting, HR, engineering design etc.; industry professionals with a basic understanding of IT and its implementations will need to be retrained to build the necessary expertise.

Upgrade institutions, increase seats of learning and set up schools of advance studies

- Schools of Advanced Studies and Special Research Groups need to be set up. The existing RECs (Regional Engineering Colleges) and IITs can also be upgraded with a view to nurturing, building and retaining the technological edge over time.

- It is suggested that in order to enhance the output of quality IT manpower, India should aim to establish at least one IIT or an IIIT in every state of India. 43 RECs may be upgraded to bring them to the level of the IITs as far as quality and quantity of faculty, availability of labs and infrastructure is concerned.

Computer courses in engineering disciplines

- It is suggested to introduce comprehensive computer science program in every engineering discipline across the country. These students would be very useful for the software industry since they will have technical expertise in their related areas along with knowledge of computer science.

Attract research students from outside computer sciences (cross migration)

Lack of research students spells doom for the computer science and engineering department at the IITs and IISc.

- Attract research students from a totally different pool such as pure and applied science, Physics and Mathematics. The same approach can be adopted to train research faculty for postgraduate computer science and engineering departments.

Emphasis on Foreign Languages

At present Indian software export is a US centric. In order to perforate into European, Latin America and other Asian countries like Japan, Russia, etc. there is a need for knowledge of various foreign languages along with software expertise. This will help to combat the impact of inherent advantage of certain countries like China in Asian markets.

It is strongly recommended that educational institutes/engineering colleges should impart education in foreign languages and include various courses in foreign languages and make it mandatory to undergo such course at least in any one foreign language.

Regulatory environment

The Indian regulatory environment consists of following elements – Telecom regulations, cyber laws, investment policies, capital market regulations, procedures, labor laws and taxation. Creating regulatory environment that supports the growth of the IT sector will require the Government to continue the process to ease regulatory bottleneck and built up a conducive environment for the IT industry and make significant changes to each of the elements.

Telecom Deregulation

Lack of proper deregulation of telecom has become a major weakness for India. Telecom deregulation would help to reduce the number of vendors/service providers for end to end connectivity resulting into ease of operation, reduction in lead time and combat multi vendor coordination complexities.

Currently the telecom regulations act as a hindrance for the development of Domestic National Call Centers, by not permitting even the connectivity of domestic call centers.
- Government should permit the interconnectivity between call centers or other units of IT enabled services for the disaster recovery and load sharing between the centers for optimum utilization for expenses resources (international bandwidth)

- In order to improve the bandwidth availability, it is recommended that the Government set aside funds for laying undersea-cables and futuristic networks.

- Permit VoIP, encourage and accelerate IP telephony as IP telephony is expected to be about 40% cheaper.

Soft Bonding

A complete single window clearance concept should be strengthened. The STP/EHTP scheme setup for the purpose to facilitate and regulate the software industry has proved to be a catalyst for software and service industry.

- The norms of subjecting the software units operating under STP & EOU schemes of physical bonding of the duty exempted imports/ indigenous purchase need to be relaxed. Mandatory custom bonding creates hurdles in the smooth operations. It is suggested to switchover to soft bonding and to permit unlimited domestic access to promote the software industry.

IT Act 2000 – Cyber Laws

IT Act implementation is a move into right direction. It is aimed to provide the legal framework so that legal sanctity is accorded to all electronics records and other activities carried out electronically.

- Setting up certification agencies, to validate digital signature process need to be expedited.

Amendment in Labour Laws

In order to push further the computer software and services in general and IT Enabled Services in particular-

- Government should modify labour laws, in order to reduce the hardship faced, by the industry in setting up the units, from local authorities and concerned departments.

- IT Enabled Services face a restrictive labor regime in some states. This requires to be eased to allow them to provide round the clock, round the year (24 x 7) services to user countries. The Government needs to tune labor laws with prevailing conditions in IT scenario.

- Currently IT enabled services (Call Centers) fall under the Shops and Establishment. It is suggested to have a new category, which is neither a factory nor a shop, but one, which is a "service category". Further "Inspector Raj" should be reviewed.

Effective and well-laid out 'Copy-Right Protection Regime'

The set of rules must be in harmony with TRIPS (trade related intellectual property rights) regulations of WTO (World Trade Organization) and WIPO (World Intellectual Property Organization) treaties. To develop a domestic software industry, copyright laws must be passed and enforced (legally and by persuasion).

While piracy levels within the domestic market have already come down from the earlier 89 % levels to the existing 61 %, these statistics will have to be reduced further.

Jeremy Butler, past senior Vice President, International at Microsoft, estimates that biggest "opportunity" in software export is stopping piracy.

- All cases of reported piracy should be booked. Government agencies and public sector units must ensure the use of legal software. This will add to the revenues of the software and services companies.

Implement the Communications Convergence bill

The Convergence bill should be in place at the earliest.

Reduce Trade Barriers

- Tariffs quotas, currency conversion restrictions, needless bureaucracy, on computers, software, communication equipment, and related information processing products need to be removed. This will make it possible for software companies and universities to import modern hardware and software tools at competitive prices. It will also encourage general expansion of the information technology sector and create demanding, sophisticated users.

- Special tax-rebates and hardware duty-deduction should be made to encourage R&D operations tax and financial incentives to attract subsidiary offices of software companies can be offered. For example, Ireland offers a 10% corporate tax rate for computer services companies, employment grants for jobs created, capital grants toward the cost of computers, equipment, office furniture and buildings, training grants, rent subsidy grants for companies renting facilities, and research and development grants.

Domestic Market

Create packaged and shrink wrapped software

Traditional packaged software is the largest segment in the software products market and is made up of applications solutions, applications development tools, and systems infrastructure software. Growing as it is, at the compounded annual rate of 18 %, the software products market will be nearly six times its current size in 2008. The top growing segment in the packaged software sector is middle-ware (18.4 %), cross industry applications (14.3 %) and consumer applications (13.2 %). Other hot growth areas will be programming development tools and systems level software.

In order to achieve a multiplier effect on the growth in the domestic market, it is essential to promote the growth of application packages by companies in India. The government needs to provide certain incentives to promote rapid growth of application packages. These incentives can be in the form of

- Providing income tax incentives on application packages developed in the country.

- Tax deduction to the extent of 133 percent can be provided towards Research & development expenditure of application packages.

- The government and industry can sponsor the development of certain application packages in India. These packages may cater to key areas like education, rural development, land records, e-judiciary, e-police etc.

- Initiation of special grants awards by the Government and industry for package development. These combined grants can be given to the top three to five packages of the year.

- Provision of easy loans by banks/venture capital institutions towards marketing costs of application packages

Developing national, regional, local level e-libraries

- E-Libraries at regional and national levels may be set up and provide access to their catalogs and content, from any library, through any Internet access point.

- About 250 centers may be established with 5 main centers with an estimate of about Rs. 500 Crores .

Special soft loan facility

- Soft loans, subsidy, sponsorship etc. for Indian companies developing their branded products, application software should be made simple.

Mechanistic translation of Inter-Languages/ Territorial dialects

The development and adoption of local language software is an imperative for increasing the penetration levels of IT across the country. The software industry should be encouraged to develop regional language software.

Mechanistic translation of Inter-Languages/ Territorial dialects and speech recognition systems are necessary to take the benefits of IT to the Indian masses.

- While C-DAC has taken important steps in this direction, private companies also need to work for State Government sponsored dialect software development programs.

- Allocation of Rs. 1000 Crores is required for the execution of this project.

Allocation of 3-5% to be earmarked for IT investment by every Government department

The Government is one of the major investors in IT and as per government directive, around 3% spending of every department be earmarked for IT usage.

- It is suggested that this 3% allocation be made more effective and even pushed up to 5% in subsequent years. Also, most of the amount is spent predominantly on hardware. The Government should not shirk from spending on software and maintenance.

Realizing the benefits of information technology, most developed countries have been rapidly increasing IT spending not just in absolute terms but also as a percentage of GDP. IT Spending as a proportion of GDP in big-spending countries like the SU is expected to rise from 6.06% in 1999 to 7% by 2008.

- IT spending in India is estimated at 1.68% (up from 1.25% in 1998-99) as a proportion of GDP. This needs to be increased to 2 to 3%.

Spur computerization in specific sectors

- The Government should spur computerization and automation in specific sectors such as financial and banking services, transportation, healthcare, defense, railways, among others, in order to reach advantages to masses. Government agencies should go for major web enablement.

Implement e-governance within departments

The Central and various State Governments have already taken innovative initiatives in this direction. Further it is noticed that computerization benefits within Government departments are not realized on account of lack of trained manpower to implement and maintain the existing systems.

- States should further stimulate the growth of the software and services sector by implementing e-governance and outsourcing e-governance initiatives such as the issue of driving licenses, the payment of electricity bills and the filing of income tax returns to the industry.
- There should be a synergy between e-governance at the state level and the national level.
- The Government should ensure that technical manpower is actualized to effectively use the existing hardware and software. Manpower, particularly non-IT professionals within Government departments will have to be trained to absorb and accept the technology.

Encourage e-procurement

- To boost the domestic market, the Government should implement e-procurement on an experimental basis and review it accordingly.

Export Market

Move up the value chain

- To move up the IT services value chain from piece/part maintenance work to full project implementation. There is an opportunity for some companies to build IT consultancy completes life cycle practices to advice companies on IT strategy and architecture issue.

- The parameters of quality and bottom-line by shifting the business focus from Onsite to Offshore projects. Though the trend is already in favor of the offshore, but it needs a boosting strategy. Educated unemployment in smaller towns can be efficiently harnessed in software services business, especially when IP Telephony is allowed.

Build the India Inc. brand

Building an India Inc. brand is critical for India to achieve its revenue and FDI aspirations.

- Govt. can assist to build the India Inc. brand by the use of its influence with organization like WTO, WEF and other global forums to secure the comparatively free movement of knowledge workers globally.
- The Government should create a fund for marketing and enhance the Indian image abroad. This may require road shows, marketing presentation, etc. In addition the MIT should set up at least one large communication and data center in the US and Europe, which can act as the front end for ITES (IT enabled service providers).

- The focus of this campaign should be to place India as an overall IT savvy country, good choice for investment, exciting environment for attracting global companies and a nation that boasts top IT expertise and talent.
- An allocation of Rs. 100 Crores are required to be invested.

Supporting SMEs

SMEs constitutes 70% of the number of total units and contribute only 14% of total software export. If Indian industry has to achieve the target of USD 87 billion by 2008, it needs significant contribution from SMEs. In order to promote SMEs, innovative initiatives and support from Govt. might do wonders.

- Government should give priority to SMEs and bring them into the mainstream to play a important role in the growth of software industry and IT services. It should also play the role of an enabler and facilitator in the segments of venture capital (even though there are VC funds, they are not adequate), and market support.
- Plug and play facilities for start ups – to provide ready to use infrastructure on nominal rent basis for a certain period.
- Incubation for specialized applications for promoting the IT Enabled Services. Startups can be fostered through incubator organizations that can provide them with facilities, technical guidance and management support for a limited time.
- Academic institutions and industry through fellow programs, which provide internship in start-ups, can facilitate idea generation among SMEs. Graduate to business incubators- organization like STPI can act as a front end between academic institutes and industry for manpower support on internship basis. Also venture fairs can be organized that act as meeting grounds for start ups, investors and acquirers.
- Through foundations, technological and managerial cooperation between Indian SME companies and overseas companies could be established.
- During the X FYP, Rs. 1000 Crores can be set aside as a special support fund for SMEs to promote SMEs and support to market their products overseas.
- STPI should also set up a business exchange facility through a portal that attempts to get overseas buyers in touch with SME companies. The portal would have a comprehensive profile, skill sets and track record of SME companies in India. It would also attempt to make a compelling case for outsourcing to Indian companies to outsource to Indian SME developers. This is an opportunity area for India since most large Indian companies cover and cater to Fortune 1000 customers only leaving a huge market of SME companies untapped.
- It should also play the role of an enabler and facilitator in the segments of venture capital (even though there are VC funds, they are not adequate). STPI should play a proactive role for venture funding. STPI is well suited for this job as it has the technical and business bandwidth to be able to evaluate such projects better on one hand and it has also total viability on trends and new services requirement in the world markets on the other.
- Incubation centers and marketing hubs need to be set up overseas at least one in each continent. Incubation centres in Japan, Europe, Australia and US may be targeted by 2003. There is also a need to set up the business support centres in Tokyo, Europe and Australia to promote SMEs.
- For this purpose, STPI may be allocated a sum of Rs. 100 crores.

Enter into agreements with end user countries

The Government could assist in opening up new opportunity areas overseas for software and services companies by

- Securing agreements with end user countries and regional hubs on India specific visas and work permits.
- Providing fiscal and tax incentives for setting up dedicated offshore parks in target countries.

Alter profile of software content

- Indian software companies need to get into higher skilled development of complex and integrated software including visual computing, modeling, prototyping and simulation.

Focus on original technology

The Indian software industry has not produced enough original technology—original operating systems or computer languages and technologies that can be marketed globally. There is a requirement to beef up activity in this area.

- To become a leader of information technology and to move up the value chain India need to create original technology, IPR.

Expand the focus to markets outside the US and create a strategy for globalization

- In light of the existing US economic slowdown, the software industry needs to expand the focus of its activities to other markets including Canada, Latin America, Africa, Europe, Australia, New Zealand and South East Asia. Deeper inroads can be made into non-English speaking countries such as Japan, Korea, China and Singapore, among others.
- Globalization is a buzzword in the industry during 21st century. In order to take over the market better and to enhance customer confidence level, Indian software companies should adopt a strategy for globalization.
- It is suggested that at least three road shows be conducted every year during the X FYP period. The road shows will involve an estimated expenditure of Rs. 7.50 Crore, with Rs. 2.50 Crores proposed to be raised from the industry.

Marketing Channels and Network

- Joint-marketing effort by MIT, industry associations, quality accrediting and corporate representatives by opening liaison offices.
- Organizations such as the STPI could set up a software brand equity fund to help in the marketing activities, especially for the small and medium companies.
- Promotional offices in markets such as the USA, Europe and other parts of the world can be set up to market the products and services created by Indian IT software and services companies.
- Launching an independent "Trade Promotion Council" on the lines of "ITPO," dedicated to international exhibitions, embassy / consulate collaborated seminars
- Comprehensive market research & potential scouting is required. Teaming of NASSCOM-CMIE or services of even local and international research agencies like MODE, ORG-MARG, A.C.NIELSON could be sought in their strength pockets.
- There are many examples of coordinated and collective marketing activities. Ireland has established Industrial Development Agency offices in 17 cities in North America, Europe and the Far East, and many other nations have similar offices. In Chile, the Economics ministry subsidizes technical assistance and consultation, market research, preparation of promotional material, marketing design, and quality certification. They also co-sponsor the annual meeting of

Iberio-American Software Exporters and a regional trade show, maintain foreign offices, and aid the organization of software-producing enterprises.

Professional consultant to be hired

- Recognizing the fact that India has got a little success in marketing Indian manufactured shrink wrapped software packages and in order to give an impetus to this process, the government and industry should hire a consultant as a collaborative effort on long term basis, say for a minimum of two year period to ensure India as globally competitive for its products. The consultant will help them identify the underlying causes of failure and prepare a road to capture a significant share in the global market and implementation plan in this area.
- An investment of Rs.10 Crores may be allocated for this.

Key Thrust Areas

Some major areas of opportunity are emerging for the Indian software and services sector—both for the domestic and export markets. These include:

- Bio-informatics
- Embedded systems, high end chip design
- Network security
- Broadband Technologies
- Wireless Internet
- Quantitative and qualitative in skill set and software management
- E-commerce & M Commerce
- R & D Services

Bio-informatics

Biotechnology is giving a new lease of life to the information technology through Bio-informatics. Bio-informatics is a combination of computer science, Information technology and Genetics, which explores the world of bio-scientific research. Genomic (study of blue print for human life) and proteonomics (study of the actual building blocks, proteins, the living matter that genes produce) research requires a tremendous amount of computing power and computer science knowledge. It has spawned, and recently accelerated, a whole new field bio-informatics adding new potential to IT Industry.

Embedded Systems

Embedded systems and high chip design is an emerging market. It has proliferated in the recent past, especially in the Internet access device market, the consumer market and the small office/home office (SOHO) appliance markets. Devices that have made their way into the market include personal digital assistance, browser enabled cellular phones, automobile electronics, etc.

Opportunity segments

- Consumer electronics
- SOHO and home networking
- Industrial Automation including simple devices like sensors and motion controllers, etc.
- Automotive segment

- Real time operating systems
- Mobile computing

This market is growing at a rapid pace of around 42.3 % a year. Five segments within these markets are growing particularly fast. In information devices/appliances, information appliances are growing at 56.4 %, smart phones at 50.6 % and hand held companies at 37 %. Internet content and software are growing at 47.7 % and 40.7 % respectively. Information appliances, such as Cidco iPhone and Jini based appliances, will grow exponentially, rising in value from under US$ 1 billion in 1997 to US$ 44 billion 2008.

Indian companies are suited for the development of embedded systems on account of the fact that:

- India has a supply of highly skilled engineers and cost advantages
- This is one segment where Indian companies can exhibit their competitive advantage
- The offshore development model, which is the most significant selling proposition of Indian software services is particularly amenable to embedded software where constant client interaction may not be required

The market size, growth and potentially higher revenue productivity could make embedded software a significant growth driver for larger Indian software companies.

Network security

The Indian E-commerce market is expected to be over USD 5 Billion by 2005. In order to realize it, more people have to go for e-business. And it is possible only when people have the trust and confidence for this medium, after all trust is the corner stone for any business to happen. Secured networks can only help in creating a trusted e-business environment, which is becoming a backbone of Indian industry.

Emerging Technologies

Broadband Technologies

Consumers expect to surf the Web, download large files, and have real-time video conferencing and other tasks through a wireless communication link with the same data rates as their desktops. The consumer further expects a uniform user interface that will provide access to the wireless link whether shopping at the mall, waiting at the airport, walking around town, or driving on the highway. Broadband technology is the technology, which can achieve these parameters for reliable and secure communication worldwide. This is one of the key thrust area in telecom sector which boosts the existing sector to new dimensions.

Wireless Internet, 3G

 It is a 3rd generation communication system. The goal of 3G mobile telecommunication system is to deliver high bandwidth services to mobile users. 3G networks are designed to support full mobility, multi-environment. The growth in data and mobility are the key drivers for 3G networks which provide more flexibility for users and applications in both real and non real time. Wireless Subscriber base is increasing everyday with tremendous advancement in telecommunications; customer expectations for improved services spread and mobility grows. The landline in any of its form limits

the access to a global network because of its complications and limitations. Hence, it has become the need of hour to supplement the wired network with a wireless Internet.

Quantitative and qualitative in skill set and software management

As technology is growing at a rapid rate, there is a need for highly skilled manpower that should be equipped with the right technical skills not only in terms of quantity but also in terms of quality. In order to achieve the targeted GDP, software development seems to be one of the options to achieve the national goal.

Software, which is becoming the basic platform for all these developments, its management plays a vital role. Existing software development activities lack the qualities to qualify for a competent software development environment and management is the key area, which needs prioritized attention in order to maintain the lead in software export.

IT Enabled Services

The Internet and other advances in technology have ushered in the virtual age, where services can now be delivered remotely. Geographic boundaries has been dissolved as software companies provide customer interaction services, help desks, medical transcription, translation localization services, data digitization, legal databases, data processing, back office operations services, digital content development, remote network management and specialized knowledge services to customers in the local and foreign markets.

IT Enabled Services or Remote Processing services are today being considered a hot growth market for the Indian software and services industry. This is a sector that is expected to generate significant employment opportunities in the future. As per McKinsey & Co, activities accounting for over half a trillion US dollars could be performed by global IT enabled services by 2008. The two most promising segments in IT Enabled Services during 2001-02 are Customer Interaction Services including Call Centers and Content Development and Animation.

As per projections, IT Enabled Services can generate revenues of Rs. 81,000 Crores and provide employment for 1.1 million people in the next eight years.

Growth factors for remote processing services

The growth factor is in evidence due to the following factors:
- IT Enabled Services revenues jumped from Rs. 2,400 Crores in 1999-2000 to Rs. 4,100 Crores in 2000-01.
- This segment of the software industry currently employs 70,000 people and accounts for 10.6 % of the total IT software revenues.
- In the current year, the sector is expected to show a high growth of 54 %, well above the industry average, which is being pegged at around 40-45 %. Revenues during the year for IT Enabled Services are expected to touch Rs. 6,300 Crores .
- Already a large number of players are operating in this market including key MNCs that have set up their call centers to cater to the requirements of both the overseas and domestic markets.
- Some of the other IT Enabled Services activities that have witnessed a rise over the last two years include medical transcription, and back-end processing operations.
- The offshore economics of IT Enabled Services is as good as those of IT service. Revenues per employee for many areas of IT Enabled Services are comparable to those of IT services.

- India's value proposition is already leading IT Enabled Services hubs such as Ireland and Singapore to back-end their operations in India.

E-business solutions

The Indian IT industry should target to earn $4-13 billion from e-solutions services by 2005 according to a recent study undertaken by the Boston Consultancy Group (BCG). The worldwide market for e-solutions products and services was USD 180 billion in 2000 and is estimated to grow to USD 640 billion by 2005[1]. Over the last decade Indian IT services firms have positioned themselves as a credible provider of IT services. They can leverage their past success and the current market opportunity and aspire to achieve revenues of $4-13 B (1-3% share of the overall e-solutions services market) by 2005, and $ 13-33B (2-5% share of the overall e-solutions services market by 2010)

Meeting the above aspirations would require a modified approach as compared to traditional IT services assignments due to the way e-solution services are sold and implemented. Indian companies will need to build capabilities and adapt their strategy and approaches in two broad areas.

- Modify marketing and implementation approach to suit sales of e-solutions; and
- Build domain expertise in select industry verticals/e-solutions products

The Indian IT industry should aspire to target $ 1B of revenues from e-solution products by 2010

The BCG study further states that there are significant challenges for Indian IT firms to develop a credible reputation in product development. Indian IT firms should set themselves an aspiration to achieve revenues of USD 1 billion (0.25–0.5% of the overall e-solutions products market) by 2010 and set themselves a yardstick with which to measure their success in the future, BCG says.

In order to meet the above aspiration, Indian firms need to develop the following three items:

- Capabilities for identification of opportunity space based on an understanding of product maturity;
- Process for product development through collaboration with leading edge end user clients; and
- Partnerships with system integrators, and value added resellers for rapid commercialization and roll out.

R&D Services

R&D services, a small part of India's software exports till a few years ago, has suddenly taken off and crossed $1 billion. It has become a serious alternative to traditional IT services or high end consulting. R&D services are less vulnerable to slowdowns, and often earn companies more revenue per employee. If Indian firms want to make world class products one day, R&D services are the first milestone. It is estimated that India today employs about 30,000 people in R&D services and that this segment is presenting a new opportunity. A Merill Lynch study expects revenues from India-based R&D services to touch $4 billion in the year 2005, possibly 17 % of India's software exports by then.

A broad range of IT companies is outsourcing R&D from India. These include players such as Cisco, Lucent, Texas Instruments, Nortel Networks, Compaq, Intel, Sony, Fujitsu, and Nokia. There are also several smaller players and even many start ups. A large number of technologies are also being developed here in the areas of basic telecom, data networking, mobile technologies, home networking, chip design, automotive and medical electronics, operating systems, storage area networks, etc.

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[1] Source: IDC, BCG Estimates and Analysis

Chapter 4: IT Infrastructure

1. IT Infrastructure - Scope

IT Infrastructure comprises of the equipment and systems, which allow data communication facility to take place from & to, any corner of the world. The main constituents of IT Infrastructure are as below:

- National Communication Backbone
- International Communication Backbone
- Last Mile Access/ Connectivity
- VSAT Infrastructure & Services
- Internet Service Providers (ISPs)

2. Status and Review of the Ninth Plan Achievements

The most important landmark in telecom reforms came with the New Telecom Policy 1999 (NTP-99) which can be termed as the **3rd generation of reforms** (1st and 2nd generation reforms were in eighties and early nineties).

Its first qualitative difference was the acceptance by the government that telecommunications was a sufficiently important for common man whereas earlier it had been viewed as a "cash cow". The major departure in the policy was scrapping of the policy of inviting bids for grant of licenses to the private sector. The thrust now is, to go in for revenue sharing model instead of making the investors to pay to the government right up-front, before earning out of the services licensed.

The other important out come of the NTP-99 is that of introduction of Universal Service Obligation (USO) with a view to achieve balance between provision of universal service to all uncovered areas, including rural areas, and provision of high level services capable of meeting the needs of the country's economy. The amount so collected as USO, would be used to subsidize the services in rural areas which as such are uneconomic for investment. It would be termed as "USO Fund" and managed by an independent body.

In line with the NTP – 99, telecom sector has been *opened up* as per details below:

1. Basic Services (Fixed Line Telephony)
2. 2. Mobile telephony
3. Internet Service Providers (ISPs) including International Gateways (Satellite or Submarine Cable based), except VOICE (which is likely to be opened-up by March 31st, 2002 with the ending of VSNL monopoly on the same.
4. National Long Distance Operations (NLDOs).
5. VSAT networks as Closed User Group (CUG)
6. The service providers are allowed to set-up last mile facilities (cable or wireless) in their service area.

7. **Foreign Equity** [2] has been permitted as per details in **Table – I.**

Achievements of the Ninth Plan

During the period, investment of about US$ 160 Bn was made (Public Sector - US$ 135 Bn and Private sector - US$ 25 Bn). However, investment by the Private sector has only been around 15% of the total investment and nearly 20% of the investment made by the public sector. Details of the cumulative status of the telecom infrastructure, are summarized below and in **Tables II, III & IV:**

TABLE - I FOREIGN DIRECT INVESTMENT		
S.N	**FDI LIMIT**	**TELECOM SERVICE**
1.	100 Percent	◆ Internet Services (without international gateways) ◆ NLDO Infrastructure Providers (Category – I) ◆ E-Mail services ◆ Voice Mail services

a) VSNL has about 43 satellite based International Gateways (Std-A-9,Std-B-8, Std-C-2, F3-10, F2-1, F-7 & H4-6) through out the country.

b) STPI has set up 20 Software Technology Parks each with dedicated satellite based International Gateway. As per the ISP Policy, about 120 ISPs have obtained approval from DOT for setting-up their own satellite gateways. However, till now about 12-15 gateways only are operational.

c) There are three submarine OFCs terminating at the premises of VSNL as per details below:

o FLAG – **Mumbai** 10Gbps (US$ 150 Mn invested) – connects to UK, Spain, Italy, Egypt, UAE, Soudia Arabia, Thailand, Malaysia, Indonesia, Hongkong, Korea and Japan.

o SEA-ME-WE (SMW 2 & 3) – Mumbai & Cochin – connect via Singapore to East France.

d) In the private sector, two of the ISPs (Bharati & Dishnet), have announced setting up of their own International Optical Fiber Cable landing stations in collaboration with Singapore Telecom & South-East Asian Cable Network (SEACN). These cables would be capable to handle data rate up to 8.4 Tbps & 2.6 Tbps, respectively. However, they are expected to be ready by end of 2002.

e) The VSAT (Very Small Aperture Terminals), technology, is the most popular solution for providing connectivity at remote, hilly and low population areas, where laying of cables is not possible as well as, is not financially viable. VSAT systems are also very useful for emergency and disaster management applications due to easy and faster deployment and direct transmission with the satellite. As a result of the technology advancements, VSATs operating in Ku Band, are one of the popular media for Direct-To-Home (DTH) TV, Internet access (Satellite Internet) etc., since the same can operate with small roof top mounted antenna of diameter 0.8 – 1.2 Meters. About 4,928 VSATs were installed in 2000-01. This increased the overall tally of VSATs installed in the country till 31st March 2001, to **17,545**.

2.	74 Percent	♦	Internet services (with own international gateways)
		♦	NLDO Infrastructure Providers (Category – II) – End-to-End bandwidth.
		♦	Radio Paging Services
3.	49 Percent		National long distance services
			Basic telephone services
			Cellular mobile services
			Other value Added services

3.
4. **TABLE – II**
5. **GROWTH OF PRIVATE SECTOR SERVICE PROVIDERS**

PURPOSE / AREA	EFFECTIVE	LICENSE ISSUED
Cellular Mobile Phones (CPMs)	8	8
Cellular Mobile Phones (CMPs)	14	34
Basic Services	6	6 – Lic., 40 - LOIs
IP – I	10	10
IP – II	5	5
Internet Service Providers (ISPs)	384	456
ISP Gateways permitted	62	240
VSAT services	10	10

At present, all the ISPs have about **1Gbps,** for Internet services (VSNL: 863Mbps, STPI: 35Mbps and Private ISPs: 150Mbps) and 868Mbps is being used for International Private Leased Circuits (IPLC) for software exporters (VSNL: 798Mbps, STPI: 70Mbps). There were nearly 3 million Internet subscribers as on 31.3.2001 as against, 0.96Mn in 1999-2000 and 0.24Mn in 1998-99 & achieved CAGR of 190%. On the basis of 1 Subscriber resulting in to 3 Users (average), the total number of Internet Users in India stood almost at 9 Million.i.e

f) The equipment required for the area of IT Infrastructure, comprises systems like, Satellite Earth Stations, Networking Equipment/ Systems, Network Management Software, VSAT systems, Test and Measuring Instruments etc.. Most of these equipment are imported and there is adequate representation of these manufacturers to provide after sales support etc.

h) International Comparison:

Internet, however, is still at nascent stage in India. It is expected that actual growth of Information & Communication Technologies (ICT) would take place during this plan.

Details of the bandwidth flowing from the USA to develop & developing countries are as under:

- ❑ Between USA and Europe: 56.24Gbps
- ❑ Between US –N & S : 02.64Gbps
- ❑ Between USA and Africa: 00.47Gbps

International scenario of Internet penetration in other countries, is as given in Table – V. **India has a long way to go………………………..**

TABLE – III GROWTH OF TELECOM SERVICES					
TYPE	YEARS				
	1997-1998	1998-1999	1999-2000	2000-2001	2001-2002
Fixed Lines in Million.	17.8	21.61	26.65	32.71	40.53
Cellular Mobile in Millionn.	0.88	1.20	1.88	3.58	5.58
Tele-density / 100	1.93	2.32	2.86	3.58	4.49
Internet Subscbrs/ 1000	0.14	0.25	0.85	3.00	-

TABLE –IV GROWTH OF RURAL TELEPHONY					
ACTIVITY	YEARS				
	1997-98	1998-99	1999-00	2000-01	2001-02
Fixed Telephones (Mn)	2.84	3.65	4.82	6.69	8.29
Tele-density/ 100 persons)	0.41	0.52	0.68	0.93	1.14
Share of Rural Areas	15.2	16.0	16.9	18.4	18.0

3. Inadequacies and Constraints

There are several constraints in the existing system due to which the infrastructure has not been comparable to international standards.

Table – V International Comparison for Internet Density			
COUNTRY	INTERNET USERS (%)	TELEPH - ONES (%)	PCS (%)
SINGAPORE	37.0	56.2	53.3
HONGKONG	27.8	55.8	30.2
JAPAN	23.1	50.3	29.8
AUSTRALIA	42.7	51.2	48.1
NEW Zealand	29.7	47.9	33.0
PHILIPPINES	01.4	03.7	01.8
MALAYSIA	06.5	19.8	07.0
CHINA	02.6	16.4	01.6
INDIA	00.3	03.3	00.6

The most critical aspect of the Internet use in India, is the VERY HIGH cost of the Bandwidth as compared to other countries, specially USA. This is so since Internet has grown in USA & therefore, in order to get best results out of Internet, any of the ISPs will have to get connected to a US ISP.

Details of Inadequacies & Constraints

1. **Fragmented Policy regime**

Policy for development of Information Technology sector, is carried out independently by two agencies of the Government viz., MIT and DOT. Telecom infrastructure plays the crucial role in the growth of IT and therefore, unless planning for the Information and Communication Technology (ICT) is carried under one roof, the desired results may not be achievable.

2. **Subsidized charges of Telecommunication services**

Communication services have so far been regulated through subsidized pattern of charging and as a result, it has no relevance with the return on investment. There are anomalies as well, since charges are decided based on the per capita income of the people i.e. more the calls, more the tariff, which in fact, acts as disincentive instead of incentive, if the utilization of the telephone is high. World over the telecom tariff is cost-based and there is incentive for more and more use, i.e. tariff goes on decreasing with the increase in traffic from a telephone account.

3. **Lack of coordination among bodies having infrastructure**

No coordinated and forward looking planning. If coordinated suitably and included as mandatory provision in the plans of Ministries/ Departments/ Organizations responsible for other infrastructure like Roads, Rail, Gas/ Oil Pipes etc., by now there would have been ducting available through-out the country and that too in a very cost effective manner. It would have enabled, faster laying of the cables and saving in several months of loss in organizing Rights of Ways (RoW) etc.

4. **Restrictive approach to Licensing – Technology neutrality not implemented**

Technology neutrality not respected in its entirety i.e. most of the permissions/ approvals for telecom services are technology specific for example, in VSAT licenses technology specified is TDM/TDMA, bandwidth restrictions and so on. These are counter productive measures and even worse is their negative effect on the economies of scale of services. In other words, bundling of services on a common platform, media etc. is not encouraged.

5. **Decrease in Quality of Services due to lack of tough competition**

There is no focus on the Customer Relation management (CRM) services mainly due to absence of serious competition and as a result there is extreme and wide-ranging dissatisfaction among the masses.

6. **Opening – up of Telecom sequentially in several steps**

Artificial fear of losing business, when monopoly is ended, has made the liberalization exercise difficult and slow due to several entry barriers, still existing, in form or the other. Liberalization could not take place in one go, but it happened sequentially in different intervals. Due to these problems, the take off by the private sector has been slow and on the other hand, whatever investments are made, are far from the break-even. ISPs & others, are facing a severe financial crunch.

7. **High Licensing Fees/ Performance Guarantee – still vogue**

There is concept of collecting huge amount of license fees etc. right in the beginning at the time of granting permissions, which has gone in the favor of only handful of well established houses and there is practically no scope for the professional groups to make any dent in this area. For example, the requirement of Rs. 500 Crores deposit (cash and in BG form) for NLDOs and then the cases of Mobile and Fixed Telephony, are some of the examples due to which, in spite of best efforts, there has not been great success.

8. Interconnection of networks not allowed

Interconnection of networks is not permitted seamlessly. This, from the point of users, is a serious issue. Today, convergence of technologies has made it possible for any user to avail all the services of Voice, Data and Video through one box installed at home, but because of restrictions on interconnection and neutrality of technology not being respected, users are denied benefits of the technology.

9. Lack of Dynamic Policy to keep pace with the vibrant technology

The information technology is developing so fast that it has become difficult to keep track of the same. However, there is no escape and benefits of the same must be passed on to the public. Therefore, there is need to adopt 'Dynamic Policy regime, where the entire policy framework should be reviewed seriously in a period of short duration, say, every two years and all bottlenecks removed. Such reforms should not take decades to happen.

10. R&D through Private Sector, not in the schemes of Government of India

Government of India has taken various steps to promote research and development by the public sector but there is no serious focus to promote the same in the private sector.

11. Promoting Privatization process in the first 3-4 years

No serious focus on addressing the business issues which has resulted in to fragmentation of investment plans and unlivable capacities. However, Govt. has a role to play in getting business opportunities to the ISP's so that they reach break-even faster and thereafter, pass the benefits of the cheaper services to the customers.

12. No norms for Internet QoS

There are no norms framed by TRAI for the Internet services. As a result there is no check of any kind on the level of services being offered by various ISP's.

Further, since the costs of the international connectivity are still very high, ISP's prefer to club several customers on one port of the router. For example, the present ratio of sharing a 64Kbps link., is of the order of around 300 persons, which is too low and poor.

Therefore, there is need to fix Minimum and Maximum through-put available to any customer from the ISP's and the same should be made part of the Service level Agreements between the user and the ISPs.

4. Tenth Plan imperatives & Strategies

Tenth Plan of the Government of India has special significance since it happens to be the first five year plan of the 21st Century which is passing through the IT Revolution which has brought a paradigm shift in the manner businesses would be conducted in the future. IT would be the vehicle of growth of the nations and its share in the GDP would become the measure of the relative growth of the nations world over. IT is the main focus area of India due to tremendous export potential.

The overall objective of the 10th plan, would be use Information Technology for the economic and social development by way of addressing the following:

❖ Affordable and effective communication facilities to all the citizens.

❖ Enabling Indian IT companies to become truly global players.

❖ Building a modern and efficient telecommunications infrastructure to meet the demands for the "bandwidth hungry" and mission critical applications.

❖ To devise and implement the rules and regulations permitting convergence of telecom, IT and media in order to make available, cost effective solutions to the common man.

❖ Transformation of the telecommunications sector to a greater competitive environment, providing equal opportunities and level playing field for all players.

❖ To introduce IT for all applications in the Government system of functioning through the program "e-Government" and provide greater flexibility and convenience to the citizens.

❖ To provide Internet access in all the schools, colleges etc. with a view to develop talent and intellect among the future generations.

❖ To promote the Indian IT potential vigorously to enable India to move towards becoming global super power in the area of Information Technology.

Internet demand drivers

The demand for the IT infrastructure would mainly be driven by the following important sectors of the economy:

❖ Export sector, specially the export of IT Software, Services & IT Enabled Services
❖ E – Commerce applications
❖ E-Governance
❖ E-Learning
❖ Initiatives for bridging the digital divide like the Community Information Centers (CICs)

IT Software & Services

IT Software, Services and the IT Enabled Services, are among the major users of the It Infrastructure and the communication bandwidth. This sector is very sensitive to the quality as well as the size of the infrastructure required. India has several advantages over other developing countries and therefore, has a definite niche in this area. Therefore, requirements of the same, are required to be addressed properly so that there are no gray areas resulting into set-back to its performance.

IT Enabled Services are bandwidth hungry applications and therefore, proper care is to be taken to size the infrastructure i.e. communication backbones etc.

Software Exports in the last five years

IT software and services export sector, is the most important niche of India. The success of reaching mark of US$ 6.2 Bn export by 2000-01, has lead India to fix a target of US$ 50 Bn export by the year 2008, as per details below in Table – VI.

TABLE - VI

LAST 5 YEARS			BY YEAR 2008-09		
Year	Export (Rupees Bn	Exports (US$ Bn)	Market Segment	Total market for India (US$ Bn)	Exports (US$ Bn)
1996 – 97	37	1.0	IT Services	38.5	23
1997 – 98	65	1.5	Software Products	19.5	8
1998 – 99	109	2.4	ITES	19.0	15
1999 – 00	170	3.8	E- Business	10.0	4
2000 – 01	285	6.2	Total	87.0	50

E – Commerce

Internet's killer application, World Wide Web (WWW), has revolutionized the information sharing through the net, setting up of shops, stores, libraries, class rooms, discussions rooms, music/ video parlors, cinema halls, Universities, colleges and so on.

As a result of this innovation, Internet processes, have been oriented towards commerce applications since it is going to bring paradigm shift in the manner business is being and would be conducted in the future. It would be possible to order every thing right from the home PC, may it be grocery items, gifts, books, air lines tickets, cinema hall tickets or whatever. In other words, the need for the Internet is going to be driven heavily by the E-Commerce applications.

E-Commerce would take place in the following two modes:

- Business – to – Business (B2B) e-Commerce
- Business – to – Customer (B2C) e-Commerce

TABLE-VII B2C E - COMMERCE		
S. N	**Industry**	**B2C** (US$ MN)
1.	Telecom Services	300
2.	Consumer Electronics	200
3.	Travel	250
4.	Automotive	250
5.	Financial Services	250
6.	Books	100
7.	Music	100
8.	Others	50
9.	**Total**	**1500**

A per study by Boston Consulting Group, growth of e-commerce in India would take place as per details

The findings of BCG are based on the assumption of **35 Million Internet Users** by 2005-06. As a matter of fact, in the area of e-Commerce, both connectivity and content will have to grow together and generate enough awareness. People must understand the advantages and the tangible gains they will get, otherwise, no one would use these services just like this.

Internet penetration across the country with almost uniform density rate would be pre-requisite to start any such business using e-commerce. Therefore, Government must come out with plans to take IT to masses.

TABLE – VIII	B2C E - COMMERCE	
S. No	Industry	B2B
1.	Automotive	30-35 %
2.	Consumer Goods	25-30 %
3.	Computers	25-30 %
4.	Pharmaceuticals	10-20 %
5.	Metals	10-20 %
6.	Telecommunications	10-20 %
7.	Financial services	10-20 %
8.	Chemicals	10-20 %
9.	Agricultural products	10-20 %
10.	Textiles & other consumer goods	10-20 %
11.	Refineries	0-10 %
12.	Shipping/ transportation	0-10 %
13.	Industrial/ electrical machinery	0-10 %
14.	Services	0-10 %
15.	Paper/ office products	0-10 %
16.	Construction	0-10 %
17.	Utilities	0-10 %

B2B e-Commerce

B2B transaction volume is expected to touch **US$ 50 Billion** in India by 2006-07 or as per the details given in Table – VII.

B2C E-COMMERCE:

In India, B2C transaction volume is expected to touch **US$ 1.0 to 1.5 Billion by** 2005, as per the details

E-Governance/ E – Education:

E-Government, E – Learning and IDCs would also greatly influence the need for higher bandwidth on the Internet.

E-Government is the transformation of public sector internal and external relationships – through Internet - enabled operations, information and communication technology – to optimize government service delivery, constituency participation and governance. While, the **E-Governance** is the development, deployment and

enforcement of the policies, laws and regulations necessary to support the functioning of a digital society and economy, as well as e-government.

Therefore, e-Governance is about more than building Web-enabled front for old back-office applications. It is about transforming the ways people govern themselves. Governments based on geographical space will need to re-examine their roles in a connected world.

E-Education would include educational portals and whole lot of academic database. Distance education/ virtual colleges etc. would become very popular in the times to come since it is an immediate solution to solve the problem of getting experienced faculty for new academic institutions. For example, it may perhaps be possible to double the number of IITs (from 6 to 12) by just introducing the e-Education methodology, while the number of faculty remains the same.

IDCs (Internet data Centers) would grow with the rise in e-Commerce, E-Governance, E-Education etc. As the volume of content goes on increasing and cliental base also expands, it would be difficult to self-manage the Servers as well as ensure uninterrupted 24/7/365 level service. This would, in turn push the business of the IDCs.

Human Resource Development

Human Resource Development for the IT Infrastructure is extensively technology oriented and requires development of specialists in different fields of Networking and Communications like IP Switching, ATM, Satellite Communications, Photonics, Network integration, Security etc

There is no structured and serious focus in the country for this kind of high end manpower development. The Staff Training Institute of Department of Telecom has been only one such body focused on this type of professional development. However, the same is required to be further supported to maintain technology tracking and updating the programs.

The Media Lab Asia, could become one such professional body to develop talent and expertise. Industry – Academic joint ventures are required to be encouraged. It can further lead to sponsored research and development as well.

Details of the manpower projections and the specialized areas in which requirement of professionally trained persons is, very high and

TABLE – IX MANPOWER PROJECTIONS		
S.NO	YEAR	MANPOWER
1.	Year 1	6 396
2.	Year 2	14 475
3.	Year 3	37 398
4.	Year 4	76 152
5.	Year 5	139 987 [140, 000]

	TABLE – X MANPOWER REQUIREMENTS [SPECIALIZATION WISE]			
	DOMAIN	%	2006-07	SKILLS / CERTIFICATIONS REQUIRED
1	Network Engineers	20%	28000	Windows NT, UNIX, Novell, Linux/ MCSEs /Certified NetWare Engineer/ Administrator (CNE/A) /Cisco Certified Network Associate
2	Network Administrators	20%	28000	
3	Internet Developers	20%	28000	Visual Basic Visual C++/ HTML/ASP/Java / JavaScript
4	E-Commerce	15%	21000	
	Network Security/Manager/ Firewall/specialist	15%	21000	Security related HW & SW experience/ LAN/WAN management & systems administration (Windows NT/2000, UNIX/ Linux/ Background in VPNs, TCP/IP/Intrusion Detection/ Firewall implementation
5	Database Administration/ Managers	10%	14000	Manage, maintain & develop database systems/ Systems integrators proficient in working with applications from, SAP, Siebel, PeopleSoft, Oracle etc./ Java programmers experienced in integrating Internet applications with corporate databases.

Targets & Investment projections for the Tenth Plan

The requirement of the IT Infrastructure would be driven mainly by the demand generated by the user sector i.e. (i) IT Software, Services & IT Enabled Services, (ii) E-Commerce, E-Governance, E-Learning & others and the Community Information Centers.

Details of the growth and the 10th plan targets for the above user sectors, are given in **Table – XI**.

Targets and Projections for IT Infrastructure requirement

In the last four years, Internet grown to level of three (3) Million subscribers. The Composite Annual Growth Rate (CAGR) of 190% has been achieved during this period of four years. As a result of the all round efforts of Government and industry, Internet is going to grow in India in the next couple of years. The applications of e-Government, e-Education and e-Commerce would be the driving force.

As per the feedback from industry and discussions with ISPs Association of India, the CAGR of 190% would not be feasible in the future. However, the service providers expect CAGR of 50 – 60 **%** during the 10th plan period. Accordingly, with the CAGR of about **60%,** projected Internet growth would be 4**0 Million Subscribers by the end of the plan and 100 Million by 2008. It would result in to around 100 Million USERS by the end of the plan and 250 – 300 USERS by 2008.** *(We have based all calculations on the basis of actual subscribers. In respect of users, there are different views on the number of persons sharing one subscribed connection. Therefore, projections and targets are fixed in terms of the number of subscribers).*

Bandwidth required for the connectivity services:

The bandwidth available for Internet from India is about 1Gbps and the same is being shared by 3 Million subscribers (9 Million users). Therefore, the minimum throughput available to a user is as low as 100bps. This is the main reason of poor quality of Internet services in India.

As per the study by NASSCOM, capacity of the bandwidth for connectivity to Global Internet is of the order of 300 Gbps by the year 2005, as per the details given in Table – XII. However, these projections could be achieved since the expected growth of Internet could not take place due to very high telephone tariff and high cost of

Internet Access charges of the ISPs are nominal, the high cost of the telephone lines, is discouraging many from subscribing. The problems has got compounded with the poor quality due to so low bandwidth. Majority of the Internet users are going to be the individuals, house-holds, students and so on, for whom, dial-up is the only feasible access mechanism. Therefore, this situation, if not corrected, would have negative impact on the growth of Internet in the country.

TABLE - XI	10th PLAN TARGETS OF USERS	
ITEM	2000-01 (US$ BN)	TARGET (06-07) (US$ BN)
IT Software & Services **Export**	6.2	33.0
IT Software & Services **Domestic**	2.0	18.0
E-Commerce (B2B)		50.00
E-Commerce (B2C)		1.50
E-infrastructure [ERNET Expansion]	-	2385 Nos.
E- Infrastructure [VIDYA BAHAN]	-	60000 Nos.
Community Information Centers	487	6000 Nos.

TABLE – XII LOCAL ACCESS PROJECTIONS	
PARTICULARS	**2006-07**
I) Internet Subscribers	**40 Mn**
2) Local Access	
• Telephones / Cable TV/ WLL	**35 Mn**
Leased Lines (High Speed) OFC, Cables, Wireless, DSL	**05 Mn**
PCs / TVs with Set-Top boxes	**40 Mn**

The bandwidth would be increased only when, the number of subscribers increase, telephone costs are reduced, Government takes the lead to devise measures for improving the viability of ISPs (Tax concessions, create new markets etc.), private investment flows in NLDOs, International Submarine Cable systems, Basic Service Providers offer competition etc.

Based on the likely progress on above issues, international bandwidth required to meet the demand, has been estimated as below. It has been assumed, that with the coming up of National Internet backbone of BSNL and other OFC systems, in the corporate and select house-hold, there would be shift from narrow band systems to broadband systems and adequate provision has been made for the same. By the first two years of the plan, around 10 00 000 RKM OFC is expected to be ready by public and private service providers.

TABLE – XIII INTERNATIONAL BANDWIDTH		
YEARS	GBPS	COMMENTS
2000	10	Since these requirements for Internet have not materialized, it is expected that the same would now be met with during the 10th Plan. So the same requirements would now be for the years 2002-03 to 2006-07.
2001	40	
2002	100	
2003	160	
2004	220	
2005	300	

These targets/ projections can only be met if the PC targets are enhanced and/ or, the use of TVs through Set-Top boxes is promoted through very low cost solutions.

Most of the users would prefer Dial-up solutions but unless telephone charges are brought down, it may not happen. At the same time, Internet through Cable TV systems would have to be encouraged. It requires replacement of the broadcast quality cables to allow duplex transmission and education of the operators. It should be possible to keep low charges got Internet through this mode.

Investment Projections:

In order to assess the overall financial requirements, both on capital side and working capital side, have been estimated based on the statistics available from various sources The total capital investment needed during the plan, would be around **US$ 160** Billion as per the details given below in Table – XIV.

TABLE – XIV	INVESTMENT PROJECTIONS	
S.NO	DETAILS	INVESTMENT (US $ Bn)
1	**By Private Service Providers**	110.00
2.	**By DOT companies**	30.00
3.	**By Users of the Services**	57.50
4.	**By Government**	02.50
5.	**Total**	200.00

DOT has estimated investment of around **US$ 30 Billion** for the telecom network like telephone lines, mobile, ISDN, OFC, Microwave etc.

Thus total investment during the plan, is likely to be **US$ 200 Bn**.

ISPs would require about **US$ 25 Billion** Working Capital limit.

Areas for Technology Development and absorption

India is almost neck-and-neck with developed nations in terms
Bleeding-edge developments are still coveted, but the market is also looking more and more for technologies that stand a strong chance of offering a short-term return on investment. Following are the main areas, which have been tracked down for deeper understanding and development:

IP Storage

As per a study by IDC, the server storage is expected to reach **1.3 million Terabytes** by 2002. Therefore the IP Storage is the next emerging area for development. The advent of gigabit Ethernet, has already allowed the Ethernet pipes to handle speeds like 100 Mbps. However, the issues to be tackled here are those of, overcoming security and packet loss. The Internet Engineering Task Force (IETF), is expected to come out with initial standards by this year.

Wavelength Switching – Photonics

The development of moving data at the speed of light through Optical Fiber Systems, has made the carriers further innovative. It is possible to send gigabits of data through single strand of fiber. However, the bottleneck is at the Central Office (CO), which is based on a Synchronous Optical Network (SONET). Manipulating an optical signal in the CO still means turning it into an electrical signal, which involves opto-electronic boxes that can break it down into its 64Kbps component parts. This can be solved by development in Photonics devices that simple bounce the light around the network from source to destination and eliminates the need for going to electric and manipulate the light.

The transmission speeds due to Photonics have gone up from 1.5/2/34/45 Mbps for electrical interfaces to the range of 155Mbps to 10Gbps.

The Internet Engineering Task Force (IETF) has come out with Multi-Protocol Lambda Switching (MPLambdaS) interoperetability initiative , which seeks to bring standards to how wave-lengths of bandwidth could be identified and assigned on demand across a network of photonotic cross-connects.

Therefore, the wavelength switching would migrate from unintelligent optical cross-connects to intelligent 'wavelength routing, which will allow instantaneous 'on-demand' automated provisioning of optical circuits across large optical backbone with optimal bandwidth utilization.

Peer –to-Peer Networking

Peer-to-Peer networking, also known as distributed networking, involves a bunch of computers clubbed and networked together, via Internet or cable.

The new technology under development for the last several years is that of using the unused processing power on a network by letting PCs and servers talk directly to each other and thus they can work both as clients and servers. The technology has significant impact on the utilization of the common resources and thus lower the overheads.

IP Billing

The billing systems have undergone paradigm shift due to need for real time, get billing based on session length in a totally 'all-packet' environment. The future of IP depends heavily on IP billing systems on the benefits passed on to the carriers and users. What is required is the features which allow the carriers to bill the content used for the period.

The challenge of these billing systems lies in the fact that in packet mode where transmission can follow any available route, the packets carrying information like Video or voice, are required to be traced and sent to the billing system.

It has been forecast that the market for IP Billing, which **was US$ 110 Million in 1998,** would grow to the top of several billion dollars.

Thin Servers

Thin servers are developed to save on cost while not compromising on the quality. Space – efficient, 1.75-inch-high servers – called 1U, are already available. It has become feasible to fit-in 20 – 40 servers in a rack. These are available as 1U (sufficient for e-mail etc), 2U, 3U, 4U – 8U etc.

The challenge, however, is to **increase the processing power**, make power use more efficient – by deploying Photon Servers, common resource located at the bottom of the rack rather than each server having individual device, remote management capabilities etc.

The cutting edge effort now is to bring servers **below 1.75-inch** height. [RLX Technologies Inc. (Houston) has already done it by developing thin servers which can be as much as 336 in a rack – called "Bladed Servers" which use only 15w per unit compared to 75W in other servers].

EDGE Computing

To meet the demand of the higher performance web sites and speedier delivery of the web sites, the service providers are placing intelligence at the edge of the network., caching content and routing capabilities closer to the user instead of at the core of the network. This technology decreases the amount of bandwidth necessary to deliver content, limits traffic jam, lowers connection costs and speeds up performance by lessening the need to travel to the main server at the core of the network. In other words, the servers at the edge of the networks, are acting as mini data centers. This would facilitate wide band streaming to take place.

Another advantage is that once the service provider has down loaded the matter from the web, it can further distribute the same to its clients without need for each of them to go to the main web site, time and again, thus improving the content delivery.

The main barrier in the picking up the demand of these servers, is the cost. Since with shift of the intelligence to the edge of the network the cost at the edge has increased substantially. Therefore, next challenge is to bring cost reduction and develop innovative solutions to derive maximum benefit from this feature of EDGE Computing.

Home Networking

The awareness that Networks and PCs have started delivery of a variety of services at home itself, has pushed the use of the same. Many house hold are going in for more than one computers and then network them for deriving maximum advantage. Advantages flowing out of convergence of technologies of Voice, Data & Video, will push the technologies to more refinements in the future. Therefore, development targeted towards home networking with emphasis on low costs for devices, is going to be the profitable area.

Wireless networking is going to find greater use in house hold because of its advantage of mobility to any place in the house.

Cable Telephony

The three major electronic forms of electronic communications telephone), Cable TV and Internet are converging. The emergence of Data Over Cable Service Interface Specification (DOCSIS) 1.1, the latest protocol released by standards body Cable Television Laboratories Inc., not only enables public switched telephone network (PSTN) – like quality of service (QoS) for VoIP over cable systems, but it has also given cable telephony real reason to become the most popular.

The next generation of these systems would target securing larger profit margins through deployment of stronger applications. New software-based switches and routers will go a long way toward enabling a

growing number of enhanced services. The future will be driven by just one cable which will connect to TV, PC and Telephone.

The challenge ahead is the competition emerging from the Cable TV operators and the Telephony companies who are both trying to bundle all of these services over cable and telephone line respectively. The telephone companies are deploying DSL to manage deliver of Video content.

Multi-Access Platforms

The need to bundle the services of voice, data and video in one box, is pushing better solutions which are cost effective and easily manageable. Today there are multiple boxes for each of the services but they are required to be merged in one box, i.e. both Time-Division-Multiplexing (TDM) voice and Circuit Switched Traffic. Sitting at the edge of the network, these multi-service edge devices consolidate the functions of a number of normally separate devices such as Digital Cross Connect, SONET and ATM, Add/Drop Multiplexers (ADM, Frame Relay and ATM Switches and other devices – into one box.

The challenge in this area is not that of technology development, but of testing the best and cost effective solution since there are several vendors promising to deliver every thing possible.

Voice on DSL (VoDSL)

The biggest challenge the conventional telephony companies are facing , is that of providing cost effective solution for Voice on IP. PSTN is among the best tested methods but is very costly and therefore, will negate the advantage flowing out of VoIP concept. As an alternative, Voice on DSL is another development going on and same may come out to be most popular and cost effective solution.

DSL is an inherently convergent technology, as it enables a single copper loop to carry both voice and always-on data traffic. At the users end, Integrated Access Devices (IAD) are installed, which provide interface between DSL service and user's equipment for voice and data. This IAD can have multitude of interfaces, for example, 4 – 24 telephone ports, and Ethernet interface for data.

Another killer application of VoDSL could be for the **Customer Relation Management** (CRM) / Call Centers, which would enable delivery of extremely cost effective services to various companies across the globe.

e-Security and beyond

Information security risk increases as organizations move into e-business. E-Commerce not only revolutionizes business, it also revolutionizes **business frauds.** The e-commerce systems are continuously exposed to internal and external threats, resulting in risks from unauthorized access to information systems, disclosure of confidential business critical information, accidental or intentional modification of information, interruption or discontinuity of business services. Therefore, any successful e-business must be able to minimize the security risks and the frauds by having in place proper e-security systems and policies.

e-Security is equally important in both in B2C and B2B businesses. In B2B issues revolve around network security and corporate privacy and the B2C security issues revolve around the protection of customer information and needs.

Artificial Intelligence - Trading Agent Development

In the area of e-commerce there is wide scope for development of new products and solutions based on artificial intelligence. In short, all those areas where human intervention is required for a particular decision, could be considered for development.

One of the examples is that of **"Development of Trading Agent"** which could be used to automatically negotiate with various on-line public auction sites and submit a final statement indicating the cost and the supplier for a particular item and within the cost price announced. The public auction sites list millions of items for sale, and attract a multitude of users. Currently these, these auction sites require human interaction for participation in the auctions, almost always through web interfaces. Users manually select items they wish to purchase, submit bids and monitor the status of the auctions. It is understood that some sites support more advanced automation and monitoring tools but these also provide limited functions and still require human interaction to make strategic decisions and communicate these to the auction site. Many a time, there may not be any response and one does not get opportunity to revise the offer.

Therefore, there is scope to undertake development work in this area. Development work could be taken up in the area of **"Artificial Intelligence"** to develop items like Trading Agents.

5.   Programmes/ Projects/ Schemes for the Tenth Plan

Bridging the Digital Divide: *Community Information Centers*

Ministry of Information Technology has already addressed the issue of Digital Divide and has taken proactive action to set up Community Information Centers in the North-East Region in the country, as its first experiment at cost of about Rs. 220 Crores. It involves 487 centers to be set up at the level of State Capitals, Districts and Blocks. The project has been evolved around the VSAT technology and a hub based system has been planned to meet the requirement of the entire N-E Region.

The Community Information Centers would provide variety of information to the local people in the regions around it. There would be specific local content to support the day to day needs of the communities there. Over the period, each of the Community Information Center is expected to grow to a large IT based Business Center and may become self-sustaining to meet its requirements of funds, technical know-how etc.

 It is felt that the experiment of Community Information Centers may not stop with N-E region only. But it should take the shape of **National Program on Digital Divide.** With the opening of Internet and several ISPs coming in the market, it is estimated that the main cities and business centers would be serviced with Internet by them. However, industry may not go to remote and backward areas in the initial years or at least till some awareness is created and there is likelihood of some business.

However, if these areas are also not provided with access to Internet along with other cities, the gap of digital divide can take abnormal dimension and it may become difficult after some time to reverse the situation.

Accordingly, it is proposed in the plan that a Nation-wide Network of Community Information Centers be planned by using the latest state-of-art VSAT technology. The costs of VSAT systems are likely to fall in future, specially because, after the liberalization of licensing norms for VSAT services, India would witness proliferation of VSAT networks as it is the most flexible, fast and cheaper solution in terms of capital investment as compared to optical fiber systems.

It would be good idea to go in for one common hub for the entire country with redundancy built-in in terms of equipment as well as in terms of site/ location of the hub i.e. one hub could be in Delhi and the other redundant hub could be in Bangalore and both them should be connected in the hot-standby mode. It would provide lot of cost advantage and keep the operation and maintenance costs low.

Based on the above provision of Community Information Centers covering all the **6000** CICs in the country, has been made and provision for requisite investment is also being made.

Proposals suggested under the UN ICT Task force for Bridging the Digital Divide in developing countries, specially Asia region

Asia Region ICT Gateway in India

In order to establish connectivity to the global Internet, every country is required to set up an International Gateway using either Satellite or Optical Fiber Cable (OFC) or combination of both and then connect the same to the port of the International Network Access Point (NAP) of one of the reputed service providers like UUNET, AT&T etc. This would require a large capital investment as well as would involve very high recurring cost on the Bandwidth.

The international carriers offer discounts for getting the bandwidth upgraded and the discount slab goes on increasing as the requirement of bandwidth goes upwards. However, in the initial period when Internet services are established, countries would land-up paying higher costs. The only way to contain these expenses is to make all the service providers to collaborate and form a consortium for negotiating best rates on behalf of the service providers, instead of each one of them negotiating independently and end-up making large payments.

In addition, the service providers have to make very large capital investments in the future, specially when applications like e-Commerce take over the world. The features like network security, bandwidth management, QoS, 24/7/365 services etc. would require further investment and experienced professionals to manage the same.

Since the situation of developing countries is almost similar in terms of resources, manpower, expertise, etc., India could offer setting up a common International Gateway in India. The proposal would include complete end – to – end solution and the developing countries as such would not be required to make any other investment in this infrastructure. They would be required to arrange for local distribution of the services.

As a starting point, this offer could be discussed with SAARC members and if they find it attractive, it can be extended to other countries also. All the participating countries could have equity in the entity to be set up for its management.

The ICT Task Force could be followed up to collaborate in this project and mobilize resource, for example, the Development Gateway Foundation (DGF) of the World Bank could be requested to provide financial assistance.

It is assumed that the International resource center (IRC) would consist of International gateway, Comprehensive Network Management Systems complete with multi-user security management, billing, Customer Relationship Management etc. and would be capable to management bandwidth in the range of Gbps i.e. 10Gbps to 100 Gbps. **This kind of facility would cost around Rs. 225 Mn or US$ 5 Mn .**

Networked ICT Parks of Asia

Once the ICT Gateway is established in India, it would be an excellent opportunity to network the ICT Parks / IT Parks / Software Parks set up in any of the developing countries.

For example, the IT Park Mauritius, if networked with the Software Technology Parks of India, it would offer following facilities and opportunities to the entrepreneurs at both the sides:

❖ Companies are looking for fail-safe infrastructure, especially for on-line processes, data centers etc. This can be achieved by building adequate redundancy in the equipment/ systems/ sub-systems. However, there is requirement for site redundancy as well, in order to ensure uninterrupted operations even if there is natural calamity like earth quake etc.

❖ Internet Data Centers are becoming the preferred solution to ensure proper operations, maintenance, monitoring, un-interrupted services and facilities of mirror sites/ redundant sites etc. Therefore, the companies in technology
parks in India and in the Asian countries, can collaborate with each other to provide for such fall-back facilities.

❖ Companies could share the resources and expertise to help each other. India could be greatly benefited by addressing the markets of Gulf, Africa, Middle east etc. through countries like Mauritius.

Another example of sharing resources is that of Customer Relation Management (CRM) – call centers, where the calls could be routed to a particular Technology Park depending upon the language requirements. It would enable companies to negotiate large projects for multiple languages.

❖ The India hub would finally be developed as an Internet Exchange House, through which trading of bandwidth and other un-utilized resources can be introduced. It would improve the viability of the projects due to optimal utilization.

In other words a chain of various common domain services could be introduced at the hub such as Application Services for making the resources (say ERP) available for the time required by a particular client and so on.

Pilot Projects with social objectives

ICT has killer application in e-Governance and similarly on the social front for alleviation of the poverty and up-lifting the status of women. Following two pilot projects are suggested for the same:

A) Poverty alleviation through IT

The project would be aimed at addressing selected remote backward areas. A web site dedicated to the local needs of the area would be set up and advantages of the same would be first demonstrated to the people of that area.

The content would be developed based on the strengths of that area. For example, there may be several artisans, designers, potters, etc. who might be producing contemporary items depicting old traditions and culture. But they might not be able to make any money out of the same due to lack of awareness and means.

These strengths would then be linked to major e-Commerce sites and make an effort to take these products from this region, directly to the customers thereby eliminating the intermediaries.

B) Small Office Home Office (SOHO) experiment for women

India has a large population of well educated women folk who stay at home. However, given the opportunity, they would be willing to take up some job and perform the same with great perfection and sincerity.

Women are found to be extremely successful in services like Call Centers, Transcription etc. However, the only problem with the women staying at home, would of commuting to a work place as well as performing late shift duties. However, if they are given an Internet connection at home and contract is awarded to them to perform a function during fixed hours of the day or night, they would be extremely happy to do so. Small Office Home Office (SOHO) is an experiment to establish this concept.

Therefore, proposal is to set up a pilot project by involving some number of interested women and conduct the experiment of SOHO. One of the industry units could be asked to devise an experiment assignment of call center etc. If we are able to establish the feasibility and create confidence among

industry that this concept can work, SOHO may become popular and it would contribute significantly in the up-lift of the status of women.

Center for Contemporary Studies in ICT

India is going to witness a major change in the work culture and day to day life once ICT is made available through-out the country.

Even though, Internet came to India in 1985 along with the project – ERNET, we do not have any dedicated center which carries out technology tracking and developments in Internet technology. There is lot of work being done by various NGOs, Volunteer organizations and the bodies of the respective industry and governments. For example, there is debate and development going on Internet – II as well as new domain names are being evolved by ICANN (Internet Corporation for Assigned Names and Numbers) and in InterNIC (Integrated Network Information Center), US. However, there is no active participation of India in these developments.

In addition, there is need to generate critical mass with technology background to manage the Internet technologies of tomorrow. Therefore, professional workshops, research projects in association with industry etc., are required to be made part of the normal system in the country. An investment of Rs. 120 Million (US$ 2.5 Million) has been estimated.

Promote Seed Capital integrated with Venture Capital

Venture Capital has played critical role in promoting innovations and lead the IT Revolution. In India also, after the opening up of Telecom sector and Government of India decision to give top most priority to the IT sector, several VCs have entered the Indian market. Some of the Indians who have made mark in the Silicon valley USA, have also entered angel funding. Some of the doyen of Indian software industry have also come forward and decided to nurture the talent through funding and consulting.

It is, however, observed that the VCs have changed their strategy over the period and they are also looking for existing new companies who might be looking for financial support for expansion of their activities. However, chances of start-ups getting financed by VCs are becoming difficult.

It is therefore, felt that Government may like to consider this issue and play proactive role in coming out with some solutions so that start-ups and ventures by young qualified professionals do not go unsuccessful for want of financial assistance.

It is observed that even in United States, Government extends facility of seed money for the start-ups. It enables the entrepreneurs to convert their idea in to a demonstrable piece of work.

Proposal to MIT

MIT may consider creating a corpus of Seed Fund which could be utilized to meet the initial needs of the start-ups.

In order to take a considered decision in a case to extend the seed money assistance, it is suggested that the same may made part of any Venture Capital assistance where the model could be that the seed money gets paid by MIT right in the beginning and the release of VC funding is linked to achieving some pre-defined milestones.

MIT and the MIT – SIDBI Venture Fund and the Seed Money Corpus of MIT, could be integrated

Creation of the National Super - computing Infrastructure for harnessing the potential of Bio-informatics and other Emerging Areas

In the course of exploring, developing and value adding in the emerging area of Drugs Design Software, by TIFAC, the requirement of setting-up of a number of **Supercomputing Centers** across the country has been strongly felt to harness the potential of the **bio-informatics** area as a whole. The computing infrastructure thus created could also be utilized in enhancing India's contribution in the advancement of frontier R&D in all the emerging areas of science, technology and engineering such as nano-technology, molecular computing and future generation computing paradigms, through mobilizing and motivating its quality intellectual resources.

In this direction, **Rs. 200 Crores (US$ 40 Million)** proposal envisaging setting-up of **ten centers, has** been proposed to begin with. Each center would have a local specialization specific mandate and would establish and maintain about 1000 processors based supercomputing environment. The proposed bio-informatics initiative would not only catalyze and accelerate research in the areas of Genomics, Proteomics, Drug Discovery & associated Scientific Software Engineering but also help generate critical mass in all the frontier areas of science, technology and engineering.

The Emerging Area of Bio-informatics

The exponentially growing genomic, protein and small molecule databases and advances in computing power have bought the techniques of scientific computing to the center stage to address some computationally very demanding biological problems such as Comparative genomics, Protein folding, and Drugs design with far reaching ramifications to society.

"Genomic information has the power to transform science and medicine. The challenge for researchers today is how to interpret and analyze vast amounts of data," (J. Craig Venter). Conversion of this data into products such as medicines and smart biopolymers useful to society poses an even bigger challenge. In the field of bioinformatics, bimolecular simulation, protein modeling and drugs design, research in modern life sciences is highly dependent on the availability of supercomputers, advanced workstations, and exacting techniques. Biocomputational requirements now exceed those of other "big science" applications, such as weather forecasting, subatomic physics, and nuclear weapons research. In addition to genomics, disciplines such as bioinformatics, pharmacogenomics, Proteomics, and computational chemistry are hungering for more powerful computer systems.

Envision the emerging scenario where a patient with a severe health problem brought into All India Institute of Medical Sciences, has his/her symptoms specified and genome card scanned. The doctors and medical bioinformatics group there working on a supercomputer identify the defective gene/protein and send this data to the supercomputer at the Indian Institute of Technology, Delhi, where suggestions for a drug are developed via a back and forth exchange of data between other supercomputers in the country hosted with groups specializing in diverse areas of molecular design and these suggestions are integrated and the model of the drug molecule specific to the patient and the health problem is developed and dispatched to a Synthesis and Assay Laboratory and the drug is flown in and delivered to the patient before the end of the day. This is a perfectly realizable dream within the coming decade.

India, with its globally proven scientific and technological intellectual resources could indeed become a significant global player provided urgent measures are taken now to implement a focused national program, an integral part of which is an immediate improvement in the computational wherewithal and high speed networking within the country.

E – Infrastructure for Defence

At present most of the Defense requirements, are being met through import, therefore it would be desirable if Indian IT industry comes forward. Following are the specific suggestions made by the Ministry of Defense in this direction:

1. Development of IT infrastructure is very important for Defense Services. All the services are having their own independent network which is not interconnected. A Defense Communication Network is planned. The inter operability requirements and infrastructure need to be built which require much greater planning at the national level. At present Services depend largely on using National Information Infrastructure (NII) even for implementation of captive networks. The security provision of these diverse network need to be catered for at national level Working Group on such strategic communication.

2. Defense being highly sensitive to security. Network must provide end-to-end security with the implementation of PKI technology, COTs equipment need to be evaluated and authenticated for security.

3. The services have built their captive infrastructure for computer network. This infrastructure requires encryption technologies and their implementation in the network for information security. Here it is proposed to build up Center of Excellence in Cryptography. This will go a long way in helping defense forces in general for building up in-house crypto and computer network security solutions. Efforts should also be made to develop indigenous encryption algorithms, development and implementation of digital signature.

4. Biometrics and Access Control through Smart Card technologies are critical areas for access control to defense infrastructure as well as computer networks. Here also it is proposed to build a Center of Excellence for these areas to develop for Access Control.

5. There is need to build up an interface between Defense Forces, the IT R&D organisation, IT industry and especially Ministry of IT for fullest exploitation of IT in various fields.

6. At present, there is not adequate infrastructure for semiconductor manufacture and there is no facility for manufacture of High End Microprocessor Chip which are used as ingredients in all defense system. There should be special emphasis on this to develop R&D infrastructure and manufacturing base for VLSI Chips, micro-electronics etc.

7. There are Defense network of very low security grading, there is need for manpower and infrastructure to manage such defense networks. Here, there will be large requirements of manpower in LAN and WAN set ups. Possibility of Special Level Agreement to cover the secrecy and Official Secret Act can be explored, which will be part of Government agency providing manpower and infrastructure to manage such works.

8. From the MoD side, there is emphasis on R&D projects taking up projects of strategic nature for which quite often MoD has to look abroad for help. DRDO is also working in the area of IT and joint R&D initiative can be considered if required.

9. Need to include reps from Ministry of Defense actively in drawing future IT Plans so MoD priorities are also taken care of.

Policy Initiatives and programs

Recommendations by the Study Team on IT Infrastructure are as follows:

Recommendation 1: *To catalyze further reforms in the Financial Institutions frame work to enable it to respond to the financial needs of the Information Technology sector. The major actions required to be taken are as follows:*

❖ *Involvement of the apex Financial Institutions in the planning process*
❖ *Developing confidence among the Financial Institutions about the potential for growth and success of the IT sector.*
❖ *Evolve special norms to finance Bandwidth by considering it a tangible asset for collateral security purposes.*
❖ *Evolve norms to finance working capital needs of the IT software sector by considering the intellectual brain-ware also a tangible asset for collateral security.*

The target for Internet penetration has been kept as 40 **Subscribers** per **1000 population** by the end of the 10th Plan i.e. by 2006-07. Therefore, Internet is expected to grow over ten times from the present level of 3 Subscribers per 1000 population. Such growth is possible, if **CAGR of about 60 – 70%** is achieved in this sector i.e. Bandwidth to double every year.

The IT Infrastructure required for this growth, would need Capital Investment of cumulative **US$ 200 billion** by the service providers (ISPs, NLDOs, Local Loop Providers), DOT and & the Users of the services. In addition, Working Capital limit of **US$ 25 billion** over the plan period, would also be required.

Recommendation 2: *To coordinate fast implementation of the Convergence Bill in its true spirit, in order to provide free environment to the service providers without any restrictions for types and categories of the services. It would ensure result in to faster growth of this sector and would also offer sound viability to the investments.*

Internet services were opened up in 1999. About 437 licenses have been issued by DOT for ISP operations, out of which, 125 ISPs have been given permission to set-up own Satellite Gateway. As of now, around 138 ISPs have started operations and merely 25 of them have set up their own satellite gateways. All of the ISPs, except those who have set up own gateways, use VSNL as the Network Access Point for connectivity to the Global Internet. However, VSNL itself is providing Internet service to the end-user service and therefore, is competing with its own ISP clients. This is a peculiar situation, arisen due to ISP policy being announced in installments and in sequential manner rather than doing it in one go. It has resulted in to ISPs trying to offer all the services without going in for any niche as well as without being able to evolve any sustainable business model. Most of the ISPs are making losses and the situation is worsening further, with Financial Institutions getting negative signals about the sector and getting term lending / working capital finance, has become difficult.

Recommendation 3: *To accelerate opening up of the Telecom Sector to get it fully privatized by March 2002 as per the assurance of the government of India and seamlessly allow ISPs to provide Voice over Internet (VOI).*

As explained above, the Internet Service Providers are having serious viability problems. Therefore, there is need for the Government of India to provide certain incentives to them to improve their viability. Voice over Internet (VOI), appears to be the only solution at present, which if allowed, would become a source of reasonable revenue to the ISPs.

Recommendation 4: *To coordinate revamping of the National Long Distance Operators (NLDOs) policy to remove the entry barriers so as to ensure early investment in the sector.*

As per the policy in vogue, the applicant (**for providing the service of end-to-end bandwidth: IP-II**), has to deposit non-refundable entry fee of Rs. 1000. Thereafter, four (4) additional bank guarantees of Rs. 1000 each will be deposited with DOT before signing of the license agreement. These four guarantees would, however, be released upon completion of each one phase out of the total four phases. A Network Rollout Plan (NRP) spread over four phases has to be presented by each licensee to the Department of Telecom before signing of the license agreement. NLDOs are also required to fulfill minimum commitments for each phase, towards coverage of the service area licensed plus specified number of un-economic and remote areas. There is no license fee as such but, in lieu of the same, there is revenue sharing of 10% plus contribution towards Universal Service Obligation (USO) Fund with a total cap of 15%.

The opening up of NLDO was announced about a year back, but there has been no response from the private sector so far. As per the industry feedback, high amount of entry fee, performance guarantees (Rs. 6000 Million, all put together) and cap of 49% on foreign equity, are the major reasons for the same. NLDO is the most important and critical segment of the IT infrastructure and if the desired density of Internet use is to be achieved, all efforts are required to be put-in to attract investment in the sector. In addition to capital investment, the sector involves very large gestation period.

It is informed by the industry that there are a large number of operational difficulties related to various clearances, especially for Right of Ways, which have delayed plans of companies for laying optical fiber cables. *This issue needs to be addressed so as to make the process of providing rights of ways, simple, fast and transparent.* It involves several central and state agencies which have to agree on right of way and therefore, clear directive from the Government of India, is required.

Recommendation 5: *To prevail upon DOT to make the "Network Inter-connect" regime free without any permissions required for the same. Inter-connect of networks should emerge out of the market forces and the need to optimize resources to become competitive and offer complete package of services.*

As per the policy in vogue, there are restrictions/ obligations on the interconnection of networks of various service providers. As a result of this policy, the service providers are not able to interconnect with a network of their choice since they are being forced to go by the public sector service provider. This is counter productive and inefficient way of resource utilization. Therefore, there should be no restrictions on the interconnection of the networks. The networks should be allowed to grow based on the market conditions and issues of interconnection should become commercial business decisions of the companies.

In actuality, by discouraging the interconnect of networks, on one hand, Government of India is landing up with increased foreign exchange out go and the customers are getting poor quality of services, on the other hand. For example, there is lot of within India traffic on the Internet. However, since the networks of ISPs are not interconnected, this traffic is also traveling all the way to USA and then getting back to India. This would result in more demand for the International Bandwidth (paid in foreign exchange) and this additional demand on the backbone, is choking the pipes and resulting in to poor service quality to the end users.
Peering of the networks (national as well as International), is extremely essential and rather should be made obligatory on all the service providers and TRAI should be in a position to take action in such cases. The other major loss to the country is in terms of high-end and specialized services not being taken up. For example, if peering of the networks is freely allowed, it would promote the concept of Internet Exchanges to be set up which would become the market place for auction of bandwidth for specified duration, several value added services like Internet Data Centers, Network Operations Center (NOC), a common e-commerce place and so on.

Recommendation 6: *To coordinate with DOT to provide free environment for setting up of VSAT networks by any corporate/ institution/ service provider to supplement capabilities of the IT infrastructure as per requirements.*

VSAT technology has several features which make it most effective and desirable option for providing communication services. Remote areas, areas with less density of population, hilly areas etc. can be easily be connected with the rest of country by deploying VSAT technology. Very Small Aperture Terminals (VSATs) were specially developed as a solution to such problems faced by the nations. The advancements

in technology have multiplied the capability of VSATs in terms of bandwidth handling capacity and reduction in size of the antenna. Ku band VSATs are an example where dish of size as small as 0.8 – 1.2 Meter can meet most of the requirement of corporate and others.

VSATs have very powerful use for Disaster Management applications due to its capacity to be easily moved from one place to other, fast installation and the least nodes involved in operation and maintenance. Its other powerful use is in setting up exclusive corporate intranets for applications which can not be carried out in public domain networks. The transmission delays involved due to use of the satellites, have also become insignificant with the coming up of VSATs based on spread spectrum technology which allows VSATs to communicate with each other directly unlike TDM/TDMA technology where such communication takes place through VSAT Hub alone and involves minimum two hops and is not suitable for applications sensitive to delays like voice.

To sum-up each technology whether satellite based or OFC based, has its own features, positives and negatives and selection of the same would depend upon a business decision. Therefore, both of the options should be open to the service providers / users without any restrictions. There should be no need of licenses except for the allocation of the spectrum which should also be notified as National Spectrum Plan in line with the international standards.

Following are the specific hindrances in the way of setting up VSAT networks, which should be removed at the earliest:

1. Use of VSAT networks for Internet services should be permitted without any restriction. Only need should be to get the spectrum allocated from Wireless Planning & Coordination (WPC) wing of DOT.

2. The cable operations are allowed to set up Receive Only VSATs anywhere within the country for receiving television broadcast. However, the ISPs are not allowed to do the same.   This option of using VSATs only in Receive mode, is quite suitable for providing low cost alternatives to the people. Majority of the users down load the material from internet and there is very little traffic in the reverse direction. Due to this phenomenon, the pattern of internet traffic in the country is asymmetric today (4:1). Therefore, one can use receive only VSAT for down load from internet and normal Dial-up option for sending data from India. This is a very cost effective solution. OFC/ any other cable system does not permit asymmetric application.

3. Recently 'revenue sharing regime' for VSAT operators has been announced. The existing operators are also allowed to migrate to this regime upon settling all their liabilities of license and spectrum fees etc., till now. The issue here is that earlier the VSAT operators had several constraints and therefore, investments made by them could not become viable. Some of the serious constraints which lead to unviable investments are as follows:

    ♠ Permission to use only the Extended C-Band of frequencies. The standard band used is the C-Band. Extended c-Band is rarely used and there were no equipment being manufactured in this band. Therefore, the licenses had to get the equipment modified and thus incur high capital costs. C-Band was not purposely allotted by DOT to the private VSAT operators, since it was kept reserved for DOTs own VSAT network.

    ♠ Permission to use only TDM/TDMA technology
    ♠ Permission to have maximum of 64Kbps data rate of the entire network
    ♠ Permission to use only the Indian satellite (INSAT) , inspite of high tariff
    ♠ To be set up only as Closed User Group (CUG) - with ambiguous definition
    ♠ Interconnection with any other network not permitted
    ♠ Each and every terminal to go through the process of Departmental clearance mechanism involving days and months.
    ♠ Siting clearances taking several months

In view of the above, there are valid reasons for the Government to take stock of the position and in the overall interest of the country getting world class communication facilities, the dues of these operators should be waived off and there be no license fee thereafter. Revenue sharing mechanism should be followed. Rather, DOT may play important role of the promoter and make the investments by the private sector viable soon so that every body starts earning fast.

Recommendation 7: *To coordinate with TRAI to make it mandatory for BSNL and MTNL to unbundled the local loop and allow other service providers to co-locate their equipment like DSL which enhances the capacity of the existing copper cables from 9.6Kbps to 2Mbp. DSL is a very cost effective way to use the existing infrastructure to meet the high speed requirements of the users. It is cost effective since it does not involve any usage charges since the dial-up section of the telephone line is by-passed by the DSL when using the same for Internet services. The line with DSL modems on both ends as shown below can, simultaneously handle both voice and data.*

In order to achieve the above, the matter needs to be taken up with TRAI for issue of special orders for unbundling of local loop by BSNL and MTNL The order should also address the issue of charges so that the same are fixed with an objective to allow fair level playing field to all the service providers. BSNL and MTNL being the monopoly owner of the core telecom infrastructure, should concentrate on becoming Tier-I infrastructure provider and may not remain in the end-user services. It would earn more revenue for them as well as would speed up the coming up of telecom infrastructure.

Recommendation 8: *Government to play key role in making private investment viable fas as well as to ensure fair level playing field for it by making the monopoly service provider to support them in all fairness, in the first 3-4 years from opening up the telecom sector.*

World over telecom sector has passed through a very difficult time in the early years of opening it up. However, the telecom regulators there, have been quite effective in overseeing the development and prevailing uponthe monopoly service provider to cooperate with the private sector and jointle develop healthy competitive environment in the country. For Federal Communication Commission had to issue orders asking the incumbat to unbundled the local loop. There is similar need in India as well.

The other important and critical issue relating to improving the viability of the private investors, pertain to fast growth of market and availability, especially in the individual/house hold sector. An analysis of the practices adopted in other developing countries to address this particular issue are mainly the initiatives taken by the respective governments. For example the success of the IT hardware sector in China, has been because of the Government's program to adopt IT in all sectors of the economy and especially in the E-Government applications. There are many such examples where the Government have created immediate market after telecom sector is opened up and it is led to faster growth of the economy by the service providers and acquire status quite mere to that of the monopoly service providers.

On the basis of the above successful practice, following are the recommendations in this direction:

1. Government of India should decide a definite program for introducing E-Governance throughout the country.

2. The entire education sector including primary, secondary, university level, advanced studies and other related bodies concerned with this subject should be connected to Internet during first two years of the Plan.

3. Government of India may not invest any more in creating such infrastructure and introduce services whether on commercial basis or for captive uses which directly compete with the private sector. Instead of such requirements of the Government of India, should be contracted to the private service providers. It would generate the immediate market for these service providers who at present running into heavy losses.

4. Investment by Government of India in infrastructure like NIC, ERNET, STPI etc. may be focused on rural / under-developed regions. Similarly in respect of the schools and colleges etc, instead of spending in creating captive infrastructure, it would be a prudent decision to allocate adequate funds to these institutions so that they are able to avail services like Internet, from the available private sector services providers.

As per the present norms, in respect of the dial-up Internet subscribers, as much as 70-80% burden of the high charges is because of the telephone line usage cost. It has created negative impact on the Internet users. The main reason for the telephone charges high in India is the system of subsidized/artificial prizing and not on the basis of capital investment involved. This system might have been advantageous in the early years, however, it has no relevance in the 21st Century. An analysis made by the industry, indicates that the **telephone charges** in India could be brought up to 1/5 or so whereas the same are arrived at after considering the actual investment and operational expenses involved.

In case the above is not fiscal immediately, other alternative is to come out with special package for the Internet users where the charges could be fixed at about **20-30%** of the prevailing charges.

Recommendation 9: Implications norms in respect of International Private Leased Circuits (IPLC) required by the companies engaged in export of software and services including IT enabled services.

Indian IT companies have set up dedicated telecommunication links to the US, through VSNL or STPI & are using these links for data communication. These links can easily carry digitized voice. Therefore, they are allowed to be connected to PSTN in India, through the EPABX, then they can route the calls to the relevant extension or residence of a person, his cell phone etc. through the call-routing feature available in the EPABX equipment. Such a feature is extremely important for the software exporters since they are supposed to provide 25 hours support to their clients. The advent of such technologies has been only to tackle such situations and improve the Customer Relationship Management (CRM) capabilities.

Such freedom for optimal utilization of the telecom resources is need of the hour if India really wants to become global super power in IT since its competitors abroad, are much ahead of India in such proactive actions.

Therefore, use of such technologies should be encouraged freely. It would not result into any kind of misuse or loss of revenue to the service providers rather the volumes of the business would grow.

At present, STPI is not allowed to provide international leased circuits to the companies who want to set up export operations for IT enabled services such as call centers, whereas VSNL has been allowed to do the same. There is no rational behind not allowing STPI to offer these services and therefore, this restriction on STPI should be removed.

Recommendation 10: Infrastructure Status to entire IT Sector - Government of India has given special focus to promote development of the infrastructure sector in the country including power sector, transport etc. and a special scheme of incentives have been evolved. IT infrastructure is also high investment area, especially because of the telecommunication infrastructure required including national backbone and international connectivity. It is therefore recommended that the entire IT sector should be given the "Infrastructure Status as per the Existing Policy of the Government".

Recommendation 11: EXIM Policy issues: There are several anomalies pertaining to levying custom duty on the equipment required by the telecom service providers. For example, same equipment, when imported by the ISPs, attracts custom duty of 5% (if not manufactured indigenously) and 15% (if manufactured indigenously) whereas it is quite high if same equipment is imported by other service providers like National Long Distance Operators (NLDOs). This type of artificial

barriers should not exist and the rate of custom duty should not be based on the type of services or in other words the services should be technology neutral.

Therefore, import of all the equipment required by any of the telecom service providers, should be allowed uniformly at the rate of 5% as is allowed to the ISPs as per existing norms. Similarly the CVD on this equipment should uniformly be fixed at 16% again, as per the existing rate applicable to ISPs.

Recommendation 12: (Issues related to e-Commerce): Govt. would have to play a major role in promoting the e-commerce in India. The legal issues, fears of the people, security of information, digital signatures etc.. Following are the main issues which need to be resolved early:

1. There are several gaps in the current legal and regulatory framework in India that need to be plugged. In addition, the implementation of the IT Act is proceeding very slowly. E.g. Certification agencies are still not in place. Some of the important issues in the regard are:

    ❖ The Indian Contract Law is not covered under the IT Act: legal enforceability of electronic contracts is open to challenge, legal jurisdiction of contracts involving international parties is not defined.

    ❖ The IT Act does not clarify all the issues regarding taxation of electronic transactions: indirect taxation (customs duty for cross boarder transactions, sales tax) for goods/services delivered electronically is not clear.

    ❖ The jurisdiction of e-commerce transactions is not clearly defined: the definition of Permanent Establishment in the context of an e-commerce transaction is not clear

2. The IT Act is silent on the issue of protection of Intellectual Property Rights (patents trademarks and copyright) in the Internet space.

    •   The issue of cyber crime control is not completely addressed by the IT Act since the offences defined in the Act are not exhaustive.

    •   Law enforcement agencies are not fully equipped and trained to deal with cyber crime.

    •   Safeguards to protect privacy of personal and business data collected over the Internet are not in place.

    •   Regulatory framework for payment gateways is not fully evolved.

    •   Electronic money (e.g. e-cash, e-cheque) is not legalized today. There is no legislation governing the issuance of e-money in India.

3. The Internet opens opportunities for the government to improve its operations along all interfaces - government to customer (G2C), government to government (G2G), government of business (G2B). Some of the initiatives that the government can take in the G2C and G2G areas are:

    •   Form a working group to evolve a common e-governance architecture for governments at all levels to maximize benefits to citizens from delivery of these services;

    •   Prepare a plan to progressively offer more sophisticated service on line;
    •   Improve citizens' access and awareness about these services;

    •   Explore private sector participation in e-governance to share financial risk and ensure sustainability of initiatives; and

- Prepare plans to harness benefits from G2B (procurement savings) and G2G (transparency).

Additionally, all government employees should be provided training on the usage of computers and the Internet.

4. Establishment of consistent, internationally interoperable standards for technologies related to e-commerce is an important issue for facilitating e-commerce. These standards can relate to communication protocols, payments, security, documentation etc.

Governments in most countries have played the role of facilitator for the private sector in the determination of standards. For example in Japan the Ministry of Economy, Trade and Industry works closely with the Japan EC/CALS, an IT organization led by private sector companies that is taking the lead in standardizing the basic technologies.

In India too, the government should play the role of a facilitator encouraging industry associations to take the lead in establishment of technical standards. The government should step into the role of determining standards only if it is clear that the private sector cannot resolve the issue itself.

5. In order for promotion of e-commerce in India, regular efforts are required to track the extent of e-commerce adoption in different industries and in the economy as a whole, and to identify the key barriers to Internet adoption. This process will help the government identify problem areas and the specific issues that require government intervention on an ongoing basis. It will also provide a barometer for Indian industry to benchmark itself against other countries and understand its relative competitive position.

Recommendation 13: (Financial issues):

During 2000-01 and 2001-02, the Investment Bankers, Financial Institutions and Venture Capitalists have not been very positive about the growth of Information and Communication Technology. There has been no positive response from the institutions like IDBI, ICICI, IFCI etc. for coming forward and finance ISP projects.

The IT infrastructure sector has not been very popular with these institutions. There is perception that these proposals have high risk. As a result of this, one does not see many infrastructure projects like Tier-I and Tier-II ISPs, Internet data Centers etc. in the country.

Among various reasons, the most important reason for such perception of the financial institutions, is lack of exposure to this technology and rigid collateral security leased regime. The most important issues pertaining to the financial resource mobilization for IT Infrastructure projects, are as follows:

❖ In the IT Infrastructure, cost of the bandwidth (National/ International - Satellite / OFC), is as high as 60-70% of the total cost of the operation and maintenance. However, the same is not considered as a tangible asset for the purposes of sanctioning term loan or Working Capital limit.

❖ Similarly, the Intellectual Property is also not considered as asset, again for the purposes of collateral security.

Government of India is required to consider these issues and implement some reforms in the industrial finance structure in the country. Necessary clarifications are perhaps required through executive orders to define the assets which can be treated as collateral security by FIs and Banks etc.

6. Financial Projections (for Investment by Government)

As per the details provided in the earlier chapters, following investments are estimated for the creation of requisite IT Infrastructure and associated telecommunication facilities, in the country:

Ministry of Information Technology:

                           US$ Million

1.	**E-Infrastructure:**	
	* **ERNET expansion**	: **750**
	* **VIDYA Vahini**	: **1000**
2.	**E – Governance infrastructure** (including e-infrastructure in Govt. upto Block level by NIC)	: **650**
3.	**Bio-Informatics**	: **40**
4.	**Digital Divide**	: **10**
	Community Information Centers (CICs) and other projects under the international ICT initiatives	: **500**
	TOTAL	US$: **2950 Million**

Chapter 5: Application Development

1.   Introduction

IT has pervasive impact on all sectors of the economy that is limited only by our imagination, the approach adopted here highlights the enabling conditions and general principles that encourage the quick growth of Application Development in Information Technology.

2.   Preamble

Information and Communication Technologies (ICT) are primarily enabling technologies and form part of the infrastructure sector of a modern economy. The real benefits of ICT only accrue when they are deployed to improve productivity and performance of other industry and services in general. It is worthwhile to re-capitulate some of the fundamental characteristics of these technologies for our purposes.

- The foremost point that needs to be made is that ICT's, like any other technology, are no panacea in themselves, but are a tool – albeit a versatile one -- that permit newer ways of tackling existing problems and issues.
- The second point is that, these technologies can permit entirely new ways of addressing issues once their full potential is reached. This however, necessitates questioning basic assumptions under which governments and businesses have been operating over many decades.
- The third point is that developments taking place in ICT's are driven by private sector initiatives or by close collaboration between academia and business. This suggests the use of new models of collaboration, not only for development, but also for sustainability and replication.
- The fourth point is that government has traditionally been the provider of services in the sector. With the progressive deregulation of the sector and the entry of private sector players, there is need for government to move away from the role of an operator, to that of being a policymaker and regulator. The government role, like that of its counterparts elsewhere, needs to become more as a facilitator of private investments and protection of consumer interest rather than its current one where its role as a competing Operator comes into conflict with its role as sovereign policy maker and regulator.
- Finally, the ICT Revolution is about INFORMATION. For the technology to be exploited to its fullest potential, regulations that hinder the flow of information need to be discarded and be replaced by facilitating mechanisms: A Right to Information Act replacing the outmoded Official Secrets Act which would be one way of handling the difficulty in accessing documents, maps, photographs, etc.

Infrastructural requirements for faster growth and penetration of Internet

- Connectivity is the backbone for any IT application. Reliable and affordable communication would dictate the sophistication and spread of ICT-based applications. For rural areas, there is need to plan, and progressively extend, Internet access at a minimum rate of 28.8 or 56 kbps. Apart from basic telecom infrastructure, the availability of access devices, the costs of access, the quality of service, and the reasonable cost of hardware and software, maintenance and upkeep are issues that need to be addressed.
- The capital costs to make the necessary investments for connectivity and also for public access devices is high, but can be reduced. It is necessary therefore to look at alternate financing models such as leasing, franchise, build-own-operate (BOO), or build-own-operate-

transfer (BOOT), as well as putting in place appropriate technologies (WLL, VoIP, Ka-band, Simputer, etc.) that can lower costs compared to POTS. It will be necessary for the government to take measures to bring down the various cost components of the sector. A focus on reducing the high duty/tax structure, encouraging local manufacture, using 'open standard' software and open architectures for e-governance would bring down costs considerably. In the initial years it may be necessary to concentrate on a few projects that generate revenue, especially in view of the fact that, though there is phenomenal improvement in productivity using ICT's, the actual cost-benefit is not decisively established. The private sector would get involved in replication only where there is a clear revenue model, and in other cases the Government would have to fund the projects.

- Content creation is another major issue for developing countries in view of the skewed nature of Internet hosts and the heavy bias towards English. This involves a better understanding of local language issues and the socio-economic and cultural environment in order to get locally relevant material created. This content would need to be created by NGO's and private bodies who have the necessary local involvement.

- Only a citizen-centric approach can encourage convergence of services, both within a department and also across departments, instead of department-centric or technology-driven approach hitherto. This implies a departure from the efforts made so far that only automate existing processes.

- Cyber Laws, along with issues of digital signature, are necessary to support meaningful integration over the Internet especially wherever statutory and monetary involvement is there.

Measures for promotion of e-governance

Some lessons can be learned from successful e-Governance applications that have been implemented nationally and internationally. These are as follows :

- There is need for political ownership at the highest level and a national vision for e-governance for successful implementation. This ownership has to be reflected at appropriate levels in a federal polity, i.e. at State, District and Mandal/Panchyat levels. In the absence of ownership e-governance would remain a technology initiative and would not penetrate into day-to-day use;

- Need for a dedicated organisation to support and guide the implementation down the line. NIC has built-up tremendous infrastructure and knowledge over the years. There is now need to re-look at its objectives and for NIC to become more of a facilitator for e-governance and an intermediary between the user department and the application developer, rather than being the developer itself as has been the case hitherto;

- A new mind-set that permits exploring new areas of public-private partnership in making e-governance possible. This would also involve de-regulation and encouraging of experimentation to facilitate locale-specific applications;

- A need to define in detail the requirement -- including the data flow, common databases, etc -- plan the implementation, and develop a comprehensive 'blueprint' before rolling-out the actual implementation. This would, inter-alia, also involve defining architectures and standards and putting in place policies addressing issues of security, privacy, etc. The application development would define the hardware required and would be required to be dovetailed with the infrastructure available, before implementing across the range of Government;

- Consulting the citizens and designing applications to meet their felt needs;

- Starting with small manageable pilots before scaling-up since some IT projects can take a long time to implement because of the needs for technology changes and other modifications that need to be incorporated;

- Implementing projects in stages of increasing complexity: providing information in the first stage and then moving onto providing interactive forms and finally a payment gateway where monetary transactions can take place;
- Capacity building by setting-up new institutions like a National Institute for Smart Governance and supporting existing institutions to undertake 'action research projects' to understand processes and to develop suitable modules for course work including developing study material like case studies, etc. Such institutions could take the lead in documentation and dissemination of 'best practices' and develop competence to certify applications for use across Government;
- Addressing issues relating to IT procurement in view of the fact that many IT projects are complex and extend over a long period of time. The relationship between the customer and the vendor has to be one of 'partnership' rather than the traditional one based on simply selecting the supplier coming up with the lowest 'L1' financial bid; and,
- Adequately focussing on issues of re-engineering and management of change since they are of paramount importance when compared to technical issues associated with e-Governance. In particular would be the creation of common databases across departments and keeping them regularly updated. Instituting 'Awards' for best innovations in e-Governance and including a section in the Annual Report of Departments reporting the innovative use of ICT's to improve departmental functioning.

Measures to address issue of digital divide and taking the benefits of IT to the masses

It is necessary to keep in mind that the new technology only reflects the situation of society of today; the digital divide is only a reflection of the divides that exist in society – be they social, economic, educational, etc. The Ministry of IT had commissioned a Working Group IT for Masses on the subject. The main recommendations are given below:

Recommendations of the Working Group on Information Technology for Masses

RECOMMENDATIONS

Working Group has classified issues related to spread of IT to masses into the following categories:

- Infrastructure and Services
- Electronic Governance
- Education
- Mass Campaign for I T Awareness

Recommendations of the Working Group in these areas are as follows:

Infrastructure and Services

As a follow up to the recommendations made by Prime Minister's Task Force on Information Technology and Software Development, government has already taken number of major policy decisions to speed up the pace of growth in IT industry and services. However, the present level of IT infrastructure in the country is no where close to a common man being able to take advantage of Internet and IT services. At present, we have only 8 million homes having telephones out of a total of 24 million phones in the country, 35 million cable connections out of an estimated 70 million TV households and just around 1 million Internet connections. For benefit of IT to reach a common man, there is an urgent

need to take steps to facilitate reach of Internet and IT services at mass scale in the country. Some of these steps are given below:

100 million Internet connections by 2008

A target of 100 million Internet connections by 2008 must be set

1 million IT Kiosks by 2005

For a common man to be able to have access to Internet, it is necessary to establish public Internet access points all over the country in the form of Internet enabled IT Kiosks. For this purpose, all public utility out-lets in the country such as PCOs, Post Offices, Railway/ Bus Stations, Bank branches, Offices of Cooperative Societies, Schools, Colleges, Hospitals/ Dispensaries, Panchayat Offices, etc. should be made available to entrepreneurs/ self-employed people to establish IT Kiosks with an overall target of one million IT kiosks by 2005.

Revenue share to franchise operator to be at least 50%

Telecom network and revenues from voice telephony have been used and are continuing to be used worldwide to enable expansion of Internet. The access part of the telecom network (including the last mile) costs 65 to 70% of the total per line network cost. The network used to provide both telephone and Internet should not be duplicated in a resource-starved country like India. A local franchise operator must be allowed to set up the access network providing telephone and Internet connectivity on revenue sharing basis. Since the cost of the access network amounts to 65 to 70% of the total per line cost of setting up the network, the revenue share to this franchise operator for providing the voice connectivity must be at least 50%.

Setting up of Basic Services Operation providing telephone and Internet connectivity must be made totally license free where telephone connectivity is less than 1% of the population. Multiple small operators should be able to set up the telecom and Internet network, connect to the national or state telecom or internet network by paying the connectivity charges just like any other basic services operator does. In order to encourage setting up of infrastructure in such area, the revenue share to the government must be zero.

No licensing to set up Telephony/ Internet in low telecom density regions

Telecom and Internet connections can be set up using the infrastructure available at several thousand railway stations in the country. Setting up of such connections to provide wireless connectivity in the neighborhood of a station should be allowed in and around all stations (other than that in large cities). Such network should be allowed to be connected to the telecom and Internet network by paying the interconnection charges as levied to the basic services or cellular operators. No license fee should be charged.

Telecom network infrastructure, such as leased/ dial-up lines, co-location of DSL equipment at exchanges, etc. should be made available to Internet Service Providers (ISPs) on priority by Department of Telecom Services within 90 days of application

CUG status to private networks

Information Infrastructure projects in private sector should be given status of Closed User Group (CUG) networks on priority, including those setting up VSAT networks. These CUGs should be allowed to interconnect without any interconnectivity charges. These networks should also be allowed to connect to Internet gateways and offer E-com services. In case of VSAT networks, there should be no restriction on up-link and down-link data speeds.

As a follow up to the decision announced by Prime Minister during State IT Ministers' Conference on July 15, 2000 to remove VSNL monopoly with effect from August 15, 2000 on under-sea cable for Internet bandwidth, all requests for such connectivity should be processed within a maximum period of three months from all points of view including security aspects.

Encourage new communication technologies

The selection and use of communication and networking technologies for establishment of Internet connectivity should be left completely at the discretion of the service providers. Government on its part must facilitate allocation of frequencies for establishment of wireless connectivity in different parts of the country in a definite time frame of not more than 30 days

Promote indigenous technology development for low cost Internet access devices

Special scheme should be launched for technology development of low cost PCs, Set-top boxes for TVs, cable modems and other futuristic Internet access devices, in collaboration with IT industry, ISPs, cable operators and financial institutions to provide a technology leadership to the country in this area and also technologically help to bring down the cost of Internet access devices to affordable level by common man

Right of way to cable operators

Right of way should be extended to cable operators for laying Optical Fibre Cables. The permission should be granted within 15 days by respective municipal agencies.

Franchise operations of CICs on revenue sharing basis

Prime Minister had recently announced setting up of Community Information Centres (CICs) at block level in North-Eastern States including Sikkim. This scheme is being extended to other under-developed regions in the country. The running of these centres should be franchised by government to educated unemployed youth in the region on revenue sharing basis.

The spread of IT on a mass scale in the country will require a support infrastructure for maintenance of hardware and software. Polytechnics and ITI's must introduce training on these aspects in their courses. Also, simple tools and methodologies for self-repair/ maintenance of IT infrastructure must be packaged for use by non-professionals and made widely available to users

Evolve Standards for development of Indian languages based content on Internet

For promoting the development of Indian content over Internet, the technology, software tools and devices need to be made easy for use by the common man and standardized for content development and exchange. A Standing Committee must be set up to develop and constantly review standards for Code, Keyboard and fonts for development of Indian languages based IT services

Electronic Governance

The Working Group recommends the following steps to be taken by the government at different levels for speeding up the use of Electronic Governance in the country

Five Year IT Plans

Central and state governments should prepare Five Year IT Plans (2000-2005) to re-engineer their services in a manner that by 2005, a common

man in the country will not be required to visit government offices for normal day-to-day work and will be able to have all such interactions through Internet from homes as well as from IT Kiosks and CICs across the country.

All government departments/ ministries must set up a Task Force to prepare short term as well as long term IT Induction Plan for their internal working as well as developing citizen services based on IT. The Task Force must be empowered to get the plans implemented.

IT Sensitization of decision makers	Special training programmes/ seminars should be organized with a time bound action plan to sensitize Ministers, MPs/ MLAs and senior government officials on the benefits and applications of IT in governance.
5% of the budget for IT induction in government	Every department of the government should earmark up to 5% of its budget (Plan as well as Non-Plan) to implement citizen-oriented IT services with requisite back-office computerization. This will enable government departments to implement their IT induction plans for a citizen friendly and transparent governance as well as effectively monitor the utilization of the remaining 95% of their budget.
IT infrastructure up to working level staff in government by 2003	For IT services to be developed and sustained in the government, it is necessary that access to IT infrastructure is made available to working level staff. This requires government to establish IT infrastructure up to this level. While considerable progress has been made over the years towards this, all departments of central and state governments must prepare a time bound plan to establish government intranets with connectivity to each other and to Internet. These plans must be implemented by 2003.
Compulsory IT literacy for government recruitment by 2002	IT literacy, as per a well defined foundation course module, should be made compulsory for recruitment to government service at all levels by 2002. In case a person has to be recruited without IT literacy, he/ she should compulsorily acquire it within one year. All the existing staff of the government must be asked to attain IT literacy in next 2 years. A panel of recognized training institutions, in private as well as public sector may be prepared and updated from time to time at central/ state governments level for this purpose.
	Every government ministry/ department must implement at least one Citizen-oriented service to be completely made IT enabled by January 26, 2001. All such IT enabled services must be made web-centric so that public can access them through Internet
Annual E-Governance Reports by government departments	Each ministry / department of Central / State governments must submit an Annual E-Governance Report to the Parliament/ State legislatures every year as a part of Annual Report being currently submitted
Sharing of experiences and best practices amongst States	A Standing forum of State IT Secretaries must be set up for sharing of experiences and best practices amongst various states and facilitate horizontal transfer of IT applications and services amongst states. This will also facilitate standardization of services across the states.

Internet portal for one-point government information and services	An Internet portal for government information and services must be set up with links to central and state government departments and services to provide single window access to government from anywhere in the country. For a common man to be able to use government services over Internet, content and services should be available in local languages on this portal.
State portals to help rural artisans	State government portals should help rural artisans and entrepreneurs in publicizing and market development for products of rural artisans and handicrafts
Set up Administrative Re-engineering Commission at national level	Most of the efforts of inducting IT in the government are made to map existing procedures followed in the government on to IT based systems. With the availability of IT based solutions, most of the procedures of the government need a thorough revision. This requires a massive re-engineering of processes being followed in the government at all levels. Both Central and State Governments must set up an Administrative Re-engineering Commission/ Committee to review all procedures in the government in view of facilities available through IT.
Standardize formats/ procedures for common services across the country	Large number of services offered by government on the nationwide basis use different formats and procedures for similar functions in different states and regions. There is an urgent need to standardize these formats and procedures across the country. The concerned ministries of Central Government dealing with various sectors must establish Task Force to standardize the forms and procedures in such services across the country as well as facilitate early induction of IT in respective areas.
Data capture at the point of origination	The current practice of first using conventional manual method and then doing data entry to bring that information on network should be completely discontinued in the government. All IT based services must capture data at the point of origination itself
Prime Minister's Annual Award for best E-governance	Introduce Prime Minister's Annual Award to the best E-governed state government, central government department and services
	Some of the applications/ projects which should be taken up on priority by the government are as follows:
All government information on Internet by April 2001	All Government regulations, schemes and forms should be put on Internet by every Ministry / Department of Central as well as State Governments latest by April, 2001.
All Tenders on Internet by August 2001	All Tenders of the government should be put on Internet by August 15, 2001and submission of tenders should also be introduced through Internet
On-line bookings by January 2002	All bookings related to services provided by government must be made on-line by January 2002
All government payments on internet by 2003	All forms of payments to government such as payment of bills/ dues, taxes etc. should be made available through Internet by December 2003. Concerned agencies must prepare a time bound action plan for

establishing infrastructure and services for electronic payments.

Results of public examinations on Internet by June 2001	Results of all Public Examinations and information related to admissions to engineering, medical and other professional Colleges should be put on Internet by June 2001
Internet enabled Employment Exchanges	Employment Exchanges across the country must provide information and registration related to various job opportunities and status of applications filed by the candidates through Internet
Land Records computerization by 2005	Computerization of land records all over the country with computerized land / property documents should be made available to the public at all levels including in villages by 2005
Extensive use of IT in Judiciary	Computerization of information related to court cases particularly the ones related to land / property disputes and extensive use of computers in courts at all levels in the country for office automation and judicial applications.
File Tracking system at District Collectorates by 2002	District Collectorates must implement File Tracking System to provide Internet based information on applications submitted to them by public for various purposes by December 2002
IT Kiosks for single point delivery of government information/ services	Single point delivery of government information and services including all forms of payments should be developed. IT kiosks should be allowed to offer such services on chargeable basis to public with revenue sharing formula with respective government agencies

Education

The Working Group recommends the following steps towards this:

Computer education at block level by 2003

Computer education facilities should be set up in rural areas by identifying at least 10 secondary schools in each of the 6000 development blocks in the country by 2003. Each school should maintain a PC to student ratio of at least 1:20 with minimum of 10 PCs in a school. All school level computers and software should have local language capabilities.

All schools with computer education facilities to have access to Internet

All schools with computer education facilities should have Internet connectivity so that vast educational resources already available and to be developed by schools themselves could be shared amongst them. This will also create a sense of competitiveness amongst the schools for development of learning material.

Computer education at school level should be promoted jointly with the participation of Central Government, State Governments, Donors, Non-Resident Indians (NRIs), Industry including non-formal sector of computer education and training, Local Area Development Funds of MPs & MLAs and private individuals. This is an area where large investment is required on a continuing basis and can not be handled and sustained at satisfactory level by government sector alone. Hence, the participation by these agencies needs to be encouraged for the success of this

programme.

Entrepreneurs / self-employed people should be encouraged to establish IT education and training centres at schools by sharing the school infrastructure already available there. These agencies will have the responsibility of providing computer education to the students while offering IT education and training programmes for public from these premises. The fee structure at the level of schools should be made in such a way that these programmes become self-sustaining in the long run. The fee should be decided with the consent of Parent-Teacher Associations at the school level for this purpose with adequate provisions for cross-subsidization of poor children.

Government will continue to have a major role in encouraging and supporting computer education at school level. Government's contribution could be either in terms of direct financial support to schools or by organizing and supporting teachers' training programmes in computers and making course material and other educational material on CDs available to schools.

Pilot project for schools in 100% literate blocks

As a pilot project for establishing computer education facilities at block level, one block in a district having achieved 100% literacy in each state should be identified. Computer education should be introduced in 10 schools in each of such blocks by June 2001.

At least two teachers at every school should be trained to acquire skills to be able to sustain computer education programmes at schools.

Companies should be allowed to write-off 150% of the depreciated cost of the PCs and other Internet access devices if donated to schools/ academic institutions

Special scheme for college students from under-privileged sections

A special scheme should be launched by the government for the benefit of college students belonging to SC/ ST and Below-Poverty-Line category to learn IT through basic foundation courses. The candidates selected for government services should be given priority under this scheme.

Career guidance/ counseling

Special arrangements should be made by government and industry for career guidance and counseling to large number of students who are undertaking IT training programmes at enormous cost through private sector in the country so that investments made by their parents for providing such training could be fruitfully utilized.

Mass Campaign for I T Awareness

The Working Group recommends the following steps in this direction:

IT Yatras (Journeys)

IT Yatras should be launched under the leadership of prominent citizens / celebrities in different parts of the country. These Yatras should have facilities for demonstrating the use of IT in various sectors based on the local needs of the people on the route of these Yatras. The Yatra should be conducted through Mobile Vans, which would have computers with mobile connectivity to Internet.

Under a special scheme of IT Yatra, four Yatras could be organized from four prominent cities in the four regions of the country. The programme

of these Yatras could be divided into three phases: Pre-Yatra Phase, the Yatra and the Post-Yatra Phase. In the pre-Yatra Phase, competitions, workshops, training programmes, popular lectures, advertising over the mass media etc could be undertaken to create a mass sensitization about the benefits of IT in the country. In the Yatra Phase, the four Yatras will travel through their respective regions demonstrating the use and benefits of IT to the common man over a period of about 2 months. These regional Yatras will finally culminate into a National IT Rally at Delhi on a day which could be declared by the government as an IT Day. Prime Minister may be requested to address this rally. On this day, a national seminar on IT and its benefits to the common man could be organized in which besides lectures and presentations, prizes/ awards announced during the major competitions in the Pre-Yatra Phase could be given. The Post-Yatra phase should be used to consolidate the gains of the awareness created amongst the people regarding IT in the country.

Competitions	Schools and colleges across the country must be encouraged to start competitions with respect to application of IT in various areas. Special prizes / awards must be instituted by schools / colleges. Corporate and industry houses in the country should come forward to sponsor these prizes / awards
National IT Talent Search	A special scheme for National IT Talent Search should be launched at senior secondary level to identify and groom the students for their career development in IT sector.
Use of Radio, TV & Internet	Intensive use must be made of mass media such as Radio, TV including Cable TV, and Internet to spread the message of benefits of IT to the common man. Short films / advertisements must be made under the category of Social Advertising towards this.
Use posters, banners, displays, etc for IT awareness	Advertising campaign for IT awareness should also make extensive use of posters, banners, displays, mailers, etc. to take the message to common man.
IT Melas (Fetes)	IT 'Melas' should be organized in different parts of the country particularly in small towns to demonstrate the benefits of IT to the people across the country. Special arrangements should be made to establish IT facilities at these melas for people to have first hand experience with regard to the benefits and utility of IT to the common man.

Schemes

As a first step towards spreading the message of IT across the country and to take its benefit to rural areas and under-privileged sections of student community, Working Group has formulated the following three schemes:

- Modified Vidyarthi Computer Programme
- Antyodaya Computer Literacy Programme
- IT Yatra

Implementation Mechanism

Working Group recommends the following multi-tier institutional framework

for speeding up and sustaining the process of taking the benefits of IT to the masses:

Cabinet Committee on IT

Cabinet Committee on IT (CCIT), already set up by the government, should continue to provide leadership at the apex level and resolve all legislative and policy formulation and coordination issues at the central government level for growth of IT in the country.

Inter-State ITCouncil

An Inter-State IT Council should be set up to evolve a coordinated approach for growth of IT industry and speeding up process of E-governance in the country. This Council should meet at least twice a year.

Committee of State IT Secretaries

A Committee of State IT Secretaries, under the chairmanship of Secretary (IT), Ministry of Information Technology, should be set up to monitor implementation of the IT plans formulated by the Inter-State IT Council.

Committee of IT Managers in central government departments

A Committee of IT Managers of all the ministries/ departments of central government should be set up under the chairmanship of Secretary (IT), Ministry of Information Technology to oversee the implementation of IT plans at the central government level.

IT Task Forces at Central/ State governments level

Every ministry/ department of central government and state governments should set up an internal IT Task Force to steer the formulation and implementation of their respective IT plans.

National IT Mission

A National IT Mission is required to be launched to oversee the implementation of the recommendations of the Working Group and provide necessary impetus to sustain the level of IT related activities with the objective of taking the benefits of IT to the masses in the country. As an immediate task, National IT Mission may coordinate the following programmes:

- Mass Awareness Campaign through the scheme of IT Yatra
- Antyodaya Computer Literacy Programme
- Modified Vidyarthi Computer Programme
- Special training Programme for sensitization of Ministers, MPs, MLAs and senior government officials on the benefits of IT in governance
- Scheme for promoting development of indigenous technology for low cost Internet access devices
- Standardization of code, keyboard and fonts for development of Indian languages based content over Internet.
- Development and promotion of simple tools and methodologies for self-repair/ maintenance of PCs and other IT infrastructure by non-professionals.

Summary

The Working Group in its deliberations has extensively analyzed the current level of IT Applications in the country and its future potential. The Working Group is convinced that IT is probably the only solution for the fast paced socio-economic development in a country like India where the population of 1 billion could be converted into a large pool of human assets to fully exploit the benefits of this technology to uplift their socio-economic conditions. Unlike conventional strategies of services being planned around government schemes and funding, the Working Group recommends that government should confine its role to set in motion enabling processes to facilitate mushrooming of large number of self-employed people and groups in small and unorganized sector to develop and provide IT and IT-enabled Services up to the remotest places in the country. On its part, government has to ensure that its presence becomes a facilitator and not a bottleneck. Towards this end, all licensing provisions with respect to IT services should be removed completely, making

the market absolutely open for private sector service providers and entrepreneurs in the country. Mass scale education programmes should be launched through self-employed people in unorganized sector as well as by corporate sector to enable people to take informed decisions.

Working Group has identified some applications of higher priority to be undertaken at different levels in the country at the earliest. Some of the major milestones recommended by the Working Group for such high priority are given below:

- November 2000
  - IT Yatras (In three phases – up to June 2001)
- January 2001
  - At least one citizen-oriented service in every department of central government and state governments to be made IT enabled.
- April 2001
  - All government regulations, schemes and forms on Internet.
- June 2001
  - Pilot Project for computer education at one block (10 secondary schools) in a 100% literate district in every state.
  - Results of all public examinations on Internet.
- August 2001
  - All government Tenders on Internet.
- January 2002
  - On-line bookings of all government services.
- December 2002
  - IT literacy to be essential requirement for recruitment to government. All existing government staff to be made IT literate.
  - File Tracking System in all District Collectorates.
- December 2003
  - IT infrastructure up to working level staff in central / state governments.
  - Computer education facilities at 10 secondary schools in every block in the country
  - All government payments to be made available through Internet.
- December 2005
  - All normal day-to-day government functions to be IT enabled. No one required to visit government offices for such work.
  - Land Records to be computerized in all the states
  - 1 million IT Kiosks
- December 2008
  - 100 million Internet connections

Working Group believes that pursuing such applications/ schemes by the Government following the recommended model of enabling large-scale participation of people in its implementation will go a long way in taking the benefit of IT to the masses in the country.

The Ministry of IT has accepted the recommendations of the Working Group and has set-up a National IT Mission in accordance with the recommendations. Some of the other recommendations, especially concerning the telecom services have progressed from the time the Report was submitted a year ago. Issues such as, allowing franchising with the revenue share between the fixed service provider and the franchisee, waiving license fee for low telecom density regions -- which do not permit easy solutions on account of the very high order of investment -- have already been addressed. In addition, it was noted that some of the recommendations regarding interconnection and tariff, etc., are under the purview of a statutory body, the Telecom Regulatory Authority of India (TRAI).

Constraints on development and application of IT in various sectors and measures to promote faster use of IT

The adoption of IT would have a smooth run if two 'killer' applications are successful. These two are in the fields of education and health – distance education and telemedicine respectively. Both these applications address serious shortcomings of availability of trained teachers/doctors and the lack of adequate equipment to use available knowledge in an effective manner. Well-designed and implemented ICT applications in these fields would encourage the quick adoption of technology. Apart from the above two, some of the other applications that would spur the use of IT in a big way are the following:

- Agriculture: in the post-WTO era, it is necessary to use ICT to provide real-time information and equip the farming community with the tools to become competitive. Some of the application areas are weather forecasting, region and crop specific agronomic practices, information on weeds, pests surveillance and forecasting, expert advise through distance diagnostics, real time market intelligence (prices, demand for products, etc), post-harvest storage details and practices, land tenure/lease records, etc;
- Animal Husbandry: breeds, husbandry practices, etc.;
- Communication: low-cost messaging and e-mail services, Internet access, etc;
- Development Issues: details of various schemes, assistance available, etc.;
- Disabled & Handicapped: ICT-based education aids for different disabilities, expert advice and guidance on management/treatment through telemedicine, etc;
- Education: adopting ICT as a tool to supplement the efforts of teachers and address the serious shortage of competent teachers, training of teachers, developing of multi-media content for schools/colleges/adult education/tutorials, information on courses, options, etc. Necessary revision of course syllabi in schools and colleges would need revision to fully exploit this medium ;
- Health: ICT-based telemedicine, hospital management (bed availability, remote registration, post-operative care, etc.), preventive medicine, public health issues involving information, control, etc.;
- Government: electronic grievance handling/redressal, incentives for using email, etc.;
- Identity cards: 'smart card' based identity cards that could be built on the electoral roll database that has been developed.
- Industry: on-line registrations/filing of various returns of tax, duties, etc/information/ permissions, etc., e-procurement;
- Public Information: employment exchange registration/opportunities, examination results, time-tables (railway/airline/road), Government notifications/forms;
- Social Sector: pensions (old age/handicapped/widow), civil supplies, etc;
- Women & Children: empowerment, information about schemes, etc.

Towards these goals each Government (State/District/Local) has the leading role to play. It is the single largest spender of funds in the economy and with Planning Commission guidelines permitting the expenditure of 2 to 3 % of Plan funds for IT related activities, Government spending by itself can catalyse and kick-start e-Government which could later be privatised. State and Central Governments together can access Rs 2500 crores p.a. towards this. Various initiatives have been taken by the Central Government in this direction and are listed below :

Government of India Initiatives

- Adoption of a minimum agenda for e-governance in the Ministries/Departments of the Central Government :

- Each Ministry / Department must set up LANs and provide PCs with necessary software up to the Section Officer level.
- A) 100% training of all staff who have access to and need to use computers for their office work should be ensured.

  B) For this purpose, inter-alia, Ministres/Departments should set up or share Learning Centres for decentralised training in computers as per the guidelines issued by MIT.
- Each Ministry / Department would start using the Office Procedure Automation software developed by NIC with a view to keeping a record of receipt of dak, issue of letters, as well as movement of files in the department.
- Pay roll accounting and other house-keeping software should be put to use in day-to-day operations.
- Notices for internal meeting should be sent by email to the officers and also put up on online notice boards of the Ministry / Department.
- Ministries / Departments should use the Web-enabled Grievance Redressal Software developed by Department of AR & PG.
- Each Ministry / Department should have its own website.
- All Acts, Rules, Circulars should be converted into electronic form and, along with other published material of interest or relevance to the public, should be made available on the internet and be accessible from the Information and Facilitation Counter.
- A) The websites of Ministries / Departments / Organisations should specifically contain a section in which various forms to be used by citizens / customers are available. The forms should be available for being printed out or for being completed on the computer itself and then printed out for submission.

  B) Attempts should also be made to enable completion and submission of Forms online.
- The Hindi version of the content of the websites should be developed simultaneously, as far as possible.
- Each Ministry / Department would also make efforts to develop packages so as to begin electronic delivery of services to the public.

- Each Ministry / Department should have an overall IT version or strategy for a five year period, within which it could do detail specific action plans and targets (including the minimum agenda) to be implemented within one year.

However, the initiatives taken have been piecemeal and there is need for taking a holistic view in the matter. Towards this end a National Programme for E-Governance has been proposed and is under consideration of Government.

- Landmark decisions announced by the Prime Minister during the National Conference of IT Ministers, held in July 2000, which, interalia, decided that

  - The Union and State Governments will take specific measures to promote e-governance to improve transparency, accountability and efficiency.

  - IT for masses: facilities for IT education and IT based education will be expanded and improved.

  - Liberalisation of telecom & ISP infrastructure in the country.

- Setting up of a Centre for e-Governance in the Ministry of Information Technology (MIT) to showcase successful e-governance applications and to foster e-governance initiatives/activities in the country.

- Various State Governments have also drawn up their long term IT Plans and MIT is closely interacting with the State IT Secretaries to initiate projects on a pilot basis which could be replicated in different States after successful demonstration. Significant efforts have also been initiated by the States for computerisation of the Departments, putting citizen centric applications to facilitate efficient services.

- Earmarking 2 to 3% of annual budgets by various Central Ministries/Deptts. and State Governments for IT related activities.

- Enactment of IT Act 2000 by the government to accord legal status to the information and transactions carried on the net.

- Setting up a Working Group on 'IT for Masses' who have addressed issues of e-Governance in their report. The recommendations made are at Annexure I.

- Seting up of Community Information Centres (CICs) in 486 blocks in the North-East and Sikkim as a part of the Prime Minister's Agenda for the socio-economic development of the region at an estimated cost of Rs.220 crores to provide connectivity at the block level. A pilot project in 30 blocks has been completed.

- Setting up of Media Lab Asia in collaboration with Masschussets Institute of Technology, USA has been approved. The Media Lab Asia is a network for national as well as overseas people, projects and laboratories dedicated to bringing the benefits of the most advanced information technologies to the neediest people. The role of the Media lab is to facilitiate the invention, refinement and deployment of innovations that benefit the masses. The Media Lab Asia would work with industry, NGO, Government, and most importantly ordinary people, to bring these innovations to every village in India. The key to success for the Media Lab Asia would be combining the creativity of Indian entrepreneurship with the technical know-how of seats of learning to grow sustainable, culturally appropriate solutions. The thrust areas include Health, Education and Micro-entrepreneurship development.

- Number of initiatives have been taken under the TDIL(Technology Development of Indian Languages) programme of the MIT for development of Indian languages processing tools, human machine interface systems, translation support systems, corpora and lexical resources. The objective is to increase IT penetration, development of new products and services in Indian Languages, promote content creation (on web sites) apart from facilitating research in technology intensive area of Language Engineering.

- National Informatics Centre provides computer support to Central Govt. Department, State Govt. Department and District Adminstrations (540 districts) and new districts being created by the State Governments. NIC has set up a satellite based computer communication network for providing E-mail, Internet, File Transfer, Access to National and International Data-bases (including Bio-Medical, Land records etc.) Electronic Data Interchange(EDI), videoconferencing facility etc. NIC has set up a local area network in Centre Govt. Department and State Government Secretariats.

- In 56 Ministries/Departments web sites exist and efforts are made to update these web sites. In addition 73 Central Ministries/Departments have designated IT Managers to act as the nodal point for all matters relating to computerisation in a Ministry/Department.

3. Conclusion

The issue of connectivity is the single most crucial issue today and has to be addressed on a war-footing to release us from remaining hostages of the past. Special efforts have to be made to ensure coverage to rural and deprived urban areas to avoid growth of a digitally deprived sector. Earmarking required funds for this has to be built-in to policy as has been done in countries like Australia and Brazil with a 1% cess on telecom revenues for socially desirable schemes. Similar emphasis is necessary on developing local content by encouraging local NGOs, industry associations, student organizations, etc. to take the lead. Capacity building is another area where Government can directly play a role through supporting existing institutions and setting-up new ones. At the end of the day, all this and more, will get done only if the political leadership puts it weight behind the requirement. The Prime Minister has to own the developments in the field and enthuse the Government in the right direction.

4.   E- Governance / IT Applications

These Schemes are representative in nature with respect to the macro-level paradigm of **"Convergence & E-Governance".**

- **Telecom Infrastructure:** Strengthening and Extension of NICNET to "block" level (grass-root), as a step towards bringing in "e-governance", **with an outIay of Rs. 1500 Crores,** which will function as **"National Information Infrastructure for e-Governance"** in respect of :
  - Network Infrastructure Facility Provider (NIFP)
  - Network Service Provider (NSP)
  - Application Service provider (ASP)
  - Content ASP

- To achieve "IT enabled delivery of services in Government", as a step towards "pervasive e-Governance" in the country, **establishment of District Informatics Centre as "Centre of Excellence in e-Governance"** with the state-of-the-art NICNET Nodes and also to facilitate "establishment of National Free Trade Zone on Internet", as conceived by the USA, in a vast country like ours (India), which has been endowed with different agro-climatic and ecological conditions, for sustainable development and economic growth. This will be a step towards establishing "e-Commerce" facilities as well as "e-Governance" practices for "**Reaching the Unreached".** This will require **an outlay of Rs 600 Crores** with an estimate of Rs 1.00 Crore per district.

- Strengthening NIC as Central Certification Agency (CA) to issue digital certificates for ensuring, integrity, authenticity, etc., for Central Government Departments. This will require **an outlay of about Rs. 70 Crores.**

- IT Training Programme/Seminars on the benefits and applications of It   in Government (Recommendation 3.2.3 of the Report on "IT for the Masses") - **Rs. 4500 Crores**

    Central Sector Scheme - Rs. 2500 Crores
    - Members of the Parliament (Lok Sabha and Rajya Sabha)
    - Central Government officials
    - Para-Military Forces (CRPF, BSF, ITBF, Assam Rifles, RAF), CBI, IB, RAW, etc - to usher in IT-led Internal Security
    - Defence Forces (Air Force, Navy, & Army), Defence Establishments, etc to usher in IT-led defence security

    Centrally Sponsored Scheme - Rs. 2000 Crores
    - Members of State Legislative Assemblies/ Councils

- Members of Panchayat Raj Institutions (PRIs)/ Nagarpalikas
- State Government officials

- **Natural Disaster Management Knowledge Network:** to address prevention reduction, preparedness and mitigation of disasters at **national, state,** and **district** levels, and also **village level relief plans - Rs. 650 Crores.**
  - Creation of database at various levels and planning for all contingencies of disasters with horizontal and vertical integration
  - Strengthening of forecasting, warning and alert systems using GIS, Remote Sensing and GPS Technology
  - Human Resources development.

- **Multiple mechanisms for access to Internet and web-enabled government services:** It is essential to catalyse the creation of multiple access mechanisms for citizens to access Internet for email, information and governmental as well as non-government services. Projects that create such mechanisms, such as internet kiosks, community internet centres, integrated citizen service centres, all over the country and especially in the smaller towns and villages, would be encouraged and funded. Upgradation of existing PCO booths to internet kiosks is one of the attractive ways of achieving this. Liberal funding can also be provided for this purpose through linkage with employment generation schemes. There would be a need to extend the Centrally sponsored programme on Community Information Centres to other backward states and to launch a new programme to equip each of the block level post office with Internet facility. We may make a provision of **Rs. 500 Crores** for this purpose.

- **Information Security:** Gaps in information security environment can severely compromise national security and pose serious threats to the economy. This is one area where there is no alternative to development of expertise, technologies and tools within the country. Adequate resource allocation for R&D, development and implementation of technologies, tools as well as security plans for various requirements needs to be provided in the Tenth Plan. We may make a provision of **Rs. 50 Crores** for this purpose.

- **Research & Development of Language Tools:** While efforts are under way to take Internet and electronic citizen services to small towns and villages, language tools are urgently required to enable non-English knowing population to use the content and services available over the Internet. Earlier efforts have resulted in tools that are limited to transliteration among Indian languages. There is a very urgent requirement of language tools for machine translation among Indian languages and from English to Indian languages and vice versa. Similarly, there is urgent need to develop speech recognition and character recognition for type-written as well as handwritten matter in Indian languages. Such tools are already available for English and many other major international languages. Major R&D efforts need to be mounted for this purpose. Resource allocation for creation of such language tools, preferably in the public domain where they become available free of cost to all users, may be given high priority in the Tenth Plan. We may make a provision of **Rs. 50 Crores** for this purpose.

- **Establishment of National Institute of Smart Governance** National Task Force on IT and Software Development had recommended setting up of the National Institute of Smart Governance. This institute would enable sharing of best practices and development of innovative solutions for e-Governance, provide consultancy, training and capacity building for effective and widespread implementation of e-Governance. A provision of **Rs. 30 crores** may accordingly be made in the Tenth Plan for the purpose.

- **India Portal :** India Portal would serve as a one-stop non-stop destination for pubic access to information on various aspects of government functioning. It would also serve as a single window for delivery of government services. Although, working out of detailed proposals will take some time, a token provision of Rs. 10 crores may be made.

- Launching pilot projects **to overcome** "last mile" problems - i.e. to network ever increasing number of households by using the already existing telephones, television cables, electric power connections, and also the **Bluetooth Technology** (globally available 2.4GHz ISM Band). This requires setting up a Project **"Centre for Development of Last-Mile Solutions", under NIC,** with **an outlay of Rs.12.00 Crores.**

- Transfer of Technology in e-Governance among States - **Rs. 100 Crores**

- **Centre for Natural Resources Informatics Development (CNRID)** to facilitate building up of DSSs on Sustainable Development - **Rs. 600 Crores.**

- Imparting Training on **"Knowledge Management"** to Faculty Members of about 3500 Colleges, as approved by UGC, ICAR and AICTE, so as to facilitate them to function as an "active catalyst and facilitator" for building a **"knowledge society"** in the Country. This will require **an outlay of Rs. 800 Crores.**

- Institutional linkages with S&T institutions to work out ICT applications in Primary and Secondary Sectors as well as services sector for increasing **"productivity"** as a step towards ushering in "digital economy" in the country. **This will envisage an outlay of about Rs. 1000 Crores. (< 1 % of its GDP contribution to the Economy).** This is recommended, as the impact of ICT applications would be predominant in the sectors such Agriculture, Rural Development, Health, Education, Judiciary, Urban Development, Women and Child Development, Tribal Development, etc.

Chapter 6: Manufacturing Sector

1.   Introduction

The Study Team would be addressing the following sectors of electronics and IT industry:

- Consumer Electronics
- Industrial Electronics
- Computers
- Communication and Broadcasting equipment
- Strategic Electronics
- Components

The area-wise production targets and actual performance for the manufacturing sector during the Ninth Plan are given below:

Table 1: Production Targets & Performance in Manufacturing Sector during Tenth Plan

Sector	1997-98		1998-99		1999-2000		2000-2001		2001-2002	
	Target	Actual	Target	Actual	Target	Actual	Target	Actual	Target	Proje-ction
Consumer	7200	7600	8500	9200	10300	11200	13000	11550	17000	13000
Industrial	4050	3150	4650	3300	5350	3750	6400	4000	7700	4500
Computers	4700	2800	6600	2300	9250	2500	12800	3400	17850	4000
Comm. & Broad. Eqpt.	7400	3250	9850	4400	12950	4000	16700	4500	21650	5000
Strategic	1300	900	1500	1300	1700	1450	1950	1750	2250	1900
Components	5500	4400	7100	4750	9200	5200	12000	5500	15600	6000
TOTAL	30150	22100	38200	25250	48700	28100	62850	30700	82050	34400

The actual performance of the manufacturing sector during the Ninth Plan has been well below the targets.   Computers and Communication & Broadcasting sectors have witnessed negative growths.   Industrial Electronics, Strategic Electronics, and Components sectors, while performing below the targets, have been showing steady but low rates of growth. The consumer electronics sector has shown better than targeted performance during the first three years but is showing signs of stagnation. The overall targets for the terminal year of the Ninth Plan were based on achieving 2% of the expected world production.   The growth rate of the manufacturing sector during the IXth Plan has been about 11 %. While it is far below the growth rates achieved by the software sector, it is to be noted that this is still well above the average growth rate for the manufacturing industry.

Export Profile during the Ninth Plan

The export targets and actual performance for the manufacturing sector during the Ninth Plan are given below:

	1997-98		1998-99		1999-2000		2000-2001		2001-2002	
	Target	Actual	Target	Actual	Target	Actual	Target	Actual	Target	Proj.
El. Hardware	3440	3000	4670	1800	6440	1400	7840	4788	12430	8500

The actual export performance of the manufacturing sector during the Ninth Plan has been well below the targets. It is seen from the year-wise profile that while the first year of the Plan

witnessed an actual performance only 10% below the target, the subsequent years have seen a sharp fall. The manufacturing sector has clearly been unable to compete in the global market place.

2.   Sub-Sectoral Reports

Consumer Electronics

The industry registered about 20% growth during IX plan period. However, the industry has shown signs of stagnation during the year 2000-01 with the growth rate falling to about 4%. During 2001-02 against a target of about Rs. 17,000 Crores a production of only Rs. 13,000 Crores is expected. The major reasons for the shortfall are given below::

- Increase in local Sales Tax on all consumer electronics products w.e.f. January 1, 2000.
- High rate of taxes on consumer electronics products
- Multiplicity of Taxes such as Customs Duty, Excise Duty, Local Sales Tax, Central Sales Tax, Octroi, TOT, Surcharges etc. We should change over to a composite VAT, which should include Excise Duty, Local Sales Tax, CST, Octroi, TOT, Surcharges, etc. by 1 April 2004. All other countries, including European countries, China, Nepal and Bangladesh have a composite VAT of around 17%.
- Highly inefficient and corrupt tax collection system both at the Central and State levels.

In addition, the following factors also contribute to stagnation of the production:

- Near saturation of Urban market
- Low penetration levels of Consumer Electronics products in the rural market due to :
  - Low level of electrification in the rural areas;
  - Lower disposable income
  - High cost of end product
  - Poor availability of TV/Radio Broadcast services
  - Under developed marketing and service networks.

The industry had built capacities anticipating substantial growth in demand. Thus, capacity is not a constraint in this sector. In a highly de-regulated, de-licensed, assembly oriented industry like consumer electronics, the production by the industry is limited by the market requirements.

The major products of the consumer electronics industry are CTV, B&W TV and two-in-ones.   Major growth has occurred in CTV and two-in-ones. The B&W TV sub-sector has been badly hit. The sales tax on B&W TV has been increased to more than 12% against the earlier 4-5% w.e.f. from 1.1.2000. In addition, 4% CENVAT (non-Modvatable) on B&W TV sets has led to an increase in the price of the B&W TV set by about Rs. 200., B&W TV sets have shown negative growth in the last 2 years.

The exports in consumer electronics have declined. The cost disadvantages in terms of CST, Octroi, high cost of finance & local components, transportation cost, procedural formalities, time taken in reimbursement of drawbacks, etc., makes Indian products non-competitive in the export market.   The thrust areas where India has potential to become internationally competitive are CTV, B&W TV, Clocks & Watches, PA Systems, Audio Products. The certification for quality/safety (CE, UL, VDE etc.) have become essential for exports and presently, its cost is on the high side and adds to the export prices. Until the volumes of exports grow, charges for certification for quality/safety should be reimbursed as part of export promotion.

Industry is largely operating in cost competitive products and needs to move up on the value chain through technology or value added consumer electronics products. Digitalization and convergence of technologies has offered an opportunity to leverage our technology and engineering skills. The Ninth Plan witnessed further liberalization of EXIM policies. New consumer electronics

products like DVD player; MP3 player and VCD player are being imported for domestic consumption. With the economic growth in the country, demands for consumer electronics is bound to increase.

Investments in R&D by industry are very little and the Government support is sub-critical. To help the industry in leveraging their skills in engineering, and technology for competing with multi-nationals and to export, the Government funding to the industry sector should be in the form of grant-in-aid.

With the convergence of technologies, consumer electronic products are expected to become smart, intelligent and networked. Such interactive systems would facilitate services like Tele-banking, shopping, distance education, medical treatment, video on demand, electronic newspaper etc.

Convergence is going to greatly affect the Consumer Electronics industry. A time bound program should be evolved for introduction of Digital TV.

For a robust equipment industry, availability of critical raw material and state of art components at competitive prices are important. There is a need for a strong component industry. We are extremely weak in the active components, such as ICs. The investments in this field would come only if the domestic demand justifies setting up of the units in India.

Industrial Electronics Sector

Industrial Electronics normally includes electronics technology fields that are directly applied to industry and service sectors for achieving higher productivity, quality/reliability and the required safety needs. Following major industrial electronics technology products covering both hardware and software aspects:

- Power Electronic equipment like DC/AC drives, UPS, SMPS, Static Var. Compensators, Power Supplies and such other items
- SCADA, PLC, DCS and similar process control automation equipment including various transmitters.
- Test and Measuring Instruments
- Various instrumentation items like Alarm Enunciators, Protection equipment, Electronic Energy Meters, Electronic Weighing/Measuring systems, Industrial Ultrasonic Equipment, Electronic Relays etc.
- Energy Management Systems for power sector and other industries
- Railway Signaling Equipment, Computer Based Traffic Control systems
- Flexible Manufacturing/Robotic systems

Review of Ninth Plan Achievements

Production

The actual production figures of various major items achieved during the 9th plan period in the field of Industrial Electronics are shown in Table 1. Annual growth of 5% has been estimated for 2001-2002. Control, Instrumentation and Industrial Sector Production constituted the 14.5 % of total hardware production during 1997 has dropped to 13.2 % in 2000. The major contribution has come from process industrial electronics, power electronics and process control equipment's. It can be seen from the above table that Industrial Electronics constitutes about 13% (on an average) of the total production in the manufacturing sector. Also the last year of the Plan is expected to achieve a production level which is about 45.5% less than the targeted figure of Rs. 7700 Crores.

General Status of Industry

The demand of Industrial Electronics products is directly related to the developments taking place in the core sector industries such as steel, cement, petro-chemicals/refineries, textiles, paper mills, power plants etc. As reported by the concerned industry association, the growth in most of the core sector industry has been extremely low in the past few years thereby directly affecting the growth of the Industrial Electronics sector. The IEEMA has reported that due to slow down in the project investments in the core industry, the demand for all the relevant industrial electronic products has come down to a level of 3 to 4% growth per year.

Technology Status

In the field of Power Electronics, IGBT based AC drives now dominate the market with about 75% of the market share and the rest 25% is taken up by DC drives. The latest IGCT (Insulated Gate Commutated Thyristor) based AC drives have also been introduced in the country for improvement in productivity and quality and as an energy saving option. In the process control area, the concept of total integrated automation and architectures has been established. Products like APACS (Advanced Plant Automation and Control System) and DCS (Distributed Control System) combines both DCS and PLC capabilities in one system to reduce cost and to utilize the same configuration software independent of batch processes. Process automation systems are now capable of controlling plants in industries by providing advanced control capability, structured display environment, client/server architecture, user authorization, comprehensive alarm and data logging combined with a powerful operator display interface and Inter/Intranet viewing. Ethernet protocol is rapidly being accepted for use on the plant floor. Communication standards such as Ethernet, TCP/IP, Devicenet, Profibus, Interbus, PC and PLC interfaces etc. for industrial network have already been established in the country.

Problem Areas

Industry is totally dependent on imported technology for majority of the products. Industry is not carrying out any R&D. The earlier mode of collaboration with MNCs and manufacture in India does not seem to be working now since MNCs themselves are now present here and marketing its products. According to IEEMA, indigenous manufacturing is no longer viable due to shortage of quality component suppliers, unfavorable duty structures, etc. It is observed that duty structures on finished products and components are similar for most of the items. This makes indigenous manufacturing less lucrative.

Medical Electronics

The developments during the last two decades in the application of electronics and IT to medical field have brought about a significant change in the clinical practice of medicine and more and more computer-based systems are being used in the diagnosis and treatment of wide variety of diseases. The technology development in the area of electronics and IT have brought into the market a variety of equipment in all branches of diagnosis of diseases namely bio-chemistry, pathology, nuclear medicine and specialized branches of diagnostic radiology such as CT scan, MRI, ultrasound etc. The latest technological advances in electronics and IT have enabled the manufacture of equipment for therapeutic application especially in the area of oncology, cardiology, neurosurgery and neurology.

Radiotherapy equipment like low energy/high energy linear accelerator with 3D treatment planning system and simulation has provided the physicians and surgeons to administer the treatment to the cancer patients more effectively. The introduction of gamma knife camera can treat brain tumors and even vascular malformation without even undergoing the most difficult surgical procedures in the brain. The application of informatics for patient management and hospital administration is a common concept for delivery of services to the patient in hospitals. IT and electronics has been providing effective equipment and system in the following areas : Diagnosis,

Treatment, Multimedia knowledge based system, telemedicine as aid to medical teaching, Aids to the disabled, Data basis pertaining to endemic diseases.

Most of the medical electronic equipment has been placed under life saving category equipment they attract 0% duty. This has also in a very affected the manufacturing activity in the country. The production of medical electronic equipment in the country is of the order of Rs. 356 crores out of which most of the equipment belong to the category of hearing aids, pathology equipment, ECGs and low current X-ray machines. The high value diagnostic equipment such as CT, MRI, ultrasound, PET etc.

India should harness various expertise available at various places (IITs, BARC, SAMEER and Defense Research Establishment) to develop state of art medical electronic equipment. Min. of Information Technology in collaboration with Min. of Health may devise measures to encourage the indigenous manufacturers.

A tentative list of areas which could be attempted during the 10th plan for R&D activity in mission mode:

- Image guided surgery
- Robotics in surgery
- Researches in the area of 2D, 3D visualization in various imaging modalities
- Computerized decision support in medical imaging
- Multimedia , AI based packages and 3D Visualization for training and diagnosis
- Electronics and IT application in the rehabilitation of disabled
- Development of Linac for cancer treatment

Computer Hardware Industry

Production Profile

Production of Data Processing Systems which constituted 12.5 % of total hardware production during 1997 has dropped to 11.2 % in 2000. The major contribution has come from personal computers, printers and peripherals. It is to be noted that major part of the hardware production in this sector is based on assembly of SKDs as manufacturing from component level require high cost assembly infrastructure. The low volume of demand, rapidly changing designs of the products and lower custom duties for the import of finished equipment does not financially justify in-depth manufacturing. The actual production against production targets had been low because of inverted tariff structure, aggressive marketing and competition by MNCs. New investments could not come in because of non-conducive policies – duty, labour laws, electricity, transportation, telecommunication infrastructure etc.

It would be desirable to promote IT for productivity. The metrics of productivity need to be evolved so as measure efforts towards upgrading the productivity through IT in various sectors of economy. This will help in optimizing computing resources - reasonable configuration with lower prices. Cost will be lower and spread will be wider, that will generate higher demand and facilitate imbibing IT culture in people at large.

Technology Missions

The following IT Hardware missions with budget outlay over X Plan may be launched:

Mission	(Rs. Crores)
▪ Low Cost PC	50
▪ SOHE	

- Refurbished PC
- Thin Clients
- PC-on-Chip
- Embedded Systems   10
- E-content and Localization   80
- Collaborative IT Incubation Centers   350
- R&D intensive HRD programs   10

Total   500

Low Cost PC: The current PC penetration in India is 6.2 per thousand and target in 2008 is 20 per thousand. In order to achieve the target in terms of numbers and ensure utilization of PCs for higher productivity, it is essential that low cost (affordable) PC should be made available with Indian language support. Low cost PC could be realized as stand alone PC or re-furbished PC or Thin-client cluster or domain specific information appliances. Academia – Industry – Government collaborative venture needs to be evolved to realize proliferation of low cost PCs and develop the national strength.

SOHE PC: Low cost PCs for Small Offices, Homes & Education (SOHE): In information technology, SOHO is a term for the small office or home office environment and business culture. There is a lot of demand for low cost Personal Computers in this sector i.e. Small Business persons who want to upgrade their business by putting modern aids like computers in their business. A home user of Computer is also looking for a low cost personal computer. Various technologies in use in SOHO networks are Ethernet, modems, ISDN, ADSL, cable modem, wireless networks etc.

Stand-alone low cost PCs: Stand alone low cost PC is a Personal Computer, which has the all-minimum basic functions of the personal Computer, and low cost can be reduced by reduction of duties on imports and by manufacturing the components in India. Simputer developed at IISc. Bangalore seems to meet the above characteristics.

Refurbished PCs : The import of second-hand refurbished PCs is the solution to the dream of a PC in every home, especially in small-town India, which is where India's vast majority lives. As an alternative, the industry suggests building low-cost information devices, which may serve specific purposes, and reducing taxes to bring down costs. India's extremely poor PC penetration rate is a much-debated subject. The government could reduce taxes, duties, and thus boost PC penetration, but that would mean lower revenues.

Thin Clients : In client/server applications, a thin client is designed to be especially small so that the bulk of the data processing occurs on the server. Thin Client Server Computing solutions allow for the centralized deployment of enterprise-wide applications while maintaining the ability to support a variety of client computing devices. Applications run 100% on the server with only mouse clicks, keystrokes and screen updates moving across the network.

Radio-like Internet Access Device (RIAD) for Rural Communities: In this concept, information present on the Internet is divided into the bands like Agriculture Info band, Education band, Entertainment band, Sports band and so on. This concept also envisages using the latest technology of Text to Speech generation of different languages of India.   The console of RIAD device will have selection knobs for band selection and station selection. User can select a desired band and all the channels available on that band.

Following areas also need to focused for development and exploitation:

- Embedded Systems
- e-content & Localization
- Cross Language Information Retrieval Systems (CLIR)
- Human Machine Interface Systems (HUMIS)
- Speech technology

- Optical Character Recognition Technology:

Collaborative IT Incubators

The **role of innovation** in sustaining long term competitiveness and growth in the context of a dynamic and technology intensive sector like ICT software and services cannot be overemphasized. The process of innovation in turn interalia involves the ability to develop new products/processes/systems, new markets and new organizations. Following major services are provided by Innovative IT Incubators:

Accounting, Technology Mart, Technology clinic, Library, Laboratory, Business Consultation, Design Technology, Distribution, E-Commerce Design, Facilities, Funding / Venture Capital, Hosting Technology, Legal, Office Technology, Research, Support Staff , Training, Warehousing.

In order to achieve the targets set in the National Taskforce on IT it is necessary to develop the bright ideas of innovative people into products and market them worldwide. To fructify this it is required that one Incubator in each state capital and Prominent Universities be set up. There are 28 State Capitals and 269 Universities.

Professional Electronics (Communication, Broadcasting and Strategic Electronics)

Professional & Strategic Electronics sector comprises two major areas namely Communication & Broadcasting Sector and the Strategic Electronics Sector. The Communication & Broadcasting sector covers non-public network telecom industry, wireless communication, user specific transmission, and switching and terminal equipment. The Broadcast sector covers digital broadcasting of audio & video, IP telephony, broadband access, digital compression, hard disc based and optical technologies.

The Strategic sector encompasses the area of Satellite based Communication, navigation & surveillance system, convergence technologies including communication and broadcast, radars, navigational aids, sonars, underwater electronic system, infrared based detection & ranging system, disaster management system, internal security system etc. The Strategic electronic technologies are expensive, sophisticated and closely held by the developed countries.

The convergence of Communication, Computers and Entertainment has led to the emergence of a number of novel application in the professional and strategic electronic sector leading to development of more versatile technologies covering areas such as communication, aviation, internal security system, simulation and a host of other professional and strategic application. Emerging developments in the field of Internet, wireless communication, Global Positioning system (GPS), Geographical Information System (GIS), Robotics etc. have tremendous potential for cost effective and customized system solution. With the convergence of communication, content and distribution, the Professional & Strategic Electronic sectors are progressively merging.

Indian Scenario

The professional & strategic electronic industry in the country is largely user driven. This often leads to sub-optimal utilization of capacity. With liberalization, indigenous products have to face international competition, which, obviously, calls for increased capacity utilization through large and economic scale of production. Major contributors to the Indian professional & strategic electronic sector continue to be the Government PSUs such as BEL, HAL, ITI, ECIL etc. However, with the opening of the economy a number of private sector organizations such as TEC., BPL Mobile, Shyam Telecom, Reliance Infotech, WIPRO etc. are entering the sector.

The World production of Communication, Radar & Navy aid equipment's including broadcast (Professional & Strategic Electronics) is about $ 183 billion during the year 2000. The production of professional & strategic electronics in India during the year 2000 is about $ 1.36 billion, 0.7% of the

global production. The global professional & Strategic electronics production is growing approximately at the rate of about 4% yearly.

To help promote R&D in this sector, it was brought out that India does not have testing facilities to get design approvals for commercialization of product in European or American Countries. Indian test report for interface approvals or for electrical safety are not acceptable by developed countries. Hence, we have to take TUC or CE approvals like TBR-21, EMI and EMC test facilities from Taiwan. There is need to augment test facilities available in the country if Indian Research & Development efforts has to be supported and promoted.

Thrust Areas

Strategic Components : Components being the basic building blocks of higher assemblies, which in turn, ultimately constitute a system, consideration of the reliability of the electronic components is an important factor to ensure High Reliability (Hi-Rel) mission success. A major Hi-Rel program requires thousands of components from several suppliers, which are to perform very demanding functions and should be able to render the systems maintenance free, during the lifetime. The electronics components constitute almost 30 to 40% of strategic systems such as the spacecraft/launch vehicles cost and hence deserves major attention from the point of view of indiginisation of strategic Hi-Rel components. Some of the components that need to be manufactured within the country are:

- Memory Devices
- 12 K CCDs in visible and Near IR, Area Array CCDs
- Ku-Band TWTA
- Multi Junction solar cells (Ga-As)
- Regenerative fuel cells
- Sensors for strategic use
- Isolators/Circulators-Microwave
- Radhard Microprocessors and Peripherals for ISRO
- Fibre Optic Technology

Other thrust areas are:

- Speech Synthesis Technique
- Strategic Software
- Advanced Signal Processing
- Sensor Platform Stabilization
- Aeronautical Telecommunication Network
- Mobile/Cellular Phone Technology
- Mission Initiative on Wireless Networking and New Generation Network Access Devices/Terminals

Electronic Components (including Microelectronics, Electronic Materials, and Photonics)

Status of the Industry

Production

The production of major electronic component groups during the Ninth Plan period i.e. 1997 to 2002 is listed at Table 1.

Table : Production of Major Electronic Component during Ninth Plan

Rs. in Crores

ITEM	1996	1997	1998	1999	2000
Electron Tubes	891	1134	1513	1521	1700
Semiconductor Devices	299	309	322	419	357
Passive Components	817	896	1004	1068	1196
Electro-mechanical component	292	350	383	435	460
Special components	9	21	13	19	11
Others	1050	1300	1261	1500	1573
Total	3358	4010	4496	4962	5297
Growth Rate (%)	2.38	19.42	12.12	10.36	6.75

The growth rate achieved during the last four years has been declining continuously and it was 6.75 % during the calendar year 2000. It is largely due to increasing usage of imported components in the production of consumer electronic products. The major part of electronic components production is contributed by CPTs, PCBs, TV and audio components, ferrites, etc. The average growth during the last four financial years has been 8.28%

Target Vs Achievements

The target of production of electronic components and actual achievements for the IX plan period are listed in Table 1. The cause for major deviations can be attributed to setting up of high targets during IX plan (It was planned to produce 2% of world electronic production and export 1% of world electronic trade during terminal year of plan period.). The other factors for lower production is attributed to revised import policies. Electronic component import as bare component and in the form of populated PCBs, and finished equipments were allowed to be imported at lower custom duties without any quantitative restrictions. A major shift in electronic components technology from leaded to surface mount and increased usage of micro-electronic resulted in reduced off-take from Indian manufacturers, as many of these are not produced in India.

Exports

The export of electronic components during 1996-97, 1997-98, 1999-98 and 1999-98 has been of Rs. 520, 840, 760, and 600 crores respectively. It is largely contributed by CPTs, PCBs, Electro-mechanical components, ferrite etc. Indian units have long experience of manufacturing and competing against imports to meet the requirements in these sectors. Representative lists of components in which India can continue to export with existing technology scenario are: Semiconductor Devices (Small Signal/Power), Color Picture Tube and Deflection Components, Floppy Diskettes, Hybrid Micro-circuits, Printed Circuit Boards (DSPTH and Multi layer), Connectors, Capacitors (Aluminum Electrolytic and Plastic Films), Ferrites and Magnets, Loud speakers and its parts, and Transformer and Coils.

Make v/s Buy

The production and demand for export from India in component sector are limited to traditional items. The major export opportunities however, exist for modern chip components, micro-electronic devices and flat display deices for which no manufacturing is presently being carried out. The growth in the manufacturing in equipment sector should not be constrained by the availability of indigenously made components. In fact, Indian manufacturers should be encouraged to design and Manufacturer State of art equipment's using most modern components. The requirement of electronic components would be met from competitive sources irrespective of country of origin unless made competitively by Indian companies. Investments, however, could be made in areas where Indian companies can assure themselves of competition vis-à-vis other manufacturing countries.

Investments

During IX plan period no significant investment was made for creation of capacities for new electronic component (except for capacity enhancement for CPT and its parts). It is unlikely that any fresh investment in electronic component sector will be made in coming years. Besides most PSUs are withdrawing themselves from manufacturing of electronic components. PSUs are not likely to make any new investment in coming years.

Impact of Policy Measures

Policy initiatives taken for electronic sector during IX plan have not contributed much to the growth of manufacturing in electronic component sector. On the contrary, even existing units are finding it difficult to survive and many of them have closed or reduce their operations. If present policy continues to operate, more such units are likely to wind up in near future. Policies should be modified (along with pro-active actions) in such a manner that both Indian entrepreneurs and MNCs find it profitable and comfortable to set-up manufacturing operations in India. Government need not interfere with issues such as economic size, technology, production cost etc. These should be governed by market forces and entrepreneur's own assessment. Improvement in infrastructure (such as electricity, transport, communication, airports etc) and induction of professionals in ultimate decision making process of government should be taken on priority. Labor laws should be modified to give freedom to industry to make best use of their infrastructure in efficient and productive manner.

Implications of Convergence of Computer, Communication and Consumer Electronics

Convergence of Computer, Communication and Consumer Electronics technologies will have tremendous impact on the design, type and manufacturing technologies of electronic components. The role of micro-electronic devices will be more in most products due to widespread use of digital technology. High density information storage & retrieval devices, high resolution & portable displays, high energy density batteries and components for wireless products would come in increasing focus in coming years. These developments have already made Indian electronic component industry relatively obsolete. If corrective actions to install production base for modern components are not put in place, India will be totally sidetracked from the manufacturing sector in components.

Make Vs Buy of Critical Raw-Materials

Most of the normal and critical raw material used in the manufacture of electronic components is sourced from overseas manufacturers due to stringent requirement of purity, consistency and quality. These may be continued to be imported until the units in India in the material sector are able to manufacture and supply to large users in both India and other major consuming countries. As most materials need to be manufactured in large volume to be commercially competitive, it is necessary to have large user base. The small requirement of existing Indian electronic industry does not commercially justify the manufacturing of normal as well as critical materials for component sector. It is also necessary that the critical materials manufactured by Indian units be put to use by reputed users internationally before they will be accepted by Indian users.

Problems/constraints of Hardware Sector

High velocity of business, Correct duty structure and demand stimulation initiatives should constitute the basic framework for Policy and Procedures that needs to be put in place immediately. Microelectronics and semiconductors are once again thrust areas for development. Investment requirement in real dollar terms for the Tenth Five-Year Plan will be massive as compared to the earlier Plan periods. Hence, the policy package has to be investment friendly. The Component Manufacturers is most concerned by the following:

- Anomalies in customs duty structure
- Multiplicity of Notifications and problems of product classification leading to discretionary powers with enormous scope for misinterpretation

- Large Grey market and large scale dumping particularly from China as well as from the Nepal border
- High transaction cost as velocity of business is slowed down by delay in clearance of good, interface with numerous government authorities, multiple physical controls and no provision for self certification
- No action to provide for a conducive manufacturing environment for Electronics and IT hardware companies which is at par with the competing nations. The Action Plan II Report of National Task Force on IT and Software Development not implemented including the much awaited SBIT scheme.

Electronic Component Development Fund

One problem that the Electronic Manufacturing Sector in general and the Electronic Components Manufacturers and Material Manufacturers in particular are facing is the high interest rates for borrowing money for making investments and for carrying out their operations. This, coupled with other critical factors has resulted in the absence of any fresh investment in this sector during the Ninth Plan and in fact the closure of some existing units. Some of these factors are : technological obsolescence of the components produced, the process of manufacturing, the capital machinery used for manufacturing; zero or very low level of R&D; non-availability of the basic finished raw materials or the required capital machinery from local manufacturers; long gestation period for project implementation; poor infrastructure; high energy cost; need to maintain large inventories leading to high inventory costs; limited marketing infrastructure especially with respect to export market due to small levels of operations; procedural hassles for exports.

The parameters indicated above have a varying quantitative impact in the manufacture of a particular product. It is therefore possible to define a parameter called the "TECHNOLOGICAL COMPLEXITY INDEX" (TCI). This will have a high value in respect of items such as VLSIs where the investments are high, the technological obsolescence of the product is high as well as the technological obsolescence of the manufacturing processes and machinery. On a 100 point scale, VLSI may thus be very close to 100. On the other hand, there are items such as LEAD TABS used in manufacture of discrete electronic components where this TCI would rate fairly low say around 10 points. It can be noticed that to a large extent the investments in the electronic components industry in India have come in the low TCI area. The exception being Color Picture Tubes where the duty protection and large volumes have sustained the industry.

If the nation wants investments to come in high TCI area then we have to think of a mechanism for making capital available at low or even zero rate of interest along with longer periods of moratorium.

For this purpose it is necessary to create an "Electronic Components Development Fund" with a corpus of about Rs.100 crores to start with. Depending on where the particular product falls on the TCI curve and the seriousness/credibility of the entrepreneur, an appropriate quantum of capital could be made available at the subsidized rate of interest. The moratorium period as well as the pay back period also could be variable, depending on the TCI.

Microelectronics

Microelectronics has now come to be recognized as a core, strategic technology world-over and forms the heart of emerging Information Technology (IT) based Society. Besides IT, microelectronics applications have also become all pervasive in various walks of life - be it health and environment, agriculture, communication including internet, robotics, automation, avionics, automobiles, instrumentation, power, military etc. World over, the semiconductor content in electronics equipment is rapidly increasing in each new generation from 6% in 1985 to 23% in the year 2000 and projected to reach 40% by 2005. The last decade has seen immense growth of application specific Integrated Circuits (ASICs), Multi chip modules/systems, Low power and

manufacturability becoming essential issue in ULSI technology. Low power technology is increasingly gaining importance as hand held devices and battery operated electronics are becoming popular.

Indian Status

During the Ninth Plan period, the semi-conductor devices production has reached Rs. 178 crores. Limited economics of scale, impact of liberalization and highly competitive local market seem to be primarily responsible for the slow rise in the domestic production. In the manufacturing front, the country has 4 discrete semiconductor manufactures lead by CDIL and Usha and 3 IC fabs at SCL Chandigarh, ITI Bangalore and BEL-Bangalore. The discrete industry primarily supplies diodes, power devices etc while the IC industry caters to linear IC's, ASICs Telecom and other applications, On the fab front, SCL possesses 1.2 micron CMOS production line with 0,8 micron capability for R&D. ITI Bangalore offers 1.0 micron CMOS line with 0.5 micron R&D. BEL, Bangalore the only Indian fab line in Bipolar area is of 5 microns. In the assembly front, assembly of ICs is carried out by SPIC Electronics Limited, Chennai based on imported diffused wafers.

Microelectronics Demand

During the Ninth Plan period the semiconductor content of Indian equipment was at 13% and expected to increase to 20% in the year 2006-2007. In the terminal year of the X plan the targeted production of semiconductors in the country would be about Rs. 510 crores with current levels of investments maintained. However, if additional resources could be injected, this figure would be substantially enhanced.

Products having potential for export : Power Transistors, High Voltage Silicon Diodes, Low Power Diodes and Transistors, Thyristors, Fast Recovery Rectifiers, IGBTs, Telephone ICs products, Power MOSFETS, MEMS and SMART Sensors, GaAs discrete devices and Ics. Other Potential Areas for Export are Design of Custom devices including ASICs, IP Cores & providing foundry support, IC Testing & Test Services,ECAD & TCAD Tools, Export of technology to under developed countries, manpower training to developed countries.

Thrust Areas in R&D

- Building capabilities in areas of IC processes/manufacturing, testing and characterization
- Realizing core competence in strategic components, advanced technologies
- ECAD/TCAD simulation tools, nano-structures and special semiconductor technologies, CMOS/Bipolar/BICMOS devices, Power devices, FPGAs, MEMS and integrated systems/microsensors, Compound semiconductor processes, devices and ICs, high speed ICs and devices, devices characterization, Telecom and IT products Multi chip modules, Bio chips etc.
- Packaging
- Fast Recovery Rectifiers
- Tuner & filter
- TV rectifier (high voltage)
- Power Devices (including IGBTs /GTOs)
- MOSFETS
- MEMS and sensors
- Digital/ Analog/ Mixed Digital and Analog design
- Low power designs
- EDA /TCAD /MEMS simulation tools & specialized software

It is proposed to foster design innovation and bring out new products into the local market/ exports, a scheme of India Chip Program offering subsidy to the developer / company be put into place in the Tenth Plan. To serve this activity, an investment of Rs. 50 Crores will be needed. In addition, an infusion of Rs. 600 Crores would be need for undertaking R&D efforts and creating the necessary infrastructure.

Mega Fabs

Modern large wafer fabrication facilities known as Mega fabs are characterized by High capital costs upward of US$ 2 Billion and rapid obsolescence of technology. Because of the strategic importance of this sector, Governments in developed as well as developing world have taken a strong proactive approach to attract global players to set up mega fabs in their countries by offering a combination of fiscal incentives, which in some cases has an element of outright cash grants. The background report III of the National IT Task force dealing with Development, Manufacture and Export of IT Hardware had also suggested several policy packages in microelectronics sector to attract mega fabs In addition, Government should pro-actively invite major international companies to set up mega fab in the country by giving them appropriate incentives, and infrastructure facilities as well as removing all bottlenecks and simplifying procedures for maximizing their velocity of business which will be comparable to international levels.

Electronics Materials

The electronics components industry has been exposed to international competition by liberalization and a big gap has been left regarding indigenous availability of professional grades components in the country. To some extent this can be attributed to the non- availability of variety of electronics materials at comparative cost. Another reason being that our present material industry is mostly in the middle or small scale sector in comparison with the global industry, and thus facing challenges in competing with the international market both in quality and price. The electronics industry uses a varity of materials. There is continuous up-gradation of these materials to develop newer materials in terms of their specifications, purity level, etc. to meet the stringent quality specifications. Without a sound scientific base in the electronics materials, it will not be possible to keep pace with the latest development in the electronics component sector. This necessitates development of advanced materials synthesis and processing technologies along with novel instrumentation and measurement techniques in the country.

There is a big gap between the requirement of materials and the production of the materials in the country. India has got manufacturing base in the following areas:

- Copper Clad Laminates for PCB
- Magnetic Materials for soft ferrite, and magnetic recording media for audio and video tapes, automobile and microwaves
- Silicon
- Glass parts/Cells for B&W TV and Color Picture Tubes
- Fiber Optics Materials
- Plastic films for capacitors.

Demand and Production Profile

The share of materials in electronics manufacturing activities varied from about 60-65% in the case of picture tubes, connectors, capacitors, and magnetic media; 25-30% in ferrite components. 70% of the requirement of materials is for special features and very high purity materials and the balance 30% would be general purpose materials such as copper, steel and plastics. In addition, the electronic equipment manufacturers make use of materials in their assembly operations as well as for cabinets, chassis, connecting wires etc. At present, indigenous materials could meet only approximately 45% of the demand of the component production in the country.

Materials for IT Industry during Tenth plan

Material for IT industry is crucial for healthy growth of this industry. This sector is capital intensive and local requirement may not be adequate for cost effective production. Therefore, export together with indigenous requirement can make the manufacturing activity viable. To promote this

sector our emphasis during Tenth Plan should be focussed in the following development cum R&D activities leading to commercialisation:

- Raw Materials for Ferrite Industry
- Rare Earths based Colour Phosphors for CPTs
- Promoting Cleaner Environment Friendly Technologies

Areas in which India has capability/ infrastructure

Some of the items which have potential in the country in electronics and other sectors and also export potential are : Biaxially Oriented Poly Propylene Film (BOPP) required to make capacitor grade film upto 2 microns; Fire retardant grade epoxy resins for Copper clad laminates; Special Polymers: Special polymer include photo polymers, (photoresist materials); Raw Materials for CPT Glass; Recycling Industry (CPT Glass Recycling); Refurbishing of old computers; Technology Upgradation for development activity at NCL and C-MET; Setting up the pilot plants, infrastructure and capability.

R&D in Tenth Plan in Materials

R&D/Technology Development Programs in the Tenth Plan should focus priority wise as under:

- To consolidate and strengthen R&D activities where capability, infrastructure exists/have been developed during Ninth Plan to bring the sub-optimal R&D efforts to pilot/commercial level. Special emphasis should be given to materials having Natural Resources to make India globally competitive in these areas.

- To materials which are crucial for any of our high technology projects, be it for Space, Defense, Atomic Energy or IT and Communication Technology.

- Fundamental research on futuristic materials leading to technology upgradation.

Ministry of Information Technology is the key agency for promotion and development of electronics materials and allocation of R&D funds for this areas needs substantial augmentation to the level of Rs. 150 crores during the Tenth Plan period. Of this Rs. 100 crores should be in the form of loans to be provided to the industry to take up initiative to exploit the indigenous technology at pilot or commercial scale and technology upgradation.

Photonics

With a worldwide rapid transformation to information age, technologies that can handle and process high speed and large volume of data in different environments are receiving maximum attention. This, coupled with the fact that technologies based on the movement of electrons are reaching their limitations has lead to an increased focus on technologies using Photons - the basic unit of light. The vast information carrying capacity of Optical fibers, massive parallel processing possible through Photonics and high speed switching and computing possible through Photonics route, beside EMI free environment has made Photonics so important today.

Photonics can be considered a key Enabling Technology for several aspects of Information Technology such as Information Generation, Information Storage, Information Transfer and Information Display. There is close synergy between Information Technology and Photonics.

Indian Technology Status

Through the Photonics Development Program of Ministry of Information Technology, the following technology development projects are being pursued - Planar Waveguide Technology for

routing (Optical Switches), OADM, Modulators; Couplers based on Lithium Niobate/Glass Technology and on Silica on Silicon Technology. Design and certain characterization of Fiber Grating (FBG) (Fiber Grating Tech.), Pump laser development, erbium doped fiber for optical amplifier, WDM couplers and multi-G bit WDM source.

Photonics Industry in India

The major contribution by Indian Industry, so far, is in the Optical Fiber (OF) and Optical Fiber Cable (OFC) sector. The total Indian fiber production capacity at the beginning of the Tenth Plan would be around 100 Lakh Fkm. There was a large growth in the number of companies in Optical cable manufacture. By 2000-01, there are more than 20 companies mostly in the private sector with a total installed capacity of over four Lakh Fkm. Components such as LED's, LCDs are manufactured by a few domestic companies.

Photonics components such as Fused Couplers, Opto-mechanical Switches, fixed Optical Attenuators, Mux, Patch-cords with various type of terminators etc., Trans-receivers, LED, Photo Detector Active Alignment, Media converters, etc are being produced by a few export oriented units.

Thrust Area

Further work in the important areas such as Photonic Switching Multiplexing & Networking area including WDM, DWDM Systems, Applications, Technologies and Devices, Microwave Photonics area and All-Fiber (or in-fiber) Components & Devices needs to be continued and expanded upon. The specific suggestions is to create photonic center to look into various technological issues and market related information. Optoelectronics packaging and integrating facility, System engineering capabilities and test and measurement facilities could be built up. The Photonics Center would be networked with Photonic Technology Cells, which would also be part of the Photonic Initiative India (PII). These cells to start with could be the existing laboratories in different institutions where part of the technology has been developed. Teaching organizations whether at Academic Institutes or Training Facilities at DOT, CEDTI etc could also be part of PII and use their expertise to provide courses as per requirements. They would also lead in the think tank and guide the research work.

3.   Policy and Procedures related steps taken during Ninth Plan

The industrial, Investment, trade and fiscal policies and procedures have been further simplified, made transparent, eliminated licensing in almost all sectors and provided encouragement to entrepreneurship through market friendly systems. The policy and procedures related steps taken by the Government to promote the electronics and IT sector are given in the Study Team Report on Policy and Procedure.

4.   Perspectives and Recommendations for Ninth Plan (2002-07)

Perspectives

The manufacturing sector broadly comprising Consumer Electronics, Industrial Electronics, Computers, Telecom & Broadcasting equipment, Strategic Electronics and Components, suffers in comparison with the software and services sector. During the Ninth Plan, the software and services sector has logged impressive year to year growth rates of around 45% whereas the manufacturing sector has shown modest growth rates of around 9%. In the area of exports, the difference is even more pronounced.

Another characteristic of the manufacturing sector is the distribution of production amongst the public sector and private sector. With the exception of the strategic electronics sub-sector, production in consumer electronics, telecom and broadcasting, computers, and components is predominantly in the private sector. Since 1991, the process of economic liberalization carried

forward by successive Central Governments as also the State Governments has led to a steady dismantling of Government controls and removal of policy restrictions. A general refrain of the industry, however, is that these reforms in most cases do not trickle down to the working levels in the Central as well as State Governments.

India is a signatory to the Information Technology Agreement-1 (ITA-1) under the WTO. Under the ITA-1, India has to put in place a zero duty regime for all the items listed under the ITA-1 by the F.Y 2005-06. The Government, however, has indicated its desire to pre-pone this to F.Y 2003-04. Being part of the WTO also requires a gradual reduction in the overall duty regime, especially the peak rate of duty. Physical controls for import have by and large been dispensed with. Thus, India is slowly but surely integrating with the global marketplace as a consumer of electronics and IT products under a free trade regime. Globalization of manufacturing, however, has not happened in as deliberate a manner as in the case of globalization of consumption. This has largely been due to a domestic-centric approach of the Indian manufacturing sector coupled with a protected environment. Infra-structural handicaps, high cost of finance, rigid labor laws, low volumes of production, low velocity of business, high tariffs and invested tariff structure, non-availability of indigenous capital goods, lack of new investments, are some of the known weaknesses of the Indian Manufacturing Sector.

In the above context, for the Government to set targets for production, imports, exports, investments may be somewhat inappropriate. In fact, the Industry Associations have not provided any detailed inputs for the targets. In view of this, instead of targets, projections for the likely production in the Tenth Plan are given below:

Table 1: Estimated Production in Various Sectors During Tenth Plan (Realistic Scenario)

Sector	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	CAGR %
Consumer Electronics	13,000	15,400	18,200	21,500	25,400	30,000	18
Industrial Electronics	4,500	4,700	4,900	5,200	5,400	5,800	5
Computer H/W	4,000	4,800	5,700	6,900	8,400	10,000	20
Communication & Broadcasting	5,000	5,600	6,100	6,900	7,600	8,400	11
Strategic Electronics	1,900	2,100	2,200	2,400	2,600	2,800	8
Components	6,000	6,900	7,900	9,100	10,600	12,000	15
Total	**34,400**	**39,500**	**45,000**	**52,000**	**60,000**	**69,000**	**15**

These are based on a CAGR of about 18 % for Consumer Electronics, 5 % for Industrial Electronics, 20% for Computer Hardware, 11 % for Communication and Broadcasting Equipment, 8% for Strategic Electronics and 15 % for Components. These are generally reflective of the trends in the Ninth Plan and could be taken as a reasonable scenario for the Xth Plan. This leads to a CAGR of about 15% for the overall manufacturing sector during the Xth Plan as compared to 11% in the IXth Plan. Assuming the same CAGR of 15% for 2007-08 and 2008-09 leads to a total production of about Rs. .91,200 crores in 2008-09. This is approximately 63 % of the target of US $ 30 Billion (Rs. 144,000 crores at 1 US $ = Rs. 48.00) which was set by the National Task Force on IT in 1998. In this context, it needs to be noted that the target of US $ 30 Billion was predicated on a set of wide ranging policy and procedural recommendations including the S-BIT scheme being implemented in 1998 itself. This has not happened and hence the target, in any case, needs a review. Thus, the projections made in the table above would need to be backed by a strong pro-active approach by the Government addressing the recommendations made.A more aggressive projected scenario with CAGRs of 24 % for Consumer Electronics, 8% for Industrial Electronics, 30% for Computer Hardware, 20% for Communication and Broadcasting, 15% for Strategic Electronics and 20% for Components would lead to a total production of Rs. 90,900 Crores in 2006-07 corresponding to a CAGR of about 22% for the overall Manufacturing Sector. Maintaining the same CAGR for the next 2 years leads to a total production figure of about Rs. 1,35,000 crores in 2008-09 which is about 94 % of the target of US $ 30 Billion. The optimistic scenario is given below :

Table 2 : Estimated Production in Various Sectors During Tenth Plan (Optimistic Scenario)

Sector	CAGR (%)	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Consumer Electronics	24	13000	16100	20000	25000	31000	38100
Industrial Electronics	8	4500	4900	5300	5700	6100	6600
Computer Hardware	30	4000	5200	6800	8800	11400	14900
Communication & Broadcasting	20	5000	6000	7200	8640	10400	12500
Strategic Electronics	15	1900	2200	2500	3000	3300	3800
Components	20	6000	7200	8700	10400	12500	15000
Total	**22**	**34400**	**41600**	**50500**	**61500**	**74700**	**90900**

The more aggressive projected scenario would not only require the policy and procedural recommendations made by this Study Team and the Study Team on Policy and Procedures to be implemented in letter and spirit, provision of the proposed financial support by the Central Government in the Tenth Plan but would also be dependent on a host of other factors such as role played by the State Governments, relative competitive advantage of India vis-à-vis other countries, the state of the Indian as well as international economies etc.

As regards exports, the actual performance in the first three years of the Ninth Plan has shown negative growth rates with actual exports at Rs. 3000 crores in 1997-98, Rs. 1800 crores in 1998-99, and Rs. 1400 crores in 1999-2000. The exports during 2000-01 were Rs. 4788 crores. No authentic data is available on the actual imports and investments during the Ninth Plan. The Study Team, thus, does not have a basis for any meaningful projections for these items.

The Sectoral Reports and Industrial Associations inputs make a forceful case for major corrective steps to put the manufacturing sector on a higher growth rate path. If these steps are not taken, the prognosis for the manufacturing sector is rather bleak. The portents are ominous: There are reports of manufacturing units closing down; increasing competition from imports; Indian manufacturers companies preferring to invest elsewhere than in India; FDI preferring China, Malaysia, Singapore than India. Amidst the generally depressed sentiments, however, there are a few positive signals: Samtel expanding its operations towards being a MNC, Moser Baer exporting in a high tech area of CDR/CDW.

5.   Recommendations

The recommendations made by the Industry Associations viz. ELCINA, CETMA, TEMA, MAIT, IEEMA as well as Technical Divisions in MIT broadly address the following aspects:

- Policy and Procedures
- Research and Development
- Infrastructure
- Human Resource Development
- Exports
- General Issues

The sectoral recommendations are given below.

Consumer Electronics

- There is an urgent need to reform labour laws. The industry unanimously advocates "Exit" policy.

- With a view to enhance the velocity of business self Certification should be accepted, in the normal circumstances. Policy and Procedure should be further simplified with a view to eliminate routine interaction between Industry and Government Officials, All discretionary powers of lower level Government officials should be withdrawn.
- Policy once formulated should be applicable for 5 years. There should not be frequent changes as it upsets business plans.
- Value Added Tax (VAT) should be introduced at the earliest. In the second stage of Tax reforms, a composite VAT system should be introduced as is happening in other countries viz. European countries, China, Bangladesh and Nepal.
- Custom duty on raw materials & components (including plastic, copper & allied items) should always be lower than the finished products. Suggested Customs Duties structure is: Raw Material including Plastic, Copper etc. - 15%, Components including CPT - 25%, Consumer Electronic Products - 35%.
- A viable alternate scheme to the DEPB scheme, which is to be discontinued w.e.f. 1ˢᵗ April, 2002, should be put in place urgently.
- There should be time bound processing of cases in the Government system covering Customs, Excise Sales tax, Exports etc.
- All items reserved for SSI should be de-reserved and excise exemptions for SSI should be abolished.
- With a view to enhance understanding of each others point of view, there should be deputation of Government officers to industry and vice-versa. There should be orientation programmes at regular intervals for Government officials to increase their awareness of the industry.
- Testing and QA Centres should be set up in the private sector.
- There should be time bound programme for the introduction of Digital TV. Government decision on DTT and DTH should be expedited.

Industrial Electronics

- Serious efforts must be put in by the Government and the industry together to create world-scale manufacturing facilities for components like power semi-conductor devices, digital ICs, and other active and passive electronic components. This has to be through Joint Ventures or even wholly owned subsidiaries of some of the multi-nationals.
- The present policy for Duty Exemptions in deemed export projects etc. needs to be reviewed to ensure meaningful and greater value addition. There is no difference now between a company, which meets the minimum value addition criteria, and the one, which achieves much more than this level. A suitable incentive scheme may have to be devised for greater motivation to have value addition increased. The term value addition itself needs to be critically examined.
- In order to facilitate manufacturing in the country, components need to be allowed to be imported at a lesser duty (say at least 10-15%) than finished products. Other policy measures to motivate indigenous manufacturing needs to be explored.
- MIT, which has the responsibility for electronics development in the country, need to have a direct and a more meaningful role in finalizing the policy matters (tariffs, duties etc.) as against the existing mechanism.
- A brand image is essential for R&D on the part of R&D/academic institutes so that industry can have confidence on them. Government of India/Industry needs to nurture few centers of excellence.
- Large consortium based projects in the field of Industrial Electronics/Process Control automation utilizing the strength of our R&D/academic institutions and the engineering industry needs to be undertaken in the country to increase user confidence on Indian systems leading to higher growth both in the internal and external market. MIT may have to share a bigger responsibility in this area.
- As a measure to establish the successful indigenous technologies, it is necessary to support such developments through award of commercial projects without making mandatory clause of proven experience etc. This is practiced in almost all developed countries of the world. For example British, Japanese and German Railways have always supported their indigenous companies with commercial orders following development of various power electronic and

signaling equipment prototypes. Also countries like U.K., France and Japan have supported their respective indigenous development agencies with large commercial HVDC projects following prototype designs of similar power levels that has been done in India. It is felt MIT need to play a leading role in effecting this change in the present Government set up.

- MIT also needs to modify its role while continuing promotional work. Greater emphasis must be put to spend its resources more towards creation of information bank on global market scenario, technology forecasts, investment scenario etc. This is expected to facilitate the Indian industry largely and MIT itself has a better grip on this issue.

Professional Electronics (Communication, Broadcasting and Strategic Electronics)

- Import of total systems in the Professional & Strategic Sector should not normally be allowed. All the MNCs who want to sell their equipment in India need to set up JVs to manufacture these items.

- The indigenous manufacturing units may be permitted to import strategic products without payment of duty and on a self-declaration basis for export purpose.

- The excise duty chargeable should be 8% until 01/01/2002 and nil thereafter.

- All imports of capital goods, raw materials, piece parts consumables, components, and sub-assemblies to be made free of custom duties.

- Indigenous products matching the performance specifications of the customer have the advantages of prompt after sales services customer training, reliable repair, overhaul & maintenance by the manufacturer, product update, availability of spares etc. As such a policy, decision is to be issued by the Government in favour of indigenous products if they meet the customer specifications even at a marginal higher cost.

- Policy for mandatory buy-back by the vendors for ToT projects.

- Creation/ nomination of an agency for identifying the short term and long term requirements of the domestic customers in the sector and assignment to competent industrial R&D centers, DRDO, academic institutions with finances. The agency can hold periodic workshops for harnessing the efforts of all agencies.

- Government agencies to underwrite/subsidize the risk of failure of R&D effort made by the industry.

- R&D allocation in the Professional & strategic electronics sector to be substantially increased.

- Favourably consider the initiation of the proposed mission initiative under the thrust areas on wireless networking and new generation network access devices/terminals towards achieving technology leadership by India during the 10th five year plan.

- India does not have testing facilities to get design approvals for commercialization of product in European or American Countries. Indian test report for interface approvals or for electrical safety are not acceptable by developed countries. Hence, we have to take TUC or CE approvals like TBR-21, EMI and EMC test facilities from Taiwan. There is need to augment test facilities available in the country if Indian Research & Development efforts has to be supported and promoted.

- Infrastructure Equipment, which are basically capital equipment in nature, goes into creation of infrastructure to provide vital lines of communications for the nation, the Government policy should aim at encouraging the indigenous manufacturers to meet most, if not all, the nation's requirements for the same.

- There is need to set up dedicated training centers for upgradation of skills of the operators in assembly and testing of strategic electronics at places where the industry is concentrated. The training should be with free boarding and lodging facilities.

- A central agency may be identified to review the training needs of the industry and design training modules in specific technologies. The industry can interact with the agency to project its requirements.

- Annual consolidated training program schedules of existing agencies in the field may be published and sent to the industry in the field for better utilization.

- Government must invest through a Technology Development Fund in application oriented Research & Development for future technologies either through C-DOT or in partnership with large Indian Telecom Corporate to create local IPRs for the domestic manufacturing industry.

- The critical raw materials and most of the components are being imported for the state of the art production in strategic electronics sector. Indigenous manufacturers are few and the import of components is unavoidable. For production, the prices quoted for Indian supplies are much higher than the prices in the domestic market abroad resulting in higher prices for indigenous products. The following may be considered in this regard.

- Encourage establishment of indigenous component base through suitable fiscal incentives.

- Government may establish rate contract with leading foreign vendors to meet the consolidated requirement of Indian industry.

- Establishment of an agency abroad to procure and supply components to Indian industry.

- TEMA has make the following specific suggestions:

    - Licence fee to be ploughed back to create world class infrastructure.

    - Bilateral agreements should be entered into with SAARC and Russian Federation countries for their approval of DOT/TEC standards for the Telecom products for their network which can be exported to these countries. TEC follows ITU standards.

    - Government should set up a Telecom Export Promotion Council and Telecom Finance Corporation.

    - Non-Tariff Barriars should be imposed on imports including requirements of TEC type approval, interface approval, import at specified ports only, MRP to be inscribed.

- TEMA has indicated that the investments required in telecom are expected to be of the order of Rs. 22,000 crores in the year 2002-03 which may go up to the level of Rs.44,000 crores in the year 2006-07. The turn over of domestic manufacturing industry is much less compared to these figures. If the R&D and manufacturing facilities are not upgraded expeditiously, most of the investments will have to be met from imports. Hence, the policy on manufacturing should aim at encouraging application oriented R&D and the indigenous telecom manufacture sector to produce good quality equipment at competitive prices to fulfill the objectives of 10th five year plan in tune with NTP-99.

    Based on the above, TEMA has recommended the following :

    - Suitable incentives to the licensed telecom operators need to be quantified for use of

- indigenously manufactured equipment and;
- locally designed, developed and manufactured equipment, to give boost to indigenous
- R&D and manufacturing.

▪ Indigenous manufacturing facilities for electronic components and chips should be established to have a strong component base to eliminate excessive costs and delay in production process on account of component procurement. Duties on inputs to the component industry should be zero. R&D units that are capable of developing ICs and owning their IPR should be encouraged by declaring their product as indigenous for policy purposes even some of the ICs are fabricated abroad. This will lead to establishing a strong market presence and the setting up of fabrication facilities that are commercially viable will follow automatically afterwards.

▪ Considering that large scale investments are required in telecom manufacturing and the cost of financing is high, a telecom financing corporation may be set up to ensure cheaper financial assistance for telecom manufacturers/operators.

▪ Comprehensive test facilities (EMI/EMC/Environmental/Saftey) should be established to facilitate expeditious development and productionisation for cutting edge telecom technologies. Internationally accredited test houses should be set up that can certify products against specifications for Type Approval. Such test houses can recover the investment by testing for clients world-wide. Usually, test houses in Europe or USA have a long waiting time, and their charges are very high. India can be competitive enough in this at least to recover the investment. The facilities will of course be very useful for our industry.

▪ Procedural and policy reforms may be required to achieve high velocity of business, in terms of more transparency, simplified procedures, reforms in Labour laws, supportive infrastructure, reduced number of clearances.

▪ Special Custom Zones may be created in select areas to simplify procedures and accelerate clearances for Telecom inputs & exports.

▪ Whenever a technology is imported, it should be ensured that it is current and futuristic. In-depth transfer of technology to manufacturing units would enable local value addition for making the equipment compatible to the Indian network and future value addition in terms of hardware and software by Indian R&D. Foreign companies should ensure significant local value addition in manufacturing and a commitment to continuously upgrade the technology.

▪ Interface approvals in case of all imported consumer premises telecom equipment like terminals, EPABXs, FAX etc., may be insisted.Other countries have this requirement even for deployment of infrastructure by private operators (e.g., Brazil), in order to ensure minimum quality standards, and also to put up a barrier to entry by fly-by-night foreign suppliers of equipment.

▪ Strong promotional activity by way of participation in international exhibitions along with seminars on technology and services should take place to highlight the technology and products and for brand promotion. Strategic focus should be placed on a few select products having a competitive advantage and a few countries should be targeted where volumes can be large. Targeted marketing should be done jointly by industry and government trade bodies.

▪ Bilateral agreements within the SAARC countries and other regions having export potential for telecom equipment would be beneficial. Mutual Recognition Arrangements (MRA) in quality analysis and certification should be made to avoid the lengthy approval procedures in foreign countries.

- In 2003, while under WTO, the duty on imports of finished telecom equipment will become zero, the rational duty structure is to be ensured that all components/ raw materials used therein also become at Zero duty. In case of dual use, components to zero duty should be allowed on the same basis of end user certification of licensed telecom operators.

- Suitable Non-Tariff Barriers (NTB) be imposed to discourage cheaper non-standard products like (i) Defining specific ports for import of finished telecom equipment's to ensure uniform procedures and policies (ii) MRP indication for customer to be made compulsory, (iii) TEC fee for approval of imported customer premises equipment to be suitably hiked keeping in view of costs in other countries.

- Reforms in customs procedures and clearances are needed to introduce self-certification by manufacturers and post audit. Policy changes in customs must be to introduce procedural (a-posteriori) controls in place of physical (a-priori) controls to reduce customs clearance duration to 1 day, be introduced through policy changes in customs.

- Large Scale Investments are required to set-up a Telecom manufacturing base. With cost of financing at a higher level and the existing production capacities running at 40 per cent only due to non-uniform procurement process, it often becomes difficult for a manufacturing unit to even survive. It is suggested that 10-year tax holiday may be extended to existing manufacturing units as well as new manufacturing units being set-up, in line with tax holiday already granted to licensed telecom operators.

- There should be uniform Sales tax, Custom and Excise Tariffs etc. on all the 217 items covered under IT A-1. Only the Computers are being levied 4% Sales Tax, whereas the Telecom products are being charged at higher rates upto 12%. We reitrate that uniform Sales Tax should be levied to Telecom products as applicable to IT Sector. Unless this is done a significant part of 217 items covering the telecom products will be adversely affected. In fact, currently, the inputs and components, in many cases are upto 35% custom duty whereas the finished telecom products are at 15%. The importer also is not to pay any sales tax and hence the local telecom manufacturing industry is at a disadvantage as compared to imports. It is therefore suggested that an uniform treatment may be give to all the 217 items covered under IT A-1 papers.

Computer Hardware

- Initiatives to be taken for growing the domestic market covering business, school, and communication infrastructure.

- There should be a strong focus on selected areas of R&D. Areas of focus could be low cost PC, Smart Cards, 4G wireless etc. There should be stronger collaboration between academia and industry.

- Initiatives should be taken to make the PC affordable through various cost reduction measures covering duties, bulk purchase of components etc.

- Creation of conducive manufacturing environment by addressing the problems of low velocity of business, poor infrastructure and uneconomic volumes of production.

- Government should take strong pro-active steps to encourage and support indigenous R&D. These could cover funding of R&D to industry, first bulk purchase by the Government, special incentives/dispensations for indigenously developed products (e.g. waiver of 2 years/2 networks, provenness condition in tenders of DOT/BSNL), launching mission mode projects.

- India should be aggressively marketed as a preferred FDI destination for manufacturing by specifically targeting to have atleast 1 million/yr. capacity PC manufacturing operation and one mega fab or atleast an assembly & test plant for ICs in India.

- Initiate HRD programmes to generate 2000 to 3000 M.Techs per year in areas such as VLSI Design.

- An adequate number of PhDs as well as post doctoral level manpower is required for promotion of product-oriented research & development in IT.

- Curricula of Computer Engineering and Electronics need to be revisited to add focus on design, system integration, prototype, security and reliability.

- Awareness, testing and information Services on Standards and Quality assurance aspect need to be Strengthened. These practices should also find place in curricula.

- Industry should be given free/low cost Service on IPR for promoting innovation in IT.

Components

Infrastructure

- In order to attract investors and customers to India, planners should address some of their perceptions and concern. Some of the priority areas are:

  - Provide world-class, road infrastructure to major industrial areas, Export Processing Zones, State and Private business parks etc. linking them to nearest Airport and sea Ports.

  - Ensure sufficient, uninterrupted and quality power supply to manufacturing locations.

  - Provide modern communication facilities with large bandwidth connectivity at all the manufacturing zones as being done for software technology parks.

  - Ensure sufficient airline seat capacity, frequency and same day connectivity to all the major Industrial locations so that we can change the perception of India as a difficult place to reach.

  - Freight movement capacity and transit time to be improved to the level of Malaysia, Indonesia and China. (Now it takes seven days to ship by air to USA whereas it is only 48 hours from other Asian countries)

- Manufacturing parks should be provided with embedded facilities for tool design, tool making, sheet metal, wire harnessing facilities, industrial product design, packaging, Quality consultancy etc.

- Today's manufacturing plants have sophisticated manufacturing and test instruments which needs to be calibrated at frequent intervals. Such facilities are now available only in major metro cities and even those facilities are not able to cater to sophisticated instruments used in fiber optics and wireless manufacturing industries. In order to address this issue, Testing & Calibration Labs (like ERTL) should be attached to Industrial locations.

- Delays in clearance of inbound and outbound cargo by customs is a major concern of foreign investors. Therefore, customs facilities to be created at all parks as being done now for Export Processing Zones. Customs clearance for inputs and outputs of large, World-class plants be assured within 6 to 8 hrs. with self-declaration, as in the case of Excise.

- Industrial disputes, procedural delays in environmental issues and law and order issues are major concerns of any customer. Embedded offices of labor, environment and police outposts to be created at each manufacturing parks or townships to address these concerns.

- Good quality schools and recreation amenities must be assured near World-class plants so that foreign customers, engineers and technicians feel at home to come and work along with Indian manufacturers. This would also attract bright engineering and professional talents to come and work for manufacturing sector.

Standardization, Testing and Quality Assurance Centers, R&D base, Manpower Development & Training Centers

- It is desirable that International Test Laborites for certifying compliance to global mandatory standards like UL, CE, VDE etc. be set up near to the Industrial location. Indian test laboratories should be accredited to such certifying agencies abroad.

- Specialized industrial training centers should be located near to the manufacturing units for up-gradation and training of work force.

- Approach toward an open end R&D also need to be modified to product oriented targets. Suitable incentives should be instituted for persons/ organizations that successfully achieve their set targets. Government role should be participatory and not regulatory in formulation and monitoring of the R&D projects. Manpower engaged in such activities also need to retrained/replaced according to the needs of modern components.

Customs Duty (CD)

- O% customs duty on all inputs and capital goods

- *Policy package for local sourcing and integrated manufacturing*

- Offer incentive packages to telecom manufacturers and also for large investments projects to ensure   local sourcing of components. Follow the Chinese strategy of offering domestic market and other policy incentives for local sourcing and setting up of large scale integrated manufacturing facilities.

- Marketing companies with no clear commitment to manufacturing in future should be discouraged.

Excise Duty (ED)

- Low excise or domestic tax exemption for Grey market prone products or thrust products like PCs, mobile phones, low-end CTVs and newly emerging convergent products is recommended.

Others

- The Central Government needs to instruct all state governments promoting IT & Electronics in their respective states to provide various incentives on sales tax, octroi and other taxes for components as allowed to IT products

- Indian hardware and component companies acquiring plants, machinery's and other assets of companies abroad for technology up-gradation and expansion through swapping of shares should be exempted from taxes as is the case for the software industry. Other forms of incentive should be granted to Indian companies acquiring hardware plants overseas to encourage globalization drive

- For large-scale investment in components, a 5-year tax holiday should be allowed for all projects with investment exceeding Rs 1000 million with particular emphasis on microelectronics, SMT and semiconductors.

Urgent reforms to quickly bring back Indian component industry on fast track

- A Revamped EHTP scheme with the following modifications in the Existing EHTP scheme should be put in place immediately:

  - DTA sales by EHTP units should be raised from the existing 50% to 100% to provide for global scale flexible manufacturing both for domestic as well as export market in a duty free environment. Sales to DTA should be allowed only against payment of 50% customs duty and other domestic taxes. This 50% is expected to take care of the disability factors (like interest, infrastructure, etc.)

  - No physical control and clearance of goods through self-certification. Transactions by EHTP units should reported on monthly/quarterly basis based on a format similar to that allowed under Appendix 16-H under Public Notice No: 37 dated 1Ninth October, 2000.

  - Provision for self-removal of goods from the boundary premises of the company. For self-removal of excisable good under bond, the existing format under FORM C.T.3 in Annexure I under Central Excise Notification No: 52 dated 1Ninth October, 2000 can be applicable.

  - While all existing EHTP units can be converted into Revamped EHTP units, all other IT and Electronics Hardware units in DTA can apply to MIT for this scheme provided they satisfy the following criterion: Sales turnover of above Rs 3 Crores; For new projects, the investment should be at least Rs 1 Crores.

Adopt 10-digit product classification under HS Code

- Immediate adoption of 10-digit product classification to simplify procedures and to prevent corrupts practices.

Policies & Procedures

- If Indian manufacturing companies have to compete globally, we need to have a clear and comprehensive national policy for hardware manufacturing industry. Such a policy should also aim at simplifying regulatory procedures and offer a hassle free environment for manufacturing as offered in competing countries. Some of the focus areas are:

  - A national hardware manufacturing policy as in the case of software is to be announced identifying thrust areas.
  - Considering the WTO commitments of nil duty for finished goods by 2003, customs duty on sub assembly and components also to be abolished in order to, create a level playing field. Similarly, domestic excise duty on components and finished goods to be rationalized.
  - Manufacturing at the level of SKD/CKD to be encouraged.
  - Ministry of Commerce should form a commercial intelligence unit to monitor the incentives, protection, and duty concessions offered by other countries for manufacturing sector within the WTO commitments so that India can suitably modify our policies from time to time.
  - A single window mechanism has to be implemented in such a way that the administrative authority of the park/industrial township is authorized to provide all the required Central and State level regulatory clearance with in a reasonable period of 15 days.

- Power, water and telephone connections to manufacturing units shall be available on demand.
- Import, export, excise, Sales tax formalities to be simplified so that it can be operated on a self certified basis subject random audit by regulating agencies. Movement of incoming or outgoing goods shall not be affected by such procedures.
- Procedures at seaports and airports to be simplified so those goods are not held up for any purpose such as cooling period, handing over, export inspection etc. All such inspections and checks if at all necessary shall be done at the point of manufacture.
- Manufacturing Sector to be declared as priority sector with matching incentives, tax relief etc.
- Manufacturing sector in India can be developed by inviting large multinational system manufacturers to move their global manufacturing base to India.
- To attract such investments, Government has to offer incentives, tax relief etc which can be proportional to their contribution in terms of usage of local content, vendor/ancillary development, employment generation etc.
- All major purchases for Government/public sector projects should be based on commitments on domestic manufacture. Even under the WTO regime many EU countries, Malaysia, Indonesia etc are insisting for such a commitment from foreign companies who want to participate in such program. Since no major company can ignore huge potential of Indian market, they will be forced to seriously look at India as a manufacturing base not only for domestic projects but also for their global requirement.

Technology Development

- Continuous up-gradation of technology and manufacturing process is essential for surviving in a global manufacturing environment. Therefore the following steps may be considered in this area:

  - It is not feasible for many of the manufacturing units to find resources in the initial stage to set up R&D facilities. Government may consider offering incentives such as higher level of depreciation, liberal tax relief and low cost funds.
  - There are a number of Government research laboratories in the country with good facilities. However, the R&D activities are not focussed on manufacturability and commercialization. In order to address this issue, manufacturers may be associated with R&D projects at an early stage so that the products can be easily commercialized. Such participation should be without any financial commitment from the Industry except for the know how fee and royalty.
  - Private Corporate Houses may be encouraged to set up world class R&D Center by offering attractive incentives on tax relief, depreciation and low cost funding.
  - A Technology Venture fund may be created to encourage manufacturing industry to venture into development of innovative technologies.
  - Current manufacturing processes followed in India need updating to make it compatible with global demand and cost structure. Government may take initiative in setting up regional institutes for research into manufacturing process engineering in line with global practices. This would help small and medium manufacturing units to re-align their manufacturing processes with the global practices.
  - Lack of a good quality semiconductor foundry is limiting the growth of microelectronics in the country though we have enough competence in ASIC design. No individual entrepreneur will come forward to set up such a large capital intensive project. Government can take the lead in promoting such a project with financial participation from private sector.

Microelectronics

Proper growth of microelectronics base in the country needs coordinated efforts on several fronts. Some of the major initiatives identified for the healthy growth of this sector during the Tenth plan are touched below.

R&D promotion: The following initiatives are recommended for proper growth and utilisation of results of this sector.

- creating at least 2 units. of centralised R&D centers by way of Process Research and Resource Facilities - with pilot production to accelerate the development of industrially compatible processes and translating R&D project outcomes to products.

- 5 centers of excellence in different fields of microelectronics

- 6 Incubation Centers for the areas of design / processing / Characterisation / test /failure analysis/ reliability .

- Semiconductor Design Institute to vigorously promote IP creations within the country.

- Additional mechanisms like creation of infrastructure for continuing education and up-gradation of existing facilities for the product developments and demonstrations, creation of standards, awards for IPR creations and commercialisations to move up the value chain and fellowships to researchers to specialised in microelectronics areas other than design which do not attract enough talent and efforts.

- An incentive soft loan mechanism to promote industry interest for exploiting R&D designs / processes generated from local R&D efforts needs to be put in place.

- The R&D expenditure that would be required during the Tenth Plan for undertaking cited R&D efforts and creating the necessary infrastructure would need infusion of Rs. 600 Crores over and above the production investment,

Industry promotion:

Realising the importance of greater incorporation of Microelectronics in to electronic products & to check the demand supply gap widening in the area beyond projections in the report, it is considered essential that the govt follows up initiatives listed below:

- Attracting at least 1 mega fab in the area giving needed incentives to the parties in the area (a slew of measures suggested). Minimum investment under the head is likely to exceed Rs 2500 crores.

- Setting up at least 2 Mini fabs for ASICs , ASSP's etc. both in the public domain and in the private sector.. An expenditure of Rs 500 crores will be necessiated under the head.

- To overcome the hindrances in proliferation of design and chip implementation in the country for accelerating the local Indian IC growth, Govt need to consider underwriting appreciably the costs associated with translating IC designs into silicon implementations i.e chip fabrication. To serve this activity, an investment of Rs. 50 Crores will be needed.

- High Tech Parks have now become critical infrastructure for facilitating a vibrant local semiconductor industry. For promoting these Parks several encouragement like subsidies to build, operate and upgrade etc. separately or as a part of S-BIT zones/habitats, especially suited to microelectronics as defined earlier will be necessary. In the Ninth Plan a mere token allocation was assigned with the result the issue could not progress. In Tenth Plan period it is absolutely essential that substantial finance allocation i.e. around Rs. 1,500 to 2,000 Crores is given to pursue this activity in different corridors of the country.

- Export Incentives are needed to substantially boost the semiconductor activity in the country. Several measures of rationalising duty structures etc. as proposed in the document would be needed to give a level playing field to the domestic industry and other entrepreneurs.

Manpower Development

Any thriving industry needs continued supply of well qualified and experienced manpower as raw material for their growth. At present, with in the country there are very few institutions which give degrees / training / exposure in this fast obsolescent area. Under the Manpower Development Programme an effort has been started in the Ninth Plan and it needs to be continued with more rigour and spreading to more new institutions across the country. To this end it is proposed that the following be aimed:

- Progressively establish the infrastructure for generating VLSI Design Engineers
- Promote the development of specialised CAD tools for VLSI design
- Strengthen infrastructure for export of VLSI designs and
- Initiate India Chip Programme to support Indian Equipment Designers & system houses, which are designing VLSI chip and modules into their systems

A bare investment of Rs. 50 Crores will be needed in the area in Tenth Plan.

Semiconductor Integrated Circuits Layout-Design Act

At present Indian microelectronics industry is very low on IPR creations and re-use. With complexities of processes and designs severely increasing, world over the trend is moving towards IPR re-use and IPR creations for survival in the market driven economies. Indian set up needs to move in this direction. To increase awareness of Indian creators of IPR in all the fields of semiconductor electronics, a variety of exposure efforts need to be pursued in the Tenth Plan. Some of these are listed in the R&D initiatives. A token amount of Rs. 20 Crores will be needed in the Tenth Plan period for this activity.

Mega fabs

- All the policy instruments available to the S-BIT units will apply mutatis mutandis to the investments in the setting up and running of megafabs.

- Corporate Income Tax will be exempted for 10 years from the first day on which income is earned with permission to carry forward losses and deduct them as expenses up to 5 years. Where units are set up as S-BIT zones/habitats, 50% reduction of Income Tax for a further period of five years will be applicable.

- Dividends, if paid out, will be free from all taxes during the Corporate Income Tax exemption period in the hands of the investors or shareholders. Further, an investment allowance of 25% will be available for deduction from the taxable corporate Income.

- Compensation of training expenses including actual expenses, accommodation and transportation will be available through a cash grant.

- Legally valid guarantees will be given against nationalization, canalization and State monopolization.
- The movement of foreign specialists involved in making feasibility studies, setting up of facilities and assisting in the running of facilities shall be facilitated by simplified procedures administered by a single window which will give all clearances within 48 hours.

Photonics

We have already missed the large volume electronic manufacturing opportunity. The Photonics industry today is where the semiconductor Industry was 20 years ago. Industry experts predict that Photonics will follow the same development path as semiconductor and will attain the size as today's semiconductor based industry. The technology is still young and we have not yet lost much time in this field. If the country takes the right initiatives now, Indian can be a major player in Photonics manufacture. The following are some of the immediate steps needed to promote this sector:

- R&D activities in Photonics to be encouraged in Private sector. Duty free import of capital equipment, Government funding or subsidy for such investments, risk financing are some of the steps which the government can take.

- Availability of optical component industry is a pre-condition for attracting manufacturing investment in this sector. Fiber is the only component currently available in India. Other critical components like micro lenses, high quality dichromatic coating facility, mask fabrication facility, ceramic ferrules, pin diodes, diode lasers, fiber Bragg gratings etc are some of the components where investments have to be channeled. . Government funding, cash incentives and tax relief etc are some of the factors, which can attract private investment in this area.

- New Administrative Mechanism to encourage joint industry (public and private) - government R&D work leading to production capabilities in Photonics in India.

- Government R&D Labs should be asked to focus on Photonics related products in close collaboration with industry. Government should circulate details of available technologies among the industries through a journal so that private industry can come forward to license or for joint participation.

- Increasingly professional education institutions shall be encouraged to offer specialized courses on Photonics and fiber optics communication to ensure availability of qualified engineers.

- Industrial training institutes should be asked to commence courses with hands on training in fiber handling, fusing, optical alignments etc to ensure availability of skilled manpower in fiber optics.

- A National Centre for Photonics should be set up to address various technological and market related issues.

Institutional Frame Work for Policy and Procedures

A slew of recommendations have been made especially by the Industry Associations regarding policy and procedures. These have also been addressed by the Study Team on Policy and Procedures. There is a need to address these issues on a regular basis at different levels of Government in a well defined institutional framework rather than only as pre-budget memos/post-budget representations. The institutional mechanism could consist of an Apex Ministerial level including the Finance Minister, Minister of Commerce, Minister of IT & Communication, Secretary level covering Finance Secretary, Secretary (Revenue), Secretary (Communication); and Secretary (IT) etc. as well as the next below Scientist-G/JS level.

R&D

Various recommendations have been made to enhance the effectiveness of R&D. These cover following:

- Set-up of Centre of Excellence in specific areas.
- Promotion of consortium based R&D projects
- Award of commercial projects as a sequel to successful R&D projects (e.g. NHVDC project)
- Special incentives for products developed indigenously (e.g. waiver of two years/two networks condition in telecom, first bulk purchase by Government)
- Government to underwrite risk of failure in R&D projects by the industry.
- Technology Venture Fund
- Various thrust areas have been identified for R&D in the sub-sectoral reports.

- A general view emerging from the sub-sectoral inputs is that of an encouraging nurturing, supportive, innovative, flexible, pro-active approach by the Government the area of research and development.

The outlay required for the above as well as other R&D related initiatives has been addressed by the Study Team on R&D.

Manufacturing Infrastructure Development

That the infrastructure in India covering transport, telecom, power, water etc., is not upto the world standard is well known. The government has sought to address this through the concept of localised excellence by setting up EPZs, EOUs, EHTPs and more recently SEZs. The concept of SEZ could be further strengthened through the creation of a manufacturing infrastructure development fund to be used to enhance the level of SEZs through infusion of supplementary/complementary funds covering communication networks, clean power supply, testing and QA facilities, setting up of institutions for proto-type development and pilot production in the SEZs etc. An outlay of Rs,. 300 crores is proposed for the Manufacturing Infrastructure Development Fund during the Tenth Plan.

Manufacturing Sector Promotion

The basic philosophy behind the wide-ranging sub-sectoral recommendations is to make India a world-class environment for manufacturing electronics and IT products While the corrective measures and initiatives covering policy and procedures, infrastructure, development, R&D would address a major part of the need, there are several aspects which still require to be addressed. Some of these are :

- Improvement of manufacturing technology
- International marketing and business development support
- Support for "Greening" of manufacturing technology
- Setting up of technology incubators at academic institutions and R&D laboratories.
- Setting up an Electronic Component Development Fund to be used towards Technology Complexity Index (TCI) linked short term/long term soft loans, equity participation, grant-in-aid to compensate for the handicap due to technology complexity.

In view of the above, it is recommended that a manufacturing sector promotion programme should be launched to address all the sub-sectors of manufacturing including consumer electronics, industrial electronics, computer hardware, communication and broadcasting, strategic electronics, components, microelectronics, materials photonics etc. The programme should have built-in flexibility and a strong pro-active approach to enable quick response to the fast changing global scenario with the objective of making the manufacturing sector in India globally competitive. An outlay of Rs. 500 crores is proposed for the Manufacturing Sector Promotion Programme during the Tenth Plan.

Chapter 7: Electronics and IT policy & Procedures

1.   Introduction

In the fast paced technology sector such as Electronics and IT, the characteristics which underpin the industry and services are fast technological developments, reducing business cycle times, just-in-time and time to market. The policy framework alongwith the procedures and their implementation determine the velocity of business.

The process of embracing economic and industrial policies reforms which was initiated during 1991 was aimed at integrating with global economy. In this context it is important to appreciate that Global business must be conducted in a manner which respects the global concerns be it technology, quality, delivery, service, price etc. This in turn requires a competitive business environment as an enabler.

It would not be appropriate to tailor the policy and procedures for achieving a certain targets. It is not an exercise of optimization. The policy and procedures should be such that they enable the industry to grow in the fastest possible manner.

It is often that well meaning initiatives, policy, procedures fall by wayside due to their not being implemented in the spirit they are pronounced.

During the fourth year of the Ninth Five Year Plan (2000-01), total production in the Electronics and IT sector was Rs. 68780 crores against the target of Rs. 99150 crores, representing an achievement of 69.3%. While the software services sector has grown at a C.A.G.R. of 43 % reaching 104 % of the cumulative target in the first four years, in the hardware sector achievement of the target (first four years) has been only 59% (Table-1).   During the period, Electronics IT Hardware manufacturing units have faced difficult times with many discontinuing operations. Imports, trading and grey market operations have been on the upswing. According to the DGCI&S, Kolkata imports of electronics goods (hardware) increased from Rs. 7759.3 crores in 1997-98 to Rs. 11,505.6 crores ($ 2.86) in 1999-2000. During the seven month period of April'2000 till Nov'200 the imports were placed at Rs. 10827.0 crores which increased to about Rs.16000/- Crores ($3.5 b)during 2000-01. Thus imports of electronics hardware were about 41% of total hardware production in 1999-2000 increased to 52% in the year 2000-01.

The opening of imports regime, lowering of tariffs, coupled with number of disability factors including high finance cost, inadequate infrastructure at ports, long cycle time for the working capital, high incidence of duties/taxes, insufficient differentials between import duty on raw material, piece, parts, components and sub-assemblies and finished products   etc, has resulted in manufacturing becoming unattractive.   Manufacturers in order to remain in business are tempted to become importers/traders or even grey market operators.

Policy and Procedures should be looked at as if they provide only broad and general basic framework in which business is to be conducted. It is perhaps not possible to visualize and anticipate all the business requirements especially in technology oriented sector such as Electronics and IT. The interpretation of the policy procedures should be in a user friendly manner aiding velocity of business.

Table 1 : Electronics Production Targets and Achievements for Ninth Plan
(First Four Years)

(Rs.Crores)

SECTOR	1997-98	1998-99	19990-00	2000-01	Total
ELECTRONICS HARDWARE					
TARGET	30150	38280	48700	62850	179950
ACTUAL	22100	25250	28100	30780	106150
% ACHIEVEMENT	73.3	66.0	57.7	48.8	59.0
SOFTWARE EXPORTS					
TARGET	5850	9250	14600	23100	52800
ACTUAL	6500	10940	17150	28500	63090
% ACHIEVEMENT	111.0	118.2	117.5	123.4	119.5
DOMESTIC SOFTWARE					
TARGET	3900	5850	8800	13200	31750
ACTUAL	3470	4950	7200	9500	25120
% ACHIEVEMENT	89.0	84.6	81.8	72.0	79.0

2. Review of the Existing Policy Framework and Constraints in Growth

The economic reforms programme initiated by the Government in 1991 aims at rapid and substantial economic growth and integration with the global economy. The industrial approval, foreign investment, EXIM policies have been liberalised, the process of further liberalisation, economic reforms and simplification of policy, procedures and efforts towards making them responsive to the needs of industry continued during the Ninth Five Year Plan.

In the following only salient features of the policies - procedures are given.

Industrial Approval Policy

During the Ninth Plan Period, Consumer electronics products have been taken out from the ambit of licensing. As a result Industrial Licensing has been virtually abolished in the electronics - IT sector except for manufacturing of aerospace and defence equipment. Industries exempted from licensing are only required to file an IEM with SIA (Ministry of Industry).

Foreign Investment Policy

Foreign Direct Investments and Technology Collaborations (TC) can be approved either through automatic route (by RBI) or otherwise by the Government. Automatic approval is applicable to FDI/NRI, OCB investment except for (i) proposals that require an industrial license either under IDR Act 1951 or in terms of locational policy and for foreign investment in excess of 24% in industrial units manufacturing items reserved for small scale (ii) Proposal for which foreign collaborator has an existing tie-up and (iii) Proposals falling outside the notified sectoral policy/caps.

Automatic approval is also accorded by RBI to TCs in electronics - IT except aerospace and defence equipment, provided lump sum payment for the technology does not exceed US $ 2 million and royalty payments (net of taxes) do not exceed 5% of domestic scales and 8% for exports subject to certain stipulation for the period of payment.

'Foreign Investment Promotion Board' (FIPB) considers Foreign investment proposals outside the purview Automatic Route.

Export-Import Policy

The import of raw materials, intermediate, components, parts, consumables spares, Capital Goods and other items required by industrial, non-industrial norms is governed by Export-Import Policy which is a 5 year policy for assuring continuity to the users. The present policy is applicable for the period April 1, 1997 - March 31, 2002. The ITC (HS) classification of various items alongwith policy governing their imports is published in a volume. The policy classically listed items under restricted, SIL and Free (OGL) category. Over the Ninth Plan the policy has been annually reviewed and items were progressively moved towards free imports. In the Policy for the year 2001-02 the 'SIL' category has been abolished. The few items which remain on the restricted category would be progressively moved to OGL (Free) Category by 2003.

The EXIM policy also covers schemes which are aimed at promoting exports. Some of the important ones are briefly discussed in the following;

Export Promotion Capital Goods (EPCG) Scheme

Under the scheme units in electronics and software can import C.G. at 5% import duty on the basis of self-declaration basis, regarding the nexus between C.G. imported with items to be exported. The export obligation is 5 times the CIF value of C.G. on FOB basis or 4 times the CIF value of C.G. on NFE basis to be fulfilled over a period of 8 year.

Duty Exemption Scheme

Under the scheme imports of inputs are permitted duty free for export production. Annual Advance Licences can be obtained either on the basis of SION or on self-declaration basis. The imported inputs are ratified against norms fixed subsequently by Special ALC.

The Duty entitlement Pass Book (DEPB) schemes entitles exporters to claim custom duty credit as a specified percentage of FOB value of exports made in freely convertible currency. DEPB rates for 93 items have been fixed (Annexure 28A Item No. 83, Handbook of Policy and Procedures).

Special Imprest licence is granted to main contractor for the import of inputs required for manufacture of goods to be supplied to the specified categories of 'Deemed Exports' covered in the EXIM Policy.

Certain specified categories of supply of goods by the main/sub-contractors are regarded as 'Deemed Exports' under EXIM Policy, provided the goods are manufactured in India.

Special Economic Zones (SEZ)

During the Ninth Five Year Plan a policy package for Special Economic Zone was announced. Special Economic Zone (SEZ) is a specifically delineated duty free enclave and is deemed to be foreign territory for the purposes of trade operations and duties and tariffs. Goods going into the SEZ area from DTA are treated as deemed exports and goods coming from the SEZ area into DTA are treated as if the goods are being imported. SEZ units may be set up for the manufacture of goods and rendering of services, production, processing, assembling, trading, repair, remaking, reconditioning, re-engineering.

Export and Importability of Goods in SEZs

SEZ unit may import without payment of duty all types of goods, including capital goods, as defined in the Policy, whether new or second hand, required by it for its activities or in connection therewith, provided they are not prohibited items of imports in the ITC(HS). The units shall also be permitted to import goods required for the approved activity, including capital goods, free of cost or on loan from clients.

SEZ may import, without payment of duty, all types of goods for creating a central facility for use by software development units in SEZ. The central facility for software development can also be accessed by units in the DTA for export of software.

SEZ unit shall be a positive net foreign exchange earner. Net Foreign exchange Earning (NFE) shall be calculated cumulatively for a period of five years from the commencement of commercial production according to the formula given in Paragraph 9.A-4 of the Handbook (Vol-I).

All activities of SEZ units, unless otherwise specified, shall be through self certification procedure. SEZ unit may sell goods, including by products, and services in DTA in accordance with the import policy in force, on payment of applicable duty.

DTA sale by service/Trading units shall be subject to achievement of positive NFE cumulatively. Supplies from the DTA to SEZ units will be regarded as 'deemed exports' and interalia will be eligible for the reimbursement of Central Sales Tax; Exemption from payment of Central Excise Duty on all goods eligible for procurement; Discharge of export performance (EO), if any, on the supplier.

Duty/Tariff Structure

During the Ninth Five Year Plan, the duty/tariff structure for Electronics and IT sector has been reviewed and rationalized as part of Annual Union Budget. The Custom duty has been reduced to 4 slabs of advalorem rates of 5,15,25 and 35%. The Capital Goods and specified raw materials and components required by electronics industry are allowed to be imported under concessional rate of Customs duty.

India is signatory to ITA and is committed to bring down custom duty in a phased manner. The Central Excise Duty has been rationalized to a single slab rate of 16%.

The changes in Import-Tariff structure for Electronics & IT items during the period 1996-97 till 2001-02 alongwith the prevailing excise duty rates are summarized in Table 2.

Constraints in Growth

- The software export sector has almost trippled every two years and domestic software sector has doubled every two years, the electronics hardware industry has only grown to 1 1/2 times in three years. While the growth of software sector has been supported through the natural advantage India has in terms of scientific/engineering manpower the hardware industry is faced with number of constraints.

  Some of the major ones are as follows;
- Infrastructural constraints
- Inverted tariff structure (Table-3)
- High incidence of overall duty/taxes and other cascading effect
- High cost of finance
- Policy and procedural issues related to Industrial, Fiscal and EXIM policy' Labour laws and Inspector Raj
- Low volumes of production
- Requirement of large inventory levels
- Longer business cycle time
- Low technology level
- Lack of investment in the Electronics and IT Hardware sector
- Emerging competition from multinational corporations
- Inadequate investments in R&D

Table2 : Years Tariff Structure for Electronics & IT Items

	1996-97	1997-98	1998-99	1999-2000	2000-01	2001-02	Ex.Duty
Finished Equipment	50%	40%	40%	40%	35%	35%	16%
Capital Goods							
i. Project Imports	25%	25%	20+2%	25%	25%	25%	16%
ii.Micro Electronics	15%	15%	10-5%	15%	5%	5%	16%
(iii)Micro Electronics(68 items)			10%	0%	0%	0%	16%
Moulds, Tool,Dies	25%	25%	25%	25%	25%	25%	16%
Electronic Compo-nents	20%	20%	20+5%	15%	15%	15%	16%
i)CPT	35%	30%	30+5%	35%	35%	35%	16%
ii)Floppy Diskettes	20%	20%	20+5%	20%	15%	15%	16%
iii).CD- ROMS	10%	10%	10%	5%	0%	0%	16%
iv)IC's	20%	20%	5-10%	5%	0%	0%	16%
Piece Parts	10%, 20%	10%,20%	10-35%	5-35%	0-35%	0-35%	16%
Raw Materials	10%,20°/i	10%,20%	10-35%	5-35%	5-35%	5-35%	16%
Computer Systems and Peripherals	20%	20%	20+2%	20%	15%	15%	16%
a)HDD, FDD& CD ROM Drive	10%	10%	5%	5%	0%	0%	16%
b)Carmdge Tape drive DVD Drive	10%	10%	10%	5%	0%	0%	16%
Computer software	10%	10%	0%	0%	0%	0%	Zero%
Parts Of Computers	35%	20%	10%	5%	5%	5%	16%
Consumer Electronics Electronics	50%	40%	40%	40%	35%	35%	16%
Telecom Equipmt	50%	40%	40%	25%	20-25%	15%	16%
Parts of Telecom	50%	40%	40%	20-25%	15%	5%*	16%

*Only on some parts Others are at duty 15%/35%

Table 3 : Inverted Tariff Structure in India

Duty on inputs often more than that on finished goods	
High incidence of overall customs duties	
Capital Goods	25%
Raw materials/inputs	0-35%
Components	0-15%
Finished goods	15-35%

Comparative summary of customs duty on RM/Components/Inputs for electronics and IT industry is given in Table 4, 5

Cascading Effect of Taxes/Duties

Globalisation calls for mass production, Finished consumer product can be divided into four stages of production and two stages of marketing for efficient operations. Cascading effect of 4% CST and other miscellaneous duties & taxes including service tax, high rate of interest & high cost incurred due to weak Infrastructure increases cost of indigenously manufactured product (Table-6). Impact of taxes/duties and disability factors coming to 46% of MRP. This has resulted into manufacturing in vertically Integrated unit or at such locations where taxes are exempted. In this process production efficiencies have to be compromised. This also gives enough incentives for tax evasion there by creation of unfair competition. This impacts global competitiveness.

Raw Material Availability

The requirement of the electronics industry for items of chemical, petrochemicals and metals is of high purity and grades, smaller quantities, proprietary in nature, of high value and manufactured world over by a limited number of suppliers. The Chemical and Petrochemical items manufactured locally in the organised sector are for general applications, non-electronic grades, and not found suitable for electronic applications. The local industry does not venture into manufacturing electronic grade chemicals because of the low volume requirement, thus making it highly priced and uncompetitive. Therefore, allowing duty free import of electronic grade chemicals, petrochemicals, ferrous and non-ferrous metals in smaller quantities will not be detrimental to indigenous industry.

Small Scale Industries Sector in Electronics and IT Sector

Many of the existing units in consumer electronics, components and IT had started their ventures in the Small Scale Sector. Over the years they have grown to the organized sector and are presently the leaders in their respective areas. During the Nineties number of initiatives have been taken to encourage the small scale sector and enhance their competitiveness. Some of these include;

- A Technology Development and Modernization Fund by SIDBI
- Increased focus on tool rooms with latest equipment and machinery to address tooling requirements of small units.
- Reimbursement scheme in respect of ISO 9000 Quality Certification for individual SSI units.
- IT based initiatives for information souring.
- Excise exemption upto Rs. 100 Lakhs.
- Technology upgradation - 12% Capital subsidy scheme

Electronics Products Reserved for Production in the Small Scale Sector

1. Radio/Car Radio-Low cost upto Rs. 250 each
2. TV antennas
3. TV tuners excluding electronic tuners
4. TV booster amplifiers
5. Amplifiers for entertainment and public address system
6. Electronic fan regulators
7. Dimmers & Twilight switches
8. Telescopic aerials for radio receivers
9. Battery eliminators

Table 4: Custom Duty on Raw Materials/Inputs for IT/Electronic Components in Selected Countries

COUNTRY	CUSTOM TARIFF RANGE (%)	COUNTRY	CUSTOM TARIFF RANGE (%)
USA	0-2	CHINA	0-5
JAPAN	0-2	BRAZIL	0
SOUTH KOREA	0-2	THAILAND	0-5
EU	0-2	MEXICO	0-2
MALAYSIA	0-5	PHILIPPINES	0
SINGAPORE	0	INDIA	0-35
TAIWAN	0		

Table: 5 Custom Duty on Capital Goods for IT/Electronic Components in Selected Countries

COUNTRY	CUSTOM TARIFF RANGE (%)	COUNTRY	CUSTOM TARIFF RANGE (%)
USA	0	CHINA	0
JAPAN	0	BRAZIL	0
SOUTH KOREA	0-2	THAILAND	0-5
EU	0	MEXICO	0
MALAYSIA	0	PHILIPPINES	0
SINGAPORE	0	INDIA	25
TAIWAN	0		

Table- 6 CASCADING EFFECT OF VARIOUS TAXES & DISABILITY FACTORS 0N   EX-FACTORY   PRICES OF FINISHED TYPICAL ELECTRONIC EQUIPMENT *

(Manufacturers of)

	Stage	Total Impact	Piece Part	Compo nents	Sub-Assy	Finished Product	Distri butor	Retailer	Consu mer
1	Basic Price		18	48	72	85			
2	Custom Duty @35%	8.3	6.3						
3	Impact of CST@4%	20.5	1.13	2.23	3.34	3.94	4.64	5.22	
4	Impact of High Rate of Interest @7%	9.17	2.52	2.52	2.38	1.75			
5 **	Impact of Other Misc. Taxes-Services, Electricity, Land, Building, Octroi, T.O Etc nn SP@0.8%	3.1	1	0.9	0.7	0.5			
6 **	Higher Cost Due To Weak Infrastructure	6.2	2	1.8	1.4	1			
7	Other Manufacturing Costs		17.05	16.55	5.18	7.81			
8	Appx. Share of SP (A)		48	72	85	100	130.64	150.88	150.86
9	Excise Duty @16%	16	7.68	3.84	2.08	2.4			
10	Impact of S.T. @12	18.1							18.1
11	Freight						5	5	
12	Marketing Mark Up						5	10	
	Total	79.37							
								MRP	168.96
	I.Tax @5% on Profit	5.33	0.84	1.26	1.48	1.75			

SAY   170

**** Impact based on industry average**

Assumptions:

1. Rate of interest of 14% against International rate of around 7%.
   Impact of differential rate of 7% (14-7) in considered while calculating impact on Sale Price.
2. Cost of Distributor =A+16%(ED)+(5)Freight +(4%)CST + Mark up 5
3. Cost of Retailer = A+(5)Freight +(4%)CST + mark up 10
4. Cost of Customer = A+ (12%)ST.

Comments

1. Impact of all taxes & disability factors   79.37
   a) Post manufacturing impacts (4.64+5.22+16.00+18.1) 43.96
   b) Impact upto Manufacturing stage (79.37 - 43.96)   35.41
2. In case taxes are removed/reimbursed & disabilities are corrected export price of same product can be less than 64.59 (100-35.41=64.59), since inventory cost at each level will also reduce.
3. Impact of total taxes on MRP is 46.7% (79.37/170)
4. Impact of Income tax upto manufacturing level is 5.33. This is not considered in above comparison.

*Contributed by Shri B.S. Sethia, Director, ELIN Electronics

ITA-I

India is a signatory to the Information Technology Agreement (ITA-I). For large scale and faster proliferation of IT in the country, India had voluntarily announced advancement of zero duty regime on all IT products covered under ITA-I (217 tariff lines) by two years. Therefore, ITA-I expected to be fully implemented by 2003. As a result, if all the electronic components will be at zero duty and if the inputs for their manufacture remain at a duty ranging from 5% to 35%, the already inverted tariff structure will be further stressed and will adversely affect the indigenous manufacture of electronic components.

Velocity of business

The present procedures and regulations pertaining to exports, imports and inspections are complex and time consuming. While the companies abroad work on Just in Time inventory and are able to rotate working capital in 6 weeks in India inventory of imported items is required for 6-12 weeks and working capital cycle time to 3-4 months.

For the hardware industry, with fast changing prices and technology obsolescence, all procedures for imports, exports licensing and inspection should be in a time frame which is conducive for increase in the velocity of business.

Availability of Capital Goods

The Electronics Industry mostly requires special purpose machines and test equipment. The general purpose tool room machines are generally procured locally unless these are part of the total project. None of the machines and equipment required in the manufacture of electronics hardware including tools, moulds, dies etc. are available locally. High import duty on such imports makes the end product price incompetitive.

The duty structure does not encourage manufacture of populated PCBs. This in turn affects demand for local components. There is a need to have a competitive climate for investment and production in comparison with that present in the competing countries including those related to customs, foreign exchange regulations, labour laws, banking facilities and support infrastructure.

High duty/taxes encourage grey market, which create unfair competition .

Incentives to Electronics and IT Sector

1. Export Promotion Capital Goods scheme (EPCG) has been rationalised and extended uniformly to all sectors without any threshold limit on payment of 5% duty.

2. Approvals for all foreign direct investment proposals relating to the Information Technology sector, with the exception of Business-to-consumer (B2C) e-commerce are under the automatic route.

3. EHTP and STP schemes are implemented under the aegis of the Ministry of Information Technology through a single window mechanism of the Inter-Ministerial Standing Committee (IMSC).

4. DTA access upto 50% of the FOB value of export is permitted for electronics hardware units under EOU/EPZ/EHTP schemes and the software units under EOU/EPZ/STP schemes. Broadbanding is permitted in the DTA sales of Hardware units for items covered in the Letter of Permission.

5. Accelerated depreciation norms for computers and computer peripherals for electronic units under Export Oriented schemes (EOU/EPZ/STP/EHTP) have been enhanced. These shall stand depreciated to overall limit of 90% over a period of 3 years instead of around 5 years earlier.

6. Special Economic Zones are being set up to enable hassle free manufacturing and trading for export purposes.

7. Value addition norms for Rupee exports to Russia reduced from 100% to 33% under Advance Licensing Scheme.

8. The Depreciation on Computers has been allowed @ 60%.

9. In the Budget 2001-02, the peak rate of customs duty continues @35%. Customs duty surcharge @ 10% has been abolished on all imports, in general but Special Additional Duty (SAD) @ 4% continues on all imports, except specific exemptions. In the 2000-01 Budget, Customs duty on Computers and Peripherals had been reduced from 20% to 15% and continues to be same. The Customs duty on all storage devices, integrated circuits, microprocessors, data display tubes and deflection components of colour monitors also continues at 0%. In the 2001-02 Budget, Customs duty on Information Technology Agreement (ITA-1) items of WTO (IT and Telecom products) has been reduced from existing 20-25% to 15%. The concessional rate of customs duty for specified raw materials for the electronics industry continues. Customs duty on certain parts of Telecom reduced to 5%. 32 items (additional) of Capital Goods allowed at a concessional duty of 5% for the manufacture of semiconductors.

10. In the Budget 2001-02, the Central Excise duty structure has been rationalised from multiple rates to single rate of 16% and single rate of Special Excise Duty (SED) @ 16%.

11. Information Technology Software is exempted from Customs and Excise Duty.

12. Second hand capital goods upto 10 years old have been made freely importable.

13. EOU/EPZ/STP/EHTP units are exempted from payment of Income Tax on export profits, upto 2010, in terms of Sections 10A and 10B of the Income Tax Act.

14. Exemption of withholding tax on interest on External Commercial Borrowings (ECBs) has been extended to the IT sector.

15. Definition of Computer Software, as in Section 80 HHE of the Income Tax Act has been widened to include transmission of data.

16. Benefit of Section 80 HHE is available to supporting software developers.

17. IT Enabled Services have been made eligible for Income Tax benefit under Sections 10A, 10B and 80HHE of the Income Tax Act.

18. The donation of computers, imported duty free by EOU/EPZ/STP/EHTP units to recognised non-commercial educational institutions, registered charitable hospitals, public libraries, public funded research and development establishments, etc., two years after their use by the said units has been permitted.

19. The second-hand computers and computer peripherals donated by an outside donor to Government schools have been exempted from customs duties.

20. Income by way of dividends or long-term capital gains of a Venture Capital Fund or Venture Capital company from investment made by way of equity shares in a Venture Capital Undertaking, which has been expanded to include the Software and IT sectors, will henceforth not be included in computing the total income.

21. To give thrust to Venture Capital finance, SEBI has been made the single point nodal agency for registration and regulation of both domestic and overseas venture capital funds.

22. There will be no tax on distributed or undistributed income of Venture Capital Funds. The income distributed by the VCFs will only be taxed in the hands of the investors at the rates applicable to the nature of the income. VCFs will continue to be eligible for exemption even if the shares of the VC undertaking in which the VCFs have made the initial investment are subsequently listed in a recognised stock exchange in India.

23. Under policy on portfolio investment, Foreign Institutional Investors (FIIs) are permitted to invest in a company upto an aggregate of 24% of equity shares, extendable upto 40% subject to approvals. This limit has been raised from 40% to 49% in the Budget 2001-02.

24. Under the Employee Stock Option Scheme, income tax payable on income from GDRs purchased in foreign currency by a resident employee of IT software and service companies, shall be at a concessional rate of 10%.

25. Tax holiday under provisions of Section 80-IA (Infrastructure Status) has been extended to Internet Service Providers (ISPs) and Broadband Network providers.

26. Two-way fungibility has been permitted for ADRs/GDRs. Local shares can now be reconverted into ADRs/GDRs, subject to sectoral caps.

27. To induce more investment for R&D activities, a weighted deduction of 125% on the sums paid to any university, college or an institution or a Scientific research association for the purposes of scientific, social or statistical research has been provided.

28. A National Venture Fund for Software and IT Industry (NFSIT) has been set up with a corpus of Rs. 100 crores, out of which MIT shall contribute Rs. 30 crores.

29. STPI has set up a business support centre in the USA, which is operational since November,1999, to promote business for STP units and provide marketing support to SMEs.

30. Information Technology Act 2000 has been enacted. This act deals with Cyber Security, Cyber Crime and other information security related legal aspects. This will encourage expansion of e-commerce through internet.

3. Summary of Suggestions received from Members for Electronics and IT Hardware Sector

Key to competitiveness is creating an environment which is conducive to manufacturing. The velocity of business must increase this will reduce transaction cost. Business cycle times be compressed and made comparable globally.

- All imports and exports should be on the basis of self-declaration (on Actual User basis) as in the case of excise duty collections.
- Customs must work 24x7x365 and there should be no cooling off period
- Encourage industry to build global volumes by facilitating exports and domestic market access from the same unit.
- In this regard electronics and IT hardware manufacturing units be given the status of EHTP (the eligibility criteria may be laid out). There should be no export obligation. They may be permitted 100% access to the domestic market at 50% of the applicable duties. This will ensure localisation of the manufacturing in the country. This is expected to compensate the units for cascading of taxes on the inputs and other disability factors like high finance cost in addition to those related with the weaknesses in infrastructure etc.

- Rate of depreciation on IT products be increased to 100% from existing 60%.
- Eight percent Excise duty on all IT products. Pending implementation of VAT Nil Sales Tax on all IT products in all States
- Sales of IT products to educational institutions be exempt from local levies/VAT.
- Incentive packages be offered to telecom manufacturers and large investment projects to ensure local sourcing of components.
- Zero duty on all inputs including items of dual usage for manufacture of IT and telecom equipment (217 items covered under ITA-WTO).
- Deemed export status for Telecom equipment manufacturers.
- CST is the single largest levy which has a large cascading effect, in worst case even reaching over 20% depending upon the interstate transactions in raw material, parts, components, sub-assemblies and finished product (ref. Table-6). The levy needs to be abolished.
- Adoption of 10 digit product classification to simplify charging of appropriate tariffs and to away with discretionary powers of the assessing officers.
- The anomalies in customs duty structure resulting in negative duty differential be removed.
- Excise duty on grey market prone products like PCs, mobile phones, low end TV sets etc. to be reduced to 8%.
- Total incidence of Duties/Taxes on Consumer electronics products be reduced and be made comparable to those prevailing in the competing countries.
- Success in hardware sector is due to formation of clusters. These clusters provide informal, intense and intimate knowledge banks. The Government should invest in creating infrastructure for such clusters.
- Value Added Tax should be adopted at the earliest preferably encompassing Central and State levies. For each product category such as Electronics and IT, the on maximum limit be notified.
- The re-imbursement schemes for taxes and duties on exports be flexible to cover CBU, sub-assemblies, CKD etc. The re-imbursement period should be targetted at two weeks at the most.
- There appears to be a move to discontinue DEPB scheme w.e.f. 1st April, 2002, since it is a preferred export promotion scheme at present, unless there is a viable alternate scheme in place, DEPB scheme should not be discontinued.
- While the customs duty on equipment/components have been lowered, the duties on modules, components/raw-material, piece parts continue to be on higher side (This coupled with other disability factors such as high cost of finance, infrastructural problems and local levies/sales tax etc. seriously affecting the competitiveness of domestic production vis-à-vis imports.

WTO - ITA

India's Commitments on the IT Agreement (ITA-1) under the aegis of WTO would lead to zero duty tariff regime on 217 tariff line, covering electronic components. While the commitment to WTO is for implementation by 2005, India has voluntarily advanced the time frame by 2 years.

Since the industry continues to face the inverted tariff structure and no preparation has been done to enable the industry in withstanding the zero duty regime, it is suggested that the original time frame of 2005 and the duty phase out plan as committee internationally under ITA-WTO should not be changed.

Others

- Component manufacturers have invested in production of their piece parts as raw material are allowed to be imported at concessional duty. If production capacity of piece parts is larger than production of component, industry would like to sell these piece parts to others in order to utilise their investments to maximum extent. Presently these piece parts are not allowed to be sold to other end users as the concessional duty on inputs is for manufacture of components and not their piece parts. As a result these piece parts which are also allowed to

be imported under reduced duty, these get imported, even though spare capacity exists in the country for producing these piece parts. The industry, therefore, may be permitted to sell the piece parts in domestic/export markets.

- The industry strongly feels problems arising out of need to deal with number of Government Departments which makes them prone to periodic visits by Inspectors. Some of the interactions are as follows:*
    1. Under Factories Act
    2. From Labour Department
    3. Sales Tax
    4. Central Excise
    5. Customs
    6. Pollution Control Board
    7. Director General Foreign Trade
    8. Reserve Bank of India
    9. Concerned Ministry
    10. The Licensing Authority
    11. Regional Transport Office
    12. Collectors office. etc.

Considerable time, effort is involved in dealing with these multiple agencies. The number needs to be reduced. Self-declaration must be introduced.

Case for Modified EHTP Scheme

Amongst the major problems faced by electronics IT Hardware manufacturers are the inverted duty structure, high duty on Capital goods, problems arising out of dual usage's of inputs, high incidence of overall duty/taxes/levies, high cost of finance, delays at the ports and ambiguities at assessment level, high cost of infrastructure like power, transportation etc.

All the above problems can be addressed giving the status of an EHTP unit to electronics and IT hardware manufacturers. The eligibility criteria based either on investment or turnover could be laid out. Further, the EHTP scheme may be modified as follows;

- All imports and exports by these units should be on the basis of self declaration (on AU basis) as in the case of excise duty collections. Provision for self declaration for imports exists in the Policy under the Duty Exemption Scheme.
  This would enable the units in getting all their raw material, parts, components, capital goods at zero percent import duty. Also imports sourced locally would be eligible to deemed exports benefits.
  *Article by Shri J.O. Patel, in CETMA News, Jan'01

- Additionally the EHTP scheme be **modified** to permit 100% sales in the domestic market at 50% of the applicable duties. **This is expected to compensate the units for cascading of taxes on inputs and disability factors like high finance cost, longer business cycles apart from the weaknesses in infrastructure.**

- **This approach would help industry in building volumes of production as it facilitates production for exports and domestic market access from the same unit.**

- Further **conditions such as net foreign exchange positive (NFEP) and export performance (EP) should be removed. This would enable in preparing the industry to meet the challenge of impending zero duty regime**.

- In order to encourage such units in looking at global markets it may be ensured that the exporters are provided with finance, infrastructure at costs which are internationally competitive.

Suggested Implementation Structure

There is a need for setting up of an Implementation Committee or Task Force comprising of senior officials from Ministry of IT, Ministry of Finance, Ministry of Commerce, Ministry of Communications along with Industry association representatives - ELCINA, CETMA, MAIT, TEMA, ESC and NASSCOM. This will lead to active interface amongst the critical government agencies engaged in implementation of policies concerning the Electronics and IT industry. This Committee/Task Force may focus on all policy recommendations jointly made by the MIT and the industry associations and work on an **implementation Time Table**. The Committee may meet at least once in 3 months with three-fold objectives:

- Taking up the most critical policy issues requiring immediate implementation.
- Take stock on the growth, capacity utilisation and new investment in the industry in response to the existing policy environment.
- Deliberate on specific policy issues which involves multiple government agencies (Ministries of IT, Finance, Commerce and Communications) for implementation.

Most crucially, the **modified EHTP scheme** (recommended in the Report), which will have far-reaching positive impact, in promoting Electronics and IT Hardware industry, (faced with nil customs duty regime) can be quickly implemented through such Committee structure.

The Telecom industry has been pleading for deemed export status for local supplies made to the industry. This objective would be achieved if the entire electronics and IT hardware industry is given the status of EHTP units.

Monitoring System

For decision making, availability of complete data on industry like installed capacity for the various electronic items, number of units in that area, total investment, level of technology being used, foreign collaboration etc. is very critical. In the regulatory regime number of mechanisms were available to compile such data for example industrial licences, approval for import of capital goods and foreign collaboration, phased manufacturing programme etc. However, subsequent to introduction of liberalised economic regime in 1991, such mechanisms are no longer available.

In the current economic regime, it may still be possible to get some information on new units through study of Industrial Entrepreneur Memorandum issued by SIA, foreign collaboration approvals issued by RBI under automatic route, approvals issued by SIA after clearance by FIPB and approvals issued by SIA for 100% EOU, EHTP, STP and EPZ units etc. It is suggested that copies of all such approvals be sent to MIT. Further it should be mandatory on the part of industry to inform MIT as and when they commence production and to send production returns periodically.

Computerisation of all the records, in particular with excise and custom departments would greatly help in study of market trends.

Infrastructure Related to Testing, QC

The Study Team has deliberated in detail on various aspects of infrastructure requirements to meet the goal of hardware export, and noted that for hardware export to EU and EFTA countries some mandatory techno-regulatory obligations (e.g. CE Certification) are required to be met by hardware manufacturers of this country. Study Team also noted that at present no formalised procedures exist on accreditation of Indian testing laboratories by the "Competent Body" of EU authority for the purpose of compliance to various mandatory Directives being followed by EU & EFTA countries. It was also noted that without having adequate infrastructure for testing the export oriented products as per requirements stated above, it would be a very hard task to meet the estimated export goal.

It is therefore essential to initiate certain actions as suggested below for formulation of appropriate policies and procedures to promote export:

a) <u>Appropriate infrastructure of laboratory facilities to be created for testing of hardware and software export products as per the requirement of relevant international standards</u> . <u>Various capital goods required to be imported for this purpose may be brought under a special incentive scheme</u> which would expedite establishment of such testing laboratories within the next two years. Manufacturers-cum-exporters who are willing to establish in-house testing facilities to adopt self certification scheme for mandatory compliance may be given a special <u>financial concession to encourage the quality compliance</u> for export products.

b) Government of India may explore the possibility of entering into Mutual Recognition Agreements (MRA) with international agencies (viz., EU authority) for accreditation of Indian test laboratories for the purpose of CE Certification. This would help export-oriented units to cut short turn over time immensely. <u>National Accreditation Board of Laboratories (NABL) may be suitably empowered to take up MRA issues</u> with the EU & EFTA authorities and agreements be made within a reasonable time.

c) <u>Appropriate regulations for Electromagnetic Compatibility (both intra-system and inter-system compatibility) may be considered</u> for Indian manufacturers within a reasonable period. This would enable Indian hardware products to compete with the globally standardised imported products being used by Indian consumers. In this regard, Bureau of Indian Standards have already issued various EMC Standards promulgated by International Electrotechnical Commission (IEC) for voluntary use of Indian manufacturers. Industry should be encouraged to adopt them.

LABOUR LAWS

As the Indian IT product industry will increasingly have to compete with countries like Taiwan, Singapore, Korea and Philippines, the Indian Labour Laws in this limited sector should not be adverse as compared to the Labour Laws in the competing countries. In view of this, the following modifications in the Labour Law specifically applicable to the electronics and IT Products manufacturing sector, may be enacted with due consideration to the ILO recommendations

i) Women shall be allowed to work in three shifts subject to provisions of all the ILO specified conveniences including transportation from and to the door steps of the employee.

ii) Temporary status will apply for 720 days out of 3 years instead of 240 days out of one year as per the existing labour laws.

iii) Manufacturers will be allowed to downsize employee rolls by upto 10 percent of total employee strength in any year without permission.

iv) Contract Labour Abolition Act will not be applicable to the IT Sector.

v) In order to be able to run 3-shift/4-shift operations, labour law should allow upto 12 hour shifts without overtime as long as total number of hours worked per week averages the current norms of 48 hours per week.

Encouragement to R&D

The growth of Electronics and IT industry would in future be driven by technology. The growth drivers are expected to knowledge, engineering skills, creativity, R&D base, semiconductors and software for both value engineering as well as innovating/adapting technology. Competitiveness in the global markets would be conditioned by ability to leverage technology.

The investments in R&D in the industry leave much to be desired. The industry requires nurturing and hand holding. Support for R&D to industry would encourage them to also commit funds for technology/product development. There is a need to orchestrate long terms and short term strategies. A Mega R&D project (Long Term) need to be complemented by a large number of smaller projects (short term) which would help in building R&D strengths/temper.

It is suggested that the support to R&D in industry should be in the form of grant-in-aid. The amount or percentage of support may vary depending upon the nature of the project. A royalty may be charged on its commercialisation.

As a further incentive to commercialisation of R&D a 50% concession in excise duty may be considered for three years after the beginning of commercial production. This should be applicable for products designed and manufactured indigenously.

Capitalised R&D expenditure should be recognised as assets for purposes of Institutional finance .

Income-tax exemption should be given on export earnings from royalty on intellectual property.

Innovation needs to nurtured otherwise the economic growth would remain limited by the available physical resources. The strategy of growth and competitiveness needs to be centred around technology.

As the H/W sector would increasingly be using embedded software there is a need to encourage HRD in micro-electronics which would be useful for designing ASICs/VLSIs for the H/W sector.

Encouragement to Eco-friendly practices.

In the electronics and IT sector, India has lagged behind the international efforts be it in technology, process certification (ISO 9000), Quality Certification, taking initiatives in anticipating and responding to the market requirements.

Yet another opportunity is coming in our way, which if effectively managed can provide the country a sought after position in the international market. This concerns Environmental Management Systems (EMS) Certification.

Worldover, the industries are becoming increasingly concerned about achieving and demonstrating their environmental performance because of the growing compulsions from tough legislations and mounting public pressures.

Business leaders whose initial response to environmental management was reactive are now convinced of the need for a more proactive approach towards environmental issues.

Since the mid-80's in the West, and more recently in Central & Eastern countries, industries are taking a more proactive stance and recognising that sound environmental management on a voluntary basis can enhance corporate image, increase profits and competitiveness, reduce costs and obviate the need for further legislative measures by the authorities. Evidence of this is seen in the move towards "green products" with the increasing use of "life cycle analysis looking at the environmental management tools, such as environmental auditing and environmental management systems, which largely started as voluntary in-company initiatives but are now affecting the policies and regulatory approach of the European Union, governments, and the risk management policies of national and international banks and insurance companies.

The global electronics and IT industry is characterized by complex supply chains and high levels of international souring. The electronics industry was traditionally thought to be a relatively clean industry. But this image has taken a dent with greater realisation of the ecological hazards emanating from the sector. The ecological hazards come not only from the product, but also from the processes of electronic commodity production. The generic production process of most electronic items involves the use of chemicals, glass and metal parts, all of which could be harmful to the environment. This raises issues of waste management, reuse and recycling, raw material use

minimisation and waste reduction. The electronic product itself presents a number of problems, particularly as the waste stream of obsolete products grows with the rapid advent of new technology. This has given rise to issues of product disposal, product take back, recycling of product components and producer responsibility extending over the entire lifecycle of the product, from creation to consumption and destruction. An EU Directives on Waste from Electrical and Electronic Equipment (WEEE) and, restriction of the use of certain hazardous substances in electrical and electronic equipment (ROS) directives is anticipated. The directives are expected to come into force in 2008 and will have serious implications on the production processes of component manufacturers exporting to the European Union. Prior to then, major international companies are likely to introduce comparable requirements into their supply chain policies, and some are already underway.

The electronic industry in India currently has a reactive stance towards sustainability agenda.

One of the most important activities of the last few years is perhaps the development of standards in the environment field, especially those being undertaken by the International Organization for Standardization (ISO). These are essential if EMS (and related activities) is to be applied within the context of the "level playing field as required by international trade agreements both within the EU and Worldwide.

Environmental Management Systems (EMS) certification is an opportunity that can enable companies acquire the label of environmentally conscious enterprise. With a systematic approach, the environment challenges can be converted into opportunities. Increasingly companies are discovering that good environmental performance is also good business. ISO 14001 is the standard against which companies can bet the EMS certification to demonstrate their sound environment systems. These standards do not lay down specific environmental performance criteria, but these are system standards, like ISO 9000 series, which describes the management of environment based on company's environmental policy, objectives and targets defined on the basis of their significant environmental effects.

In most countries the implementation of structured environmental management in companies remains voluntary. Companies world-wide, however, are carefully assessing not only the potential financial benefits (identification of savings, improved production efficiency, new market potential, etc.) which may arise from such activities, but also the risks of not addressing organizational as well as technical solutions to environmental problems (accidents, inability to obtain bank credit and private investment loss of markets and customers.

The Study Team suggests that in order to prepare the industry for environment management related impending trade restrictions, electronics and IT industries which get conformance to ISO 4001 may be given some relief in excise duty / income tax paid by them as an encouragement.

4.   Suggestions for the Software and Services Sector

Software industry in India has shown a sustained growth at over 50% during the last 5 years. Its production has increased from Rs. 9970 Cr. In 1997-98 to Rs. 38000 crores in 2000-01 while in exports the achievements during four years 1997-2001 have been 119.5%, in domestic Software the achievement has been 79% only.

The National Task Force on IT and SW Development and NASSCOM-McKinsey Study has set the following targets for 2008.

Sector	Total Production ($b)	Export Target ($b)
IT Services	38.5	23.0
Software Products	19.5	8.0
IT Enabled services	19.0	15.0
E-business	10.0	4.0
Total	87.0	50.0

Various incentives for encouraging growth of the software industry have already been summarised earlier in the report. The suggestions received from NASSCOM for encouraging growth of the software sector are summarised in the following;

5.   Summary of suggestions received from NASSCOM for Software sector

Income Tax Related Issues

- Sub-section 9 of Section 10A/10B read with Explanation 1 is posing hurdles in the case of reorganisation of business T(especially mergers and acquisitions). Hence, it is suggested that the sub-section 9 read and Explanation 1 be omitted both for Section 10A/10B of Income Tax Act.

- In case a 100% EOU, STP or EPZ unit sub-contracts IT software and services work to another 100% EOU, EPZ or STP or to a domestic unit (under the 25% overall ceiling of domestic sales allowed), then both the undertakings be allowed tax holiday under section 10A/10B of the Income tax act (in a similar way as allowed in Section 80 HHE of Income tax act).

- The explanation to Section 10A/10B and Section 80 HHE of the Income Tax announced in the Finance Bill 2001 shall be applicable with retrospective effect.

- The term "Technical Service" under section 80 HHE of the Income Tax Act may be defined to exclude the following:

    - Expenses incurred in developing software onsite.
    - Expenses in foreign currency on marketing offices outside India.
    - Expenses incurred in foreign exchange on travel.

- The provisions under Sec. 80 HHE, clause (4A) sub-section (ii) be amended as follows:

  A certificate from the exporting company   containing such particulars as may be prescribed and verified in the manner prescribed that in respect of the export turnover mentioned in the certificate, the exporting company has not claimed deduction under this section in respect of the export turnover attributable to the supporting software developer.

  The wordings of Section 80 HHE also include services rendered in India by a supporting software developer.

- Amendments be made in Section 80 HHE and 10A/10B of the Income Tax Act, that when Indian IT software and service companies get dividends from its overseas subsidiaries, which is also engaged in the same business of software and services, then the dividend so received should be treated as an export of software and continue to get tax exemption.

- Central Board of Excise and Custom may issue a notification defining online information and database retrieval services as follows:

- "Online Information and database retrieval services" means any information on database which is purchased, provided or sold online.

- Employees Stock Option Scheme which has brought into effect prior to the announcement of SEBI guidelines on the stock options will continue to enjoy the exemption as stipulated under proviso to Sub Section 2, Clause III of Section 17 of the Income Tax   Act.

- A clarification may be made for the purposes of Section 4 of the Income Tax Act, cost of acquisition means the perquisite value as computed under section 17 and cost of acquisition of those shares. Such clarification should be with retrospective effect.

- Suitable amendment in the Act be made to modify the cost of acquisition for non-resident employees who have been granted shares in Indian Company. Such cost of acquisition could be taken as the value on which the tax, being tax on perquisite value, has already been suffered in the host country of the residence (either at the time of exercise or vesting).

- Currently, benefit provided by a company either free of cost or at concessional rate to its employees by the way of allotment of shares etc. are not taxed as perquisites if the allotment is part of Employees Stock Option Plan or Scheme of the Company. The budget proposed to restrict this by adding that the Employee Stock Option Scheme needs to be in line with the guidelines issued by SEBI. The first proviso to Section 17(2)(iii) be amended by inserting the words "directly or indirectly including any welfare trust created for this purpose by the company" after word "benefit provided by the company" contained in the said proviso.

- As per the proviso to section 92C(4), where an upward transfer pricing adjustment is made to the income of an assesses availing deduction under sections 10A, 10B or under Chapter VI-A, the deduction shall not be allowed in respect of the amount by which the income is enhanced pursuant to a transfer pricing adjustment. The proviso to section 92C(4) as proposed in the Finance Bill, 2001. This would ensure that the transfer pricing provisions impact assesses enjoying tax holidays, only subsequent to the expiry of the tax holiday period.

Suggestions for Promotion of ITES

- Need for definitions of various IT Enabled Services
- Need for inter-connectivity between call centres and other service centres at various locations for load sharing, disaster recovery.
- Need for inter-connectivity across networks of different service providers.
- ITES sector should be permitted setting up of international Gateways for captive needs.
- Need for 24x7 support of DOT links.
- The ITES being a 24x7 operation. The support of local authorities is a must. The issues range from problems in working hours, women not being allowed to work in night shifts, use of ACs and backup generators, registration with multiple authorities, requirement of ESI etc.
- Currently domestic and International Call Centres require a separate licence. There is a need to treat them as a single entity for uniform distribution of load.
- Awareness be created for ITES as a profession and suitable training programs initiated in Medical transcription, Animation, Data digitization etc. upto Degree level.
- Single window clearance for setting up of a ITES.
- For Indian Brand promotion a special fund be created.
- Venture Capital Fund for start ups in ITES
- Interaction of Centre-State Government to develop quality infrastructure in various parts of the country (Smaller towns) for location of ITES.
- Encourage women entrepreneurs in ITES through special policies for Loan/VC and also encourage tele working.

Suggestion for Exim Policy

1. Removal of Physical bonding. IT software developers/exporters should be exempted from physical bonding of their premises/equipment by customs under the various export promotion schemes including STP/EOU/EPZ etc.

2. Donation of Imported computers. Amendment/clarification to Customs Notification 47/98 be issued to permit donation of loaned computer systems to specified institutions on confirmation from the foreign client, who had loaned the equipment, that they do not want back.

3. Depreciation on Computers and Peripherals. The ceiling of 90% of depreciation on computer be removed and instead 100% depreciation be allowed.

4. DTA Sales. Sales of software, IT services and IT Enabled services into Domestic Tariff Area (DTA) be permitted through blanket approval up to the entitlement limit which, if need be, can be verified post facto. The provision of case-by-case approval be dispensed with.

5. Incentives similar to SIL. EOUs be permitted to import similar goods, as are being exported by it, upto 25% of their export turnover at NIL import duty, and be allowed to sell into DTA at NIL duty. This measure would benefit the exporters without attracting any WTO provisions.

6. Relaxation in Customs bonded Certificate. In respect of an EOU occupying different floors within the same building, a Single Private Customs Bonded Warehouse (PCBW) Licence should be adequate. Also a single B-17 Bond should be allowed for monitoring value and duty for all PCBW under the same range of any division. In addition, the requirement of 100% surety or 5% bank guarantee should be waived as was done the case of 3-in-1 bond.

7. Flexi-time Working. Global concept of flexi-time working should be accepted with no restrictions on EOUs on their working schedules.

8. Enhancement in powers of Superintendent of Customs. Superintendent of Customs monitoring STPI, EHTP, EOU units be empowered to permit bonding of premises, Re-export, Inter unit transfer and others such transactions and these be approved by Deputy Commissioner of Customs post facto.

9. Enhancement of powers of Director STP. The facility of sub-contracting part of their process in DTA as is allowed with the permission of Assistant Commissioner of Customs be extended to STP units also with the permission of Director STP.

Suggestion for Human Resource Development

- With a view to integrate the core competencies/expertise of the country and innovative information technologies, re-engineering of the technical education and training system of the country with focus on IT education should be undertaken.

- Strategic intervention (through National Program for Human Resource Development in IT) under a definite plan of action with emphasis on critical infrastructure like computer and networking facilities, faculty, curriculum, courseware, promotion of innovation.

- Monitoring the capacities of institutions periodically with the objective of trebling the intake in IT/IT related programs by 2003-2004 for the system as a whole with strategic use of various institutions for different purposes. Whereas a cautious approach is proposed for self financing institutions, the premier institutions shall be encouraged and facilitated to increase in intake of IT/IT related programs, introduce new programs and use new technologies for increase their reach and enhancing effectiveness through a networking approach.

- A multi pronged approach for increasing the availability, improving quality and retaining quality faculty in IT should be undertaken. A flexible and modular approach in curriculum design to facilitate students mobility both horizontally and vertically, developing a mechanism of equivalence of program/courses, special emphasis on courseware in Indian languages and for laboratory activities and web based courseware is proposed. Immediate implementation of the recommendations of PG Review Committee for promotion of postgraduate education and research in all fields of engineering and particularly in IT/IT related areas.

- Continuous review of trends in IT manpower, both for IT hard core sector and it enabled services is suggested with a view to create public information on IT manpower so that the system can make periodic adjustments

Encouragement to E-Commerce in India

E-Commerce is expected to play an important role in shaping the economy, influence the way business are run (reduced procurement costs, reduced inventory costs, lower cycle time for launch of new products, lower marketing costs etc.) and bring about significant increase in productivity. Certain initiatives required by the Government to promote e-adoption in India are;

- Resolve legal and regulatory issues for e-commerce transactions e.g. legal enforceability of electronic contracts, legal jurisdiction of contracts involving international parties, customs duty on cross border transactions etc.
- Address security and trust issues associated with e-commerce
- Promote on-line payments.
- Encourage more players to set up communication infrastructure.
- Become a facilitator for establishment of consistent, internationally interoperable standards related to e-commerce

Chapter 8: Human Resource Development

1.   Background

.The Study Team on Human Resource Development mainly concentrated on adequacy of manpower requirements in the IT Sector as a whole to achieve the software export targets of US $ 50 billion as also a turnover of US $ 87 billion by the year 2008 and suggest appropriate strategy and measures in respect of requisite infrastructure with special focus on Human Resource taking into account emerging educational technologies.

Task Force on HRD in IT has recently submitted its Interim Report. The Task Force in its Interim Report has made several recommendations which inter-alia include strengthening of Computing and Networking Infrastructure in Category-II (50 in number) and Category-III (nearly 200 in no.), creation of Faculty Development Fund, Curriculum and Courseware Development Initiatives, leveraging use of IT for modernization/ Digitisation of libraries etc. Total budgetary support of Rs. 2000 crores spread over the next 8 years has been proposed. The Task Force has also identified agencies for indicative course of action with reference to various recommendations.

In this interim report, Ministry of Information Technology along with MHRD has been identified as agencies for the indicative course of action with reference to *'creating enabling environment to invite visiting faculty from industry, reputed institutions from India and abroad';* encourage *'Adjunct Faculty'* from IT industry; facilitate educational institutions - IT industry collaboration; and setting up of Special Research Groups and Schools of Advanced Studies in thrust and emerging areas.

Study Team, noted that adequate attention has been given to the demand and supply of IT professionals by 2008, by way of monitoring intake & out-turn capacities of institutions periodically in the formal sector of education of the Interim Report of the Task Force. Study Team, felt that MIT's role is more as promotional in nature and as a facilitator to bridge the gaps that exist between *'what is supplied by the educational & training institutions in the formal sector'* and *'what is required or demanded by the industry'.* The study team, therefore, focused on MIT's role in the non-formal sector of Education and Training by way of short-term courses by reputed institutions, while preparing this report.

Summary of Interim Report of The Task Force on HRD

The Task Force has made forty seven (47) specific recommendations to ensure adequate supply of manpower for the Information Technology sector. The objective is to provide quality professionals for both meeting the domestic and global demands by strengthening and upgrading the technical education system in the country with special focus on increasing the intake in "Quality" Institutions and upgrading some of them to improve the quality of their programmes. These recommendations specifically relate to:

- IT faculty development
- IT curriculum and courseware development
- Strengthening of computing and networking facilities
- Digitization and modernization of libraries
- Use of IT for administrative support services, and
- Promoting interface with industry.

Strategy focuses on overall institutional development with networking. Measures identified for development of IT faculty include scaling up of Early Faculty Induction Programme (EFIP), Quality Improvement Programme (QIP) and introduction of Sequential Post Graduate Programmes,

allowing transmigration and switchover of faculty from interfacing disciplines. These recommendations are aimed at increasing the availability of quality IT manpower in the country and to help Indian Software services sector to increase its productivity and move up the value chain, enabling the country to capture larger share of global markets of IT software and services. They have also recommended an investment of Rs. 2000 crores over the next 6-7 years for IT education to ensure adequate number and quality of IT manpower is available.

The above would be dealt with by the Ministry of Human Resource Development. The Ministry of Information Technology (MIT) would facilitate the educational institution - IT industry collaboration and interface.

2. Status & Review Of Ix Plan Achievements

IT Industry - an Overview

India's natural resource in today's knowledge economy is its abundant technically skilled manpower. India has the largest assembly of English speaking scientific professionals in the world today, second only to US. It also has a growing bank of technical personnel, supplied by, among others, over 2000 educational institutions and polytechnics, which train more than 1,50,000 computer professionals every year. This includes the graduates passing out of the prestigious Institutions like Indian Institutes of Technology (IIT), where the quality of technical training is comparable to the best of the educational institutions in the world. As per a recent survey, more than 4 lakhs IT professionals were employed in IT industry in India by end of year 2000. This figure includes professionals, who are engaged in software, IT services and IT enabled services including professionals engaged in software development units in user organisations.

IT Professionals from India have earned a high degree of esteem around the world for their highly professional and innovative contributions to the technological advancements in this field. This has resulted in increased demand of Indian IT Professionals in many other developed countries besides USA. A majority of the developed countries including the US, UK, Japan, Germany, Italy, Norway, Hungary and Singapore are critically short of knowledge workers and have been looking for the skilled Indian IT workforce. Thus, India is today well positioned to take the advantage of its readily available, English speaking and scientifically trained pool of manpower.

India is also fast emerging as a preferred off shore software base servicing major global markets. India is being recognized as a powerhouse for providing e-commerce solutions and software for next generation communications. The cost effective IT Enabled services being provided from India are also a major advantage. IT Industry has emerged as highest growth industry over the last few years in India and it has the potential to transform the Indian economy.

Recognizing such a vast potential of Indian IT industry, Government has set a target of US $ 50 billion (Rs. 2,25,000 crores) * per annum for software exports by the year 2008. The domestic software market is projected to reach the level of US $ 37 billion (Rs. 1,66,500 crores) per annum during this period. The total size of the IT industry (including hardware) is expected to be over US $ 100 billion (Rs. 4,50,000 crores) * by 2008. With such a growth projection, IT industry is expected to emerge as the single largest contributor to the GDP of the country. According to Mckinsey report, India will require 22 lakh IT professionals by 2008 in software sector to achieve these targets.

[* 1 US $ = Rs.45]

The Hardware Industry and the Software Industry are two sides of the same coin representing India's emergence as a Global IT superpower. Whereas the Indian Software industry is performing very well, the Indian IT hardware industry is passing through a transition and is under pressure. For computers and peripherals, a production target of Rs. 17,850 crores was set for the terminal year of the Ninth Plan (2001-02). However, the production of these items has declined from Rs. 2,800 crores in 1997-98 to Rs. 2,500 crores during 1999-2000 and was Rs. 3,400 crores during 2000-01. But, then

the target was set five years ago. The IT Hardware industry is complex, highly capital intensive, intensive in R&D, highly competitive, rapidly changing and of global dimensions.

The situation, at present, has become grim for the Indian hardware industry. American hardware companies were the first to move in and are well entrenched in India now. Over the years they infiltrated and took over the distribution networks of erstwhile Indian hardware manufacturers. They made full use of their money power to set up countrywide networks. Most of these companies closely guard their growth rate figures for India on grounds that country-level figures are not disclosed by them as a matter of strategy. Companies from Korea too have started making inroads. Though their strategy is slightly different, it is equally aggressive. The Koreans made their foray in the Indian market through white goods and having set up countrywide distribution networks, they are now pushing IT products through the same channels. The Chinese too are following a similar strategy but their brand building process has just started and it will be some time before their products gain widespread consumer acceptance.

Cumulative estimate for the Indian Hardware Industry comprising of equipment and component is estimated to be US $ 220 billion (Rs. 9,90,000 crores) by year 2008. It shall generate direct employment of 16 lakh and indirect employment of 32 lakh. These requirements have been worked out on the basis of very ambitious growth targets in terms of telephone density (5 times the current level by 2008), PC penetration (10 times the current level by 2008), TV penetration (3 times the current level by 2008) and strategic and professional electronics (12 times the current production level by 2008). Not only this, 75% of indigenisation in equipment and 65% in components has been assumed. Trends show steep shortfalls in these targets. Even if these targets are met, it is apprehended that the requirement of formally trained manpower (university degree/diploma) would only be a small proportion of the manpower requirement projected. This would largely come from disciplines such as electronics, microelectronics, telecommunications and related engineering disciplines. The system broadly has the capacity to produce the numbers required.

Formal vs Non-Formal Sector

The 1980s saw a rapid growth and transformation of the IT technology scene in India, generating tremendous career opportunities in its wake. The burgeoning demand for computer professionals at all levels opened the door to the non-formal sector. This led to the mushrooming of private institutions, a majority of which were ill equipped to impart quality training. In addition to this, demand forecasts predicted a shortage of computer manpower in the nineties, which strained the formal system of education.

The fast changing technologies have put some special demands on the education and training sector. The conventional formal educational system was successful in meeting the stable or slowly changing needs of the industry of the earlier times. Technological changes force the pace of development and educational institutions have to respond to those changes with relevant educational programmes, both in content and in delivery. The rapidly changing technology needs new and frequent updating of the courses. The conventional model fails to respond to the needs of the fast changing technologies and situations requiring quick response, which characterises the modern industry. Similarly the conventional educational system could not respond to the large retraining needs emanating from fast changing technologies. The conventional formal system of education with all its advantages and strength today is under strain to cater to the huge demand of IT professionals for the following reasons:

a) The limited supply available from the formal institutions.

b) The intake of the government/government aided institutions cannot be increased substantially and suddenly in view of:

- shortage of qualified teachers

- financial constraints especially in view of the continuous updating of hardware, software and competence of teachers to keep pace with the fast changing and rapidly developing technology

- long gestation periods needed to start new courses

- adapt the course curriculum quickly to match the market requirements

c) Limited exposure to the latest tools and techniques employed by software developers for increased productivity and reliability.

d) Limited project management experience because of International standards in project management, programming and documentation not integrated in the curriculum.

e) Rigid curriculum structure, which does not cater to the fast changing trends in technology and practices.

f) Formal Sector Institutions though provide quality education, conceptional and theoretical aspects but basic practical skills and lack the ability to address applications.

g) Students from formal sector institutions generally are not exposed to the industrial problems, and the style of working of the industry and as such the student lack the experience of handling real life large problem.

A National Working Group set up under the aegis of All India Council for Technical Education (AICTE), in the year 1989, observed that private sector can play a vital role in computer training and fill the demand/supply gap considerably for following reasons:

- competence and investment potential in the private sector can be harnessed for imparting high quality instructions and training in computers.

- almost no gestation period for introduction of new and updated subjects.

- a large number of training requirements is job-specific, requiring short term training for which private institutions are well suited.

- it is comparatively easy to discontinue outdated/obsolete subjects in private training institutions as compared to government/government aided institutions imparting formal institutions.

The recommendations of this working group resulted in the launch of the DOEACC scheme of Ministry of Information Technology (erstwhile Department of Electronics).

A large number of private sector institutions have come up in the past few years and offered a variety of courses of different durations. As per NASSCOM estimates, there were more than 70,000 private training institutes in the country as on 31st December 2000. These consist of nationally spread institutes, franchisees as well as local institutes. The standards of teaching and the scale of operation greatly vary among these institutions with some of them offering a fairly good training. These institutions generally provide skill-based courses and a moderate level of expertise. The major drawbacks are lack of standardisation, unqualified and untrained staff (from conventional sense), less emphasis on conceptional aspects, inability to provide in-depth courses. Since majority of students at these institutes learn computer appreciation and related subjects, they are not directly employable by the software industry. However, the institutions in private sector (non-formal sector) have their strength in the knowledge of market demand, some of them may have contacts with the prospective employers, the network of institutions they have, the infrastructure and capability to implement

technology based education such as Computer Based Training (CBT) and Web Based Training (WBT). They have the wherewithal to produce instruction material in an appropriate format in a short time.

Study Team therefore noted that both formal and non-formal systems of education have specific roles and their own strengths and weaknesses. In order to meet the gap in demand and supply of competent manpower the role played by formal sector of education needs to be complemented by non-formal education. Institutions in the non-formal sector are playing an important role to generate required manpower to meet the software export related targets. One of the new trends is that graduates and engineers from formal sector institutes reorient or retrain themselves at the private training institutes in the non-formal sector to arm themselves with skills such as web-based technologies including e-commerce to enhance their employability prospects. As per the interim report of the Task Force on HRD in IT, non-formal sector has a capacity of 5 lakh and is growing at a rate of 20%. Therefore, presence of such a large base of non-formal educational institutions cannot be ignored. A collaboration between formal and non-formal systems of education will bring the best from every system in their pursuit to produce quality manpower in desired quantity.

MIT Initiatives during Ninth Plan

Ministry of Information Technology has initiated various programmes to generate the large number of skilled manpower in the non-formal sector of education. These include:

DOEACC Scheme

The DOEACC scheme plays a pivotal role in generating competent manpower by utilizing the resources available in the non-formal sector for education in the area of Information Technology. Harnessing the resources available at private computer training institutions to meet the projected manpower requirements assumes greater significance since this sector is better equipped to keep pace with the fast rate of obsolescence in IT industry.

The DOEACC Scheme has been formulated by All India Council for Technical Education (AICTE), a statutory body under Ministry of Human Resources Development (MHRD), and Ministry of Information Technology (erstwhile Department of Electronics), responsible for the development of technical education in the country and is being implemented by DOEACC Society, an autonomous body of Ministry of Information Technology, Government of India.

Under this scheme, institutions are granted permission to conduct DOEACC accredited O (Certificate level), A (Diploma level), B (MCA level) and C (M.Tech. level) courses, subject to their meeting well defined norms and criteria. The Society conducts examinations twice in a year for the students undergoing DOEACC Courses. Students who qualify in the examination are awarded Certificate/Diploma by the Society. The Society has 2,91,600 students registered with it as on 31st March 2001 and 1,52,000 paper candidates appeared in the January 2001 examination for all the four levels. So far, a total of 26,919 have qualified in DOEACC examinations.

IT Enabled Distance Education

One of the recommendations of the National Task Force on Information Technology and Software Development is to set up Virtual Universities/Institutions in the country so as to achieve the Software export target. World over Online Learning is being viewed as an effective methodology to promote distance education and learner centric, self paced learning. Ministry of Information Technology (MIT) has identified Online Learning/ Distance Education as one of the thrust area, with reference to producing high quality high-end manpower. A series of projects had been initiated in 1998-99 to address these quantitative requirements of trained manpower without compromising professional quality. These initiatives of the Ministry focus mainly on the promotion of Internet-based Distance Education especially towards the higher-end skill formation for the IT Sector. Online

Learning - Internet Based Distance Education/Web Based Distance Education has tremendous potential and offers wide ranging opportunities, which include,

- Training: Training of working professionals (continuing education mode) to upgrade their skills in the latest technology
- Generate additional qualified professionals (in asynchronous mode)
- Percolate high quality education from the premier institutions to the lesser-privileged institutions.
- Distance Education as IT Enabled Services.
- Attempts to narrow down the gap between Distance Education and Formal education by introducing concepts like Virtual Campus, Virtual class room etc. and provide frequent interaction between Teacher-Teacher, Teacher-Student, student-student (concepts of collaborative learning)
- Setting up of Virtual University and Institutions.

Further:

- It is expected to generate a huge market opportunity in terms of development of courseware, course delivery, development of software, etc.
- There is also a possibility to export the educational Instructional materials to other countries.

To translate the promise of Digital Distance Education into actual results and ensuring good quality education via on-line and interactive model requires attention to the aspects of:

- Selection of appropriate technology for the country and the educational goals.
- Courseware engineering,
- Technology for interactive response,
- Corpus of Course material with continual updation.
- Web based course administration,
- Availability of powerful software and hardware resources for development and delivery of courseware and other related components,
- Availability of trained educators to create educational material and administer Digital Distance Education (DDE) systems.
- Dissemination Infrastructure.
- Powerful and reliable testing environments, and
- Most importantly, expertise and experience in use of this technology.

MIT has been focusing on promoting Online learning as a tool to achieve scalability, quality improvement, continuing education and a methodology for life long learning. It is felt that there is a need to look at various aspects like courseware development, pedagogical models, instruction design, content creation, visualization of courseware models, courseware delivery, course administration, market dynamics, acceptability/recognition, quality systems etc. pertaining to Online Learning. To address the above issues and to provide the right impetus so that the benefits that could flow from the Online Learning is maximized MIT has initiated projects pertaining to aspects of Online Learning, efficacy of imparting education through Online Courseware delivery and has also set up a National Resource Centre for Online Learning at NCST Mumbai to consolidate and strategise the activities of individual institutions. MIT has also funded projects at IIT-Delhi, IIT-Kanpur, BITS-Pilani and IGNOU; and are in the process of funding a few more projects to develop the area of Online Learning. MIT's objective at this stage is to ensure that Online Learning is utilized in the proper context so that it is not mistaken at the one extreme as substitute for classroom learning or the institution based learning while at the same time the positive aspects of this tool such as interactivity, self paced learning, wide reach-ability etc. are also optimally used to reap the benefits.

Project IMPACT

The Ministry of Information Technology (erstwhile Department of Electronics) had successfully implemented a pilot project on Electronics Industry Development Project (EIDP) - Manpower component, jointly funded by the World Bank, the Swiss Agency for Development and Cooperation (SDC) and Government of India during 1992-97. The objectives of the Project was to upgrade the quality of education and training at selected Engineering Colleges (14) and Polytechnics (12) (Participating Institutions) with the help of Resource Centres and to provide training through Continuing Engineering Education Programme (CEEP) for the industry professions and technicians in the area of Electronics and Computer Science Engineering. The above pilot project has been successfully completed to the satisfaction of World Bank & SDC and achieved the goal of upgrading the laboratory infrastructure, Institution enhancement programme for faculty and support staff, improving the learning environment, training of students for meeting industry needs, etc., in the above Participating Institutions. The PIs had also established a good Industry-Academic interaction in a mutually beneficial manner.

In order to sustain the achievements made under the pilot project IMPACT, the Sustainability Support Scheme (SSS) - Project IMPACT has been initiated at the Engineering Colleges and Polytechnics. The duration of the Project is for five years (1998-2002) and under this Project 25 Participating Institutions (PIs) are provided reducing grant-in-aid each year. The PIs are expected to generate revenues through running CEEP programmes for Industry professionals, developing and implementing research projects, providing industrial consultancy, etc. The revenue earned would help the PIs to sustain the IMPACT activities for maintaining quality-learning environment. In order to absorb, adopt and institutionalize the gains of the project, a Quality Management System has been established at 22 PIs and are certified to ISO 9001/2. Currently, 1800 students pass out from their PIs annually. Similar to Project IMPACT the faculty and support staffs of PIs are trained periodically at Resource Centers.

Employment Generation Training Scheme (EGTS)

Ministry of Information Technology is implementing an Employment Generation Training Scheme for North East States, and SC/ST/OBC candidates for other regions in the country. The overall objective of this scheme is to harness the potential of Electronics and Information Technology in providing "Employment Oriented Training" for educated youth to fill up the shortage of trained personnel in the North East and other regions. Initially, this scheme was being implemented only in the North Eastern States. Till date about 50 institutions have been supported. The scheme is now being extended to the other regions of the country.

Media Lab Asia

Ministry of Information Technology is establishing Media Lab Asia jointly with MIT Media Lab, USA in India. This project is expected to have a budget of Rs.5127.50 crores over a period of ten years. The first year programme of the Media Lab Asia is conceived to be Exploratory Program in order to identify the funding partners, establishing working relationship with local players (academic institutions, industry and NGOs), initiation of a few identified projects etc. The budgetary support from Government of India to this project is Rs.870 crores over the Ninth, Tenth and Eleventh Plan Periods. Cabinet approved the setting up of Media Lab Asia and also approved one year exploratory budget of Rs.65 crores.

The Media Lab Asia is proposed to be a network of national as well as overseas people, projects, and laboratories dedicated to bringing the benefits of the most advanced information technologies to the neediest people. It is anticipated to be an ambitious plan for meeting the grand challenges in learning, health, and enterprise. The role of Media Lab Asia is to facilitate inventions, refinement and deployment of innovations that benefit the masses. The key to success for the Media Lab Asia would be combining the creativity of Indian entrepreneurship with the technical know-how of seats of learning to grow sustainable, culturally appropriate solutions. Particular challenges include

the need to operate in many different languages and the need to support product innovation using local culture and tradition.

The Media Lab Asia would be based around village-level field projects, supported by research for technology development and partnership; the goal over a lifetime of the project is to have a sustainable presence in majority of India's villages. Initiatives, from the villages' up to the national level, would be determined by an open evaluation process designed to harness the creativity of the region's finest thinkers as well as unsung heroes.

Promotion of advanced IT education in higher learning institutions like IITs, IIITs etc.

It is necessary to promote high-end, high quality IT education in India to produce world class engineers needed for Industry, R&D Labs - to support intensive R&D programs for the Indian Industries & different missions - and to create products, tools & services related to Indian/world market etc. The areas which need special attention are Web Applications, E-Commerce, E-Governance, Web Technologies, Graphics, Multimedia, Artificial Intelligence, Computer Aided Manufacturing (Robotics, Flexible Manufacturing System, Numerically controlled Machine Tools etc.), Computer Integrated Manufacturing (CIM), Computer Aided Design (CAD) etc.

Ministry of Information Technology proposes to initiate promotion of high quality IT education in India by strengthening the IT education in the IIITs and IITs and universities etc. by providing IT infrastrcutrual facilities.

Special Manpower Development in Microelectronics (VLSI Design, Process, Testing)

Ministry of Information Technology initiated this project in March 1998 with an outlay of Rs. 14.99 crore and five year's duration. The objective of the programme is to train Special Manpower in the area of VLSI Design and related software at B.E./ B.Tech. & M.E./ M.Tech. level. In this programme, in all, 19 intuitions are participating - 7 Resource Centres (RCs) and 12 Participating Institutions (PIs). Under this project, the RCs and PIs have been given the required hardware/software along with books to carry out the VLSI design activity in their institutes. The Resource Centers provide the technical support to the Participating Institutions. This includes conducting Instruction Enhancement Programme (IEP) for training the faculty of PIs and developing Learning Material (LM) for PIs. The Resource Centers will prepare 25 LMs on various aspects of VLSI Technology/ Designing. By the end of the project, it is expected that every year about 660 engineering students of B.E./ M.E. will be trained by these 12 PIs.

VLSI Penetration Programme

VLSI Penetration Programme was a pilot programme launched for the state of Tamil Nadu with a view to train the faculty of the Engineering Colleges in the area of Digital Circuit Designing using Hardware Description Language - Very High Integrated Circuits Hardware Description Language (VHDL). It is a low cost project under which a one-week (20 hours each of theory lectures hands on training) training is imparted to the faculty of engineering colleges covering different aspects VLSI Designing using VHDL. Faculty members of 52 engineering colleges of Tamil Nadu have been imparted training under this programme.

ERNET India

ERNET is the largest nation-wide terrestrial and satellite network with the point of presence located at the premier educational and research institutions in major cities in the country. Focus of the ERNET is not limited to just providing connectivity, but to meet the entire needs of the educational and research institutions by hosting and providing relevant information to their users. R&D and training are integral parts of ERNET activities.

The ERNET backbone is a judicious mix of terrestrial and satellite-based Wide Area Network. The satellite WAN, using V-SAT technology has facilitated reliable and quick access from remote areas. The V-SAT Network acts as an overlay for the terrestrial WAN by providing back-up links between the backbone sites. The international connectivity is achieved through gateways at New Delhi, Mumbai, Bangalore and Calcutta, with a total capacity of 16 MB. Daily traffic over ERNET exceeds 20 GB. ERNET architecture is based on industry standard TCP/IP protocol, ensuring connectivity from heterogeneous computer systems and local area networks (LANs) at user sites.

3. Constraints in Developing High Quality Manpower

The major constraints in the existing formal education system have been identified by the Ninth Plan Working Group on Electronics Industry and are listed below:

- Outdated equipment
- Shortage of components
- Shortage of teachers
- Lack of motivation on the part of teachers either to innovate teaching methodologies or to keep themselves up-to-date on the latest technical developments.
- Shortage of space for labs and class rooms and insufficient provisions for proper wiring/air-conditioning, especially, of computer systems.
- Inadequate provisions for regular updatement of hardware compatible with the software.
- Lack of adequate access to laboratory facilities to students (which is related sometimes to shortage/non-availability of technical/supporting staff.
- Inadequate availability of/access to library books and journals.
- Lack of facilities and/or inadequately trained/motivated support staff for properly maintaining electronic/computer equipment. Or alternately lack of adequate funds for third party maintenance of the lab equipment.
- Inadequate exposure of faculty and students to requirements of industry in terms of skill development needed in students.
- Infrequent revisions in the curriculum. Especially in the areas of Computer/IT where the changes are very rapid, there is need to revise curriculum more frequently.
- Inadequate rapport between academia and industry which prevents the building up of mutual confidence and trust between the two and which puts a damper in their effort to help each other for better mutual profit.
- A major neglected feature is the absence of R&D culture in academia/industry (barring a few exceptions here and there), which is detrimental to the long-term interests of the country. A small number of companies have in-house R&D capability but even these try to solve specific application oriented problems of the type which can be solved in short time frames, say, 6-12 months, using known techniques. Especially distressing is the absence of sustained Ph.D programmes, which lay the foundation stone for creative innovation, encourage systematic development of new areas with sound theoretical basis etc. As a matter of fact many of the features available today in commercial software packages started as research problems in Universities. Without active support for Ph.D programmes, especially in computer software/IT area, it may not be feasible to maintain, let alone increase, the growth rate of software industry.
- Lack of access to networking facilities such as ERNET/Internet, or other communication/ Information Highway connection to other educational institutions/ Software development companies especially for Computer/ IT students.
- Inadequate offer of Continuing Engineering Education Programmes by academia to industry.

4.   Tenth Plan Imperatives & Strategies

IT Manpower Projections

It is estimated that total size of IT industry in India will be over US $ 87 billion (Rs.3,91,500 crores) by 2008. A large part of it would be from the IT Services. The major segments contributing to this industry are Software Products, IT Enabled Services and E-Business. By 2008, it is expected to become single largest contributor to the GDP of the country. One of the key issues in achieving and sustaining this level of growth will be the availability of high quality IT professionals in adequate numbers. As per NASSCOM study, this would require **22 lakh** IT professionals – 11 lakh in the ***hard core IT sector*** and another 11 lakh for the ***IT enabled service***s.

Ministry of Information Technology (MIT) has worked out a figure of ***23.67 lakh*** in three categories – 2 lakh IT professionals of category A for software products, 5.77 lakh of IT professionals of category B for IT services and E-business and 15.9 lakh of IT professionals of category C for IT enabled services and E-business. This would mean 7.77 lakh professionals in the ***hard core IT secto***r, if we broadly fit in category A and Category B manpower here. The method and calculations on which these figures have been arrived is given at **Annexure-I**.

In addition to national demand, there would be international demand in view of intrinsic quality of Indian Software Professionals and therefore premium attached to them.   However, notionally, Task Force on HRD in its interim report has suggested that we could take it as 20% of the overall manpower requirements. As per the Task Force the demand for IT professionals from USA under H1B Visa has been increased to around 2,00,000 from the present level 1,14,000. Similarly Germany, UK, Ireland, Japan are likely to permit immigration at a level between 20,000 to 30,000 per annum for IT professionals. IT being English-Intensive, we presently enjoy an advantage due to our large English speaking population, but this may soon be lost in view of concerted efforts by other nations like China to catch on. Presently, many non-English speaking countries are forced to meet their requirements only from their local markets because of the language barrier. This offers immense opportunities in countries like - Japan, Germany, France and Korea, which could be exploited, if we are able to bridge the language and cultural gap. This could be done integrating training in language cultural skills of potential countries in our regular engineering programmes in the 3rd and 4th year by tying up with the general university system and the foreign missions of those countries here in India.

The demand for IT manpower requirement will be met by the supply from various educational institutions in the country and there is no cause for panic. The numbers appear to be adequate, yet the rate of growth of IT sector worldwide cannot be predicted with absolute certainty. Further, there are serious concerns about the quality of IT manpower. As per Task Force findings at present only a fraction of the graduating students are acceptable to the industry. Low acceptance rate also results in underemployment and may have other serious repercussions.

Slowdown in US Economy and its likely Impact

The slowdown in the US economy is a factor that needs careful consideration while planning for IT manpower. India is highly dependant upon US market for software exports. According to an estimate 66% of the total software exports from the country are to USA and Canada (Europe 21% and rest of the world 13%). As per CII report most of the Indian companies have cut down their IT budget from 15 to 25 percent. The report further estimates that about 30,000 to 80,000 IT professionals are "on the bench".

Indian software exports consist primarily of body shopping, maintenance projects and new projects/R&D support. It is feared that the body-shopping segment will fare the worst because many US companies have realized that doing work in US(H1 visa style) is costly. The major impact of the slow down of the US economy is likely to be on the business of On-shore development.

Bigger companies engaged in maintenance work are not likely to be affected in a major way, as maintenance of existing software would still be a necessary function.

The volume of new projects and R&D is likely to come down. But there are not too many Indian companies offering service in this segment.

While US economy may pick-up in the days to come, it is felt that the slow down has provided a good opportunity for Indian software companies to move from on site to off shore development. US corporates looking to cut cost may find outsourcing their work to India more attractive. Further, companies may exploit hitherto untapped or under tapped markets in other countries in Europe and Asia Pacific regions. IT enabled service sector is one which has potential and may ensure that the overall export figures in the long run may not suffer.

Study team felt that the slow down of the US economy may be a temporary phenomenon. The situation is expected to turn around in the near future. It is expected that the revival of the US economy will result in a spurt in demand for software solutions and services. Therefore, we must plan carefully so that we are able to cope with this situation when it comes. The only criteria which will decide the destination for outsourcing of the requirements by US companies, will be cost competitiveness.

It is expected that while the IT Software & Services export industry will be able to achieve the growth rate of 35-40%, the margins available to the industry are likely to get squeezed due to the slow down of US economy. However, in order to ensure sustained growth, the biggest challenge is to ensure that India is always recognised as the first preference for outsourcing software development by the companies' abroad.

Our Opportunities

Slow Down period may be utilised for consolidation, introspection and to make appropriate amends. There is a need to give attention to quality in all aspects of delivery because only quality is going to sustain our efforts for a long time to come.

IT firms will have to change their single-market US focus and try to tap alternative destinations like Europe, Middle East, Japan & Australia. In doing so the HRD will have to ensure that employees have the **expertise and knowledge** of doing business in these countries. More focus on **cross-cultural orientation** to these countries will be required.

India's edge in remote maintenance and development work besides cost advantage of undertaking offshore projects will help in attracting more business home and more back offices offering IT enabled services can be set up in India. US firms keen to cut costs are now looking at Asia for outsourcing software services. World-class engineers in India cost much less compared to their US counterparts. Therefore, there would be **more job opportunities for people at India without displacement of place of work.**

Slow down provides more chances of retaining knowledge workers within the country. This could result in **lower employee turnover** in the IT industry.

There is a need to provide some **alternate avenues of employment** to the young trained technical manpower, which may be on the bench due to the slow down in the US. India has a competitive and comparative advantage in terms of quantity, talent and cost and this should be utilized to generate more job opportunities.

Our Threats

The initiatives taken up by countries like China and the Eastern Europe.

The disillusionment amongst the youngsters for IT. Slowdown in the IT sector had led to decreasing **employee morale**. We will need to address the emotional issues of the workforce to help them cope with their **depression and anxiety** over their future career prospects.

The ill repute, which our professionals may earn if sub standard deliveries continue.

We may continue to remain in the follower ship mode if technologies do not get developed out of indigenous research. We may loose out on the acceptability of the technology by masses if localization efforts for the indigenous software as well as the third party software is not taken seriously. In spite India being largely an English-speaking nation, the fact is only 5% of the population speaks English leaving huge requirement for localization.

Pressure on the job market would affect **IT training business**, as prospective students will look at alternate career options. The uncertainty in the IT sector will cause a very visible movement of trained manpower from IT industry to the more traditional Consulting & Fast Moving Consumer Goods (FMCG) sector.

5.   Programmes/Projects/Schemes Envisaged for Tenth Plan

IT Skills and Thrust Areas for IT Industry

Software Industry has attained a unique status world over and has been recognised as key for the future development. But software engineering has not been able to attain the status of an Engineering discipline yet. This is probably due to the fact that the conventional engineering disciplines have become quite versatile and IT is comparatively a new discipline. This is also the reason being put forward by academicians for not many students opting for Ph.Ds in Software Engineering. However, IT industry has made full use of engineers from conventional disciplines and have converted them into Software Engineers. In fact large portion of the IT professionals in the country are from other disciplines of Engineering and have been trained through the regular training courses by the corporate training centres through their induction and/in-service training programmes of the companies. Many companies spend 6-10% of their revenues on such training programmes and have state of the art training centres, which can train a large number of students/employees at any given time.

The NASSCOM-Mckinsey Study Report brings out two important issues that India needs to tackle to maintain and enhance its competitive advantage of abundant, high quality and cost effective human resources. First, oft-repeated need to develop over 2.2 million high quality knowledge workers in software and related areas by 2008. Second, a more important issue, it has to ensure that its workforce has the right mix of technical, business and functional skills to meet the needs of individual business segments and customer markets. To meet these twin challenges, the report further suggests:

- To expand the base of people with basic skills in IT
- To ensure continuous and rapid upgradation of skills
- To launch a concerted effort to improve India's value proposition as a workplace of choice so that people who are trained do not migrate

Whereas the effort of expansion of the base of people with basic skills in IT is to be driven primarily by the government, the continuous and rapid upgradation of skills, the report suggests should be driven by the private sector with government playing the role of a facilitator. The third step mentioned, has to be a joint effort by the government and private sector.

It is difficult to get good IT teachers who are well versed in the state-of-the-art skills required by the IT Industry. Many large IT houses have built in-house capabilities to impart such skills to their employees and also for the fresh intake. These facilities can be made available to the teaching

institutions for a faculty enrichment programme. In this way IT industry which earns high revenue is made a partner to contribute in terms of their expertise. Such a trained faculty can also be groomed for undertaking consultancy assignments as an incentive. In addition, experts available with the Industry can be encouraged to take-up teaching assignments.

It is not easy to undertake long-term prediction of the skills needed and tune the syllabus accordingly. This needs to be done at frequent intervals. As the expertise is spread over industry and institutes it is essential to bring them together to undertake this activity. Industry has to spend lot of money and time to impart computer skills to other disciplines of engineering for their line of business project and if institutes could incorporate this in their syllabus for non-computer science disciplines, it will help both industry and students. Industry also needs contemporary skills for computer science student for their line of technology project. Such skills usually are not taught in most of the engineering colleges as they sometime do not have such expertise in their faculty. Industry can play an important role, which will again help both.

Study Team has therefore felt that it may be a good idea to analyse the skills, which are needed by industry. These are:
a) Technical skills
b) Functional skills
c) Life skills

The majority of the formal educational institutes today provide technical skills. Some institutes may be able to provide functional skills because of excellent infrastructure. Few are able to impart life skills because of the quality of input and environment. This however cannot be generalised.

As per NASSCOM-Mckinsey Study, the breakup of the skills as in 1998 and that may required for 2008 is as follows:

Skills	1998	2008	Increase needed
Technical Skill	76%	54%	5.5 times
Functional Skill	16%	28%	13.6 times
Web Skill	8%	18%	18 times
Overall	**280 thousands**	**2200 thousands**	**7.86 times**

It could be seen from this table that technical skills required in 1998 was ¾ of the total manpower and would be reduced to half in 2008 whereas requirements for functional & web skills would double. This would mean that manpower development through non-formal sector needs to play prominent role.

According to NASSCOM-McKinsey study market openings are merging across four broad sectors - IT services, software products, IT enabled services and e-business and create a number of opportunities for Indian Companies. In addition to the export market, all of these segments have a domestic market component as well.

IT Services
• Web enabling legacy systems
• E-commerce/extended enterprise applications
• Standards based application integration
• Knowledge management
• Convergence applications

Software Products
• Emerging "slivers"
• Productization
• Embedded software

IT enabled services
- HR services
- Remote customer interaction
- Data search, integration and analysis
- Engineering and design services

e-businesses
- Domestic business-to-business
- NRI-oriented business-to-consumer

NASSCOM in its survey also focused on the hot IT jobs and services in demand. Some of these include:

a) Programmers/Engineers
b) Communication engineers
c) Networking experts
d) Internet, e-commerce and multimedia personnel
e) System software and support
f) Process/systems management/consulting
g) Database management experts
h) LAN administration experts
i) Office/e-mail/Groupware experts
j) IT-enabled and animation experts
k) WAP, ASP experts
l) Web designers and content staff

The long term forecasts seeks strong skills in communication and networking, software engineering, e-commerce related applications, Web designers and developers, IT-enabled services, animation and digital media experts, experienced project leaders, and those skilled professionals with a WAP, ASP, quality assurance and legacy systems background.

*IT Skills in Demand ***

Programmers/Engineers/Analysts/Computer Scientists	41%
Internet & E-Commerce Applications (Web Developers/ Design)	19%
Database Administrators/Developers	11%
Network Specialists/Developers/Communication Engineers	14%
Digital Media & Technical Writing	5%
IT-Enabled Services	10%

* Source: NASSCOM 2000 Survey

Bridge Courses for IT Professionals

As brought out in para 6.1, it is important that the work force has the right mix of technical, business and functional skills to meet the needs of individual business segments and customers market. The software and related service industry will require very large number of functional experts including front-end office automation, supply chain management, customers relation management etc. In addition, functional experts will be required to provide IT-enabled services such as finance, accounting, human resource, engineering design etc. Though the overall increase required is estimated to be about eight-fold, the increase in technical skill is about six times whereas the functional & business skills need much higher increase i.e. 14 and 18 times respectively.

Quality IT professional team needs to comprise domain experts, software engineers and experts with functional and life skills. Software engineers need to have a thorough knowledge of Software requirements, Software design, Software construction, Software testing, Software quality, etc.

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Life Skills Development

In addition, IT professionals particularly engaged in software exports need to have life skills such as Communication Skill, Time Management, Team Work, Technical Writing, Ethics, Value & Attitude.

Thrust Areas in Information Technology

The major areas for demand of manpower in immediate future are :

a)   E-business Systems
b)   Cryptography and Data Security
c)   Multimedia Technology
d)   Healthcare and Bio-medical Systems
e)   E-Governance
f)   Cyber law and IPR issues
g)   Net-Centric Computing including Web application etc.
h)   Quantum Computing
i)   36/4G Communication
j)   VLSI Design
k)   Fibre Optics Communication
l)   Digital signature certification
m)   Data mining
n)   Networking Technology
o)   GIS Applications
p)   E-Learning
q)   Content Development for Distance Education
r)   Embedded Software/Technology

It may not be possible for an academic institute to impart all the above skills essential for a quality IT professional. A mechanism needs to be devised to bridge the gap between what is offered by academic institutes and what is required by the IT industry. This can be done through the bridge courses in the aforesaid thrust areas as well for high end applications and product development activities. The NASSCOM-McKinsey Study also stresses on the need to bridge programmes.   Bridge programmes can increase the IT workforce by training graduates, non-computer science engineers and Computer Science engineers. The need for domain and functional expert can be met by training industry professional with a basic understanding of IT.

Basic & Fundamental Research aimed at Technologies for the 21st Century

Issues pertaining to special manpower for R&D program in academic and research institutions with support for basic research, etc., have been specially emphasized by the National Task Force on HRD in IT to promote long-term open-ended research and mission mode projects. The suggested areas include, theory and implementation of fundamental algorithms, mathematical basis for computation, programming languages, program translation, new programming paradigms and software architecture, new semantic models etc. Some of the frontier areas in which open-ended/long-term research is undertaken globally are quantum computing, molecular computing, soft computing, high speed networking, scaleable information infrastructure, evolutionary information systems, online and network communities, robust software, bio-elements for computers, IT security biometrics, etc.

The Task Force on HRD in IT has indicated in its interim report, that USA produces 10,000 Master degree holders and 800 Ph.D degree holders in Computer Science every year, while India produces only 25 Ph.Ds and 300 M.Tech. Degree holders in Computer Science. The Task Force has further stated 'for the country to move up the value chain in software industry and to become a super power in knowledge led business particularly computer science and engineering/information

technology, it is essential that we give greater importance to post-graduate education and research. This would be essential if we wish to graduate from mere users of IT to generators of IT products and services and wish to become internationally competitive.

In the light of the above, it is essential to have adequate number of Ph.Ds and post-doctoral level manpower for promotion of open-ended research for IT.

Manpower Development in the area of Microelectronics

In the area of CAD the estimated requirement of trained manpower would be about 1,400 in the terminal year of the Ninth plan for generation a revenue of Rs.900 crores during that year. Similarly in case of discrete semiconductor devices during the IX Plan about 400 engineers, 2,000 technicians and 1,600 support staff would be required. In case of ICs about 150 trained engineers per year would be required which may increase several fold with the proposed establishment of mega fabs.

As part of Ninth Plan exercise, a separate Sub-Group on CAD & related software was set up with a view to identify the gaps and the appropriate actions needed for the same. As part of this, Sub-Group identified that there is a big gap between the specialised manpower required vis-à-vis the availability in the country and suggested the following:

    i.   Progressively establish the infrastructure for generating VLSI Design Engineers
    ii.   Promote the development of specialised CAD tools for VLSI design
    iii.   Strengthen infrastructure for export of VLSI designs and
    iv.   Initiate India Chip Programme to support Indian Equipment Designers & system houses, which are designing VLSI chip and modules into their systems

With the above in view, the following manpower development projects: were initiated in IX plan and will be continued in the Tenth Plan as two distinct activities increasing the scope of the efforts:

    i.   Special Manpower Development for VLSI Design & Related Software
    ii.   VLSI Penetration Programme

At present to service the needs of the industry and other research groups, the universities / RECs/ IITs etc. are the traditional source of manpower. Except for IITs, microelectronics is not taught at adequate depth at the UG and PG level. Therefore the graduates/post graduates coming out of these institutions do not have adequate exposure in this area and are not able to fit the needs of the country. Special Manpower Development Programme of MIT was a first attempt to address this lacuna. We need to generate manpower exposed to all areas of microelectronics viz. Design, processing / characterisation, test & packaging, reliability etc. so that the needs in the different sector could be adequately met.

The Ninth Plan period has witnessed considerable consolidation of activities in the MNC and Indian Microelectronics Design Centres established in the country in terms of their growth as well as new units. It is expected that Tenth Plan would also be witnessing this growth phase considering that India continues to offer the low cost and highly manpower intensive chip design and related activities. Also with the fables design houses number likely to increase in the Tenth Plan, enhanced chip design and related activities is also foreseen. Considering these trends, it is estimated that about 4000 trained IC Designers/ Process & Test Engineers etc., will be required by the terminal year of Tenth Plan. This would be in addition to about 2000 technicians and 1500 support staff needed to support the manufacturing sector. These figures could multiply several folds if other national infrastructure like mega & mini fabs, centres of excellence and resource facilities become fully operational in the Tenth Plan period.

With the 2nd phase of special manpower development efforts now proposed in the Tenth Plan, it is expected that manpower level as indicated in the following Table would become available. They should be in a position to meet most of the industry / R&D requirements except that of fabs. – mega, mini etc.

Projected Manpower to be generated in the Tenth Plan

Year	Trained Manpower
2002-03	700
2003-04	1000
2004-05	1500
2005-06	2000
2006-07	2500

For launching the above activities it will be required to provide the state-of-the-art hardware and software to all the institutions to be covered under the phase II of the Special Manpower Development for VLSI Design & Related Software project as well as at Microelectronics Development Division labs. MIT labs will play the role of Resource Center for the Phase II of Special Manpower Development for VLSI Design & Related Software and VLSI Penetration Programme. The institutions covered under the phase II of the manpower power programme would also be participating in the India Chip effort of aiming to generate specific designs proven through their realisation on silicon (as a product in the multi chip form). Additional resources of Rs. 50 crores need to be provided in the Tenth Plan for getting the India Chip implemented at local industries / overseas fab houses.

6. Recommendations

The Study Team have noted the exhaustive recommendations made in the Interim Report of the Task Force on HRD in IT under various heads such as monitoring intake and outturn, improving institutional quality, improving infrastructure, networking of institutions, IT faculty development, evolving IT curriculum and courseware along with its delivery through different media, promoting PG education and research and interface with IT industry. The following recommendations should be seen as complementary and supporting in nature, keeping in view the promotional role of Ministry of Information Technology.

Faculty Development

1) Non-availability of adequate, qualified teachers is a serious concern and impediment to spread of IT education and in generation of quality IT workforce. Therefore, there is a need for periodic faculty appraisal/ certification/ upgradation of the IT faculty both in the formal as well as non-formal sector of education.

2) 'Instructor Enhancement Programme' for training of faculty as was done under 'Project Impact' needs to be scaled up as a National Programme. Towards this end institutes specifically dedicated for 'Training of Teachers' in the field of Information technology may be set up in different regions of the country.

3) There is a need to train the IT faculty in the application specific thrust areas. In order to facilitate faculty enrichment in the upcoming thrust areas, reputed institutions (such as Category-I institutions identified in the Interim Report of the Task Force on HRD in IT) may conduct faculty enrichment programmes for the benefit of Category-II and Category-III institutions. Identification of application specific thrust areas should be continuously monitored by Category-I institutions with

constant interaction with leading industries in India and abroad to keep pace with the technological advances.

4)   "Training the Teachers" programme of the DOEACC Society needs to be strengthened and made mandatory. Benefit of this programme could be extended to the other institutions in the non-formal sector.

Enhancing the Quality and Content of Courses

5)   In order to produce quality IT professionals, more emphasis need to be placed on software quality control, software process engineering, software project management and software system life cycle. Appropriate modules may, therefore, be included in the course curriculum in both formal and non-formal sector of education.

6)   While the course modules are identified by the emerging needs of the IT industry, course content may be created with the help of experienced teachers who can bring in pedagogical aspects.

7)   Application oriented bridge courses need to be initiated for immediate employability in promising areas such as GIS, network security, embedded systems, VLSI designs, Fibre optics communication and networking, data mining, digital signature verification etc. to mention a few.

8)   Special attention needs to be given to development of life skills such as communication skills, time management, teamwork, technical report writing, business ethics etc. Appropriate modules may be built into the courses offered.

9)   Institutions teaching foreign languages need to introduce courses for IT professionals for development of skills in technical report preparations/ translations.

10)   There is a need to develop specialized manpower in the area of Security (Certified Manpower for Information Security Area CISA)

Fiscal/Government

11)   Government procedures may be made flexible for enabling teaching faculty for working with private enterprises in software technology.

12)   Industrial houses to be given appropriate fiscal benefits for:

  a)   Instituting Chairs in educational institutions

  b)   Funding research in educational institutions

  c)   Offering scholarships in educational institutions

  d)   Upgrading facilities in educational institutions

  e)   Committing to hiring a certain number of engineering graduates for a specified duration.

Accreditation

13)   There is a proliferation of computer training institutes in the non-formal/private sector but there is no system of evaluating their credentials. A nodal body should be set up to check the credentials of the institutes and oversee their working periodically.

14)	Certain minimum norms in terms of academic curriculum, infrastructure, teaching faculty and methodology needs to be laid down as criteria on the lines of DOEACC scheme. The institutions in private/non-formal sector would be required to follow these criteria to prevent mushrooming of ill-equipped IT Institutes which do not impart quality education.

15)	A system of certification or rating of the institutions in private sector is to be devised on the lines of the AICTE gradations of private Engineering Colleges. This will serve the dual purpose of providing incentives for institutes to improve and also serve as a guide to students to decide the best institutes to join.

16)	There is a need for evolving standards, practices and certification mechanism for recognition/ accreditation of online learning courses.

17)	The institution of a private institute must be accompanied by financial guarantees and roadmaps to be given to AICTE regarding the background of the promoters, their qualifications to undertake a educational venture, accounts of funds received, flow of funds etc. Auditing these accounts by a chartered accountant to be appointed by AICTE to be made compulsory.

18)	There is an immediate need to accord recognition to the DOEACC 'C' level qualifications. Being an M.Tech. level course, the recognition will not only boost the course but at the same time will be a source of faculty for IT undergraduate level courses.

19)	DOEACC Society should attempt to get wide acceptance of their qualifications by well known/large industrial houses for its students to enhance their employability prospects in the private sector.

20)	DOEACC Society may attempt for grant of "Deemed University" status. In this connection DOEACC Society may collaborate with other organizations like CEDTI/ ER&DCI, which have introduced M.Tech. level courses in affiliation with universities.

21)	The accreditation mechanism for IT education may be strengthened, by among other things by way of decentralizing the power of the AICTE to the States.

Student Welfare

22)	There is a need for educating the students and public at large by releasing suitable advertisements to apprise them about the various aspects that should be looked into by students before enrolling in a training institute. DOEACC Society has been releasing such advertisements periodically. AICTE is also following this practice for formal technical education. AICTE may extend the same to non-formal education also.

23)	There is a need to enforce a system particularly for institution in the non-formal sector whereby they can charge fees on monthly/quarterly basis rather on an annual or one time basis, as a safeguard to prevent huge monetary loss to students in the event of a training institution closing their shutters abruptly.

Industry-Academia Interaction

24)	There is a need to set-up a Core Group/Committee from industry and educational institutions to assess the future skills required and suitably design educational and training programmes relevant to the needs of the industry. This core group would identify current and emerging global technologies, available and emerging global markets, national development plans, technology developments within the country, and accordingly assess the needs for IT personnel in different sectors. The Core Group will also assess IT manpower requirements on regular basis.

25)   Promote Govt.-industry-academic linkages by supporting research and development of courseware engineering, instructional design, pedagogical issues, development of courseware etc., aimed at continuing education/skill updation at industry.

26)   Commitment from Industrial houses to adopt educational labs/ institutes needs to be encouraged. The in-house training facility in large IT houses can be made available to get quality IT teachers. There is a need to devise a mechanism to accredit such in-house training centres. Accredited training centres may be treated at par with educational institutions for the purpose of fiscal incentives.

27)   IPR sharing between Industry and academic institutes may be encouraged (this assumes that the educational institute participating is of a high calibre and is able to generate sufficiently large amount of intellectual input).

28)   A National Centre for Continuing Education for the working professionals/engineers as a scaled up version of the Continuing Engineering Education Programme (CEEP) under Project Impact needs to be set up.

Online Learning

29)   Development of interactive learning material on all the subjects beginning with science & mathematics needs to be encouraged. Online learning should follow the paradigm, which enable its use from a stand-alone appliance to intranets to the Internet depending on feasibility and availability of infrastructure.

30)   There is a need to develop "Teacher's version', which makes use of the same "digital content" but providing teacher's perspective. The role of the teacher is to be viewed as a facilitator that amplifies online learning.

31)   There is a need to develop "Simulators" for vocational training on the lines of training given to airline pilots on ground-based simulators.

32)   R&D activity needs to be supported in Online Learning in areas like courseware engineering, pedagogical models, instructional design, delivery mechanism, quality system, market dynamics, etc.

33)   Online Learning requires to be promoted not only for IT related subjects but also for other engineering disciplines including preparation of online course material in these areas.

34)   Since Online Learning has a significant role to play in up-gradation/updation of knowledge and skill in the industry in the backdrop of high rate of obsolescence, educational institutions may be supported to offer courses in online mode for corporate sector and industry.

35)   There is a need to strengthen ERNET facilities with a view to provide open access to students interested in "On-line learning".

Basic and Fundamental research

36)   There is a need for setting up of Schools of Advance Studies and Special Research Groups in emerging areas.

37)   Open-ended research including basic/fundamental research in frontier areas of IT, with long-term benefits in view, in institutions of higher learning/R&D institutions like TIFR, IITs, IISc., etc., needs to promoted/supported.

38)   Research activities in frontier subject areas like robust software, human computer interface, evolutionary systems, quantum computing, bio-elements for computing, molecular computing,

knowledge discovery, high-end computing etc., needs to be encouraged in order to produce required number of Ph.Ds and post-doctoral researchers.

39)   Research Chairs may be supported in higher learning institutions jointly with the industry.

VLSI Design

40)   Phase II of the Special Manpower Development for VLSI Design and Related Software may be initiated to cover 40 more institutions spread across the country, to lay emphasis on development of expertise by the institutions in certain specialised area like Analog Designs, Digital Designs, Mixed Mode designs, Low Power Designs.

41)   VLSI Penetration Programme which was launched as a pilot project in Tamil Nadu may be extended to cover another 100 Engineering Colleges throughout the country with special emphasis on IC Design, Process Characterisation and Testing.

41)   The national infrastructure set-up as in-house laboratory activities at MIT in Microelectronics will play a lead role in manpower generation in the areas of ECAD/TCAD tools, chip design and testing to complement other efforts in the country.

7. Financial Outlays

	Description	Amount (Rs. in crores)
1.	Strengthening IT education in IIITs and IITs and Universities etc. by providing IT infrastructural facilities (including a pilot project of Rs.30 crores)	280.00
2.	Special Manpower Development in Microelectronics (covering VLSI Design, Process, Testing etc.)	50.00
3.	Promotion of Research Manpower	50.00
4.	National Programme for training of teachers @ Rs. 60,000/- per man month for 5,000 teachers and creation of infrastructure required for the same	80.00
5.	Employment Generation Training Scheme for Backward Areas	10.00
6.	Setting up of National Centre for Continuing Education for working engineers/professionals/ strengthening of CEEP	32.00
7.	Awareness Programme for students/general public at large through advertisements	5.00
8.	Special Manpower Development in the area of Security, Entrepreneurship Development and other upcoming areas	50.00
9.	IMPACT Proposal for N.E. Region	33.00
10.	Project proposal for Women Technical Institutions	71.00
11.	Networking of Participating Institutions under Project Impact @ Rs. 1.5 crore for 5 years per Institution for 45 PIs & RCs	68.00
12.	Establishment of IMPACT-ITES Centres @ Rs. 3 crores per engineering college & Rs. 1.5 crores for Polytechnics, 14 Engg. Colleges, 11 Polytechnics, RC, PIU etc.	70.00
13.	On line Learning	60.00

Annexure-I

Working Details of IT Manpower Requirements

NASSCOM-McKinsey Report (released in December 1999) identified various segments of Software Industry as IT Services, Software Products, IT-Enabled Services and E-Business. The contribution of these sectors to the overall targets by 2008 viz. US $ 50 billion (Rs. 2,25,000 crores) for software exports and US $ 37 billion (Rs. 1,66,500 crores) for domestic software as estimated in the report are given in Table-I below:

TABLE-I

Segments	Export		Domestic		Total	
	US $ Billion	Rs. (in crores)	US $ Billion	Rs. (in crores)	US $ Billion	Rs. (in crores)
IT Services	23	1,03,500	15	67,500	38	1,71,000
Software Products	8	36.000	12	54,000	20	90,000
IT-Enabled Services	15	67,500	18	18,000	19	85,500
E-Business	4	18,000	27	27,000	10	45,000
Total	50	2,25,000	37	1,66,500	87	3,91,500

[1 US$ = Rs.45]

Various segments of IT industry require different skill levels. While the manpower for Software Products segment require highest skill level, the IT-enabled Services segment could be served by professionals who could come from non-IT disciplines as well but have adequate proficiency in handling IT tools relevant to the sector concerned for which IT enabled services are to be provided. Manpower skills available in the country from various institutions can be classified under three broad categories as given in Table-II below:

TABLE-II

Category	Qualification/Source	Segment for which suitable
A	B. Tech CS/E * from Grade A Institutes	Software Products
B	Non-CS/E B.Tech from Grade A, CS/E from Grade B and MCA from Grade A & B Institutes	IT Services E-Business
C	B.Tech from other Institutes, Non-formal Stream & Diploma from Polytechniques/ it is	IT Services E-Business

(*CS: Computer Science, E: Electronics)

In the above table, institutes have been graded as A, B and C based on the skill level of IT professionals being produced by them. In the present system, IITs, IIITs and IISc. are considered to produce highest quality of engineering graduates in the country and have been graded here as A category institutes. With a view to enhance the base of high quality professionals in the country, it is necessary to strengthen the quality of large number of next category of institutes to this level. Other institutions will continue to be graded as B and C based on the ranking given by AICTE and Ministry of Information Technology from time to time.

The per capita productivity of IT professionals also varies according to their skill levels. Expected annual per capita productivity by the year 2008 is US $ 100,000 (Rs. 45 lakhs) for Category A skills, US $ 75,000 (Rs. 33.75 lakhs) for Category B skills and US $ 15,000 (Rs. 6.75 lakhs) for Category C skills. Based on these productivities and targets to be achieved in the year 2008, the

estimated number of professionals required under various categories to serve the needs of different segments of IT industry are given below in Table-III:

TABLE-III

CATEGORY	Targeted Turn Over in 2008 [X]		Per Capita Productivity (Annual) [Y]	No. of people required to achieve the targets at the beginning of the year 2008 [X/Y]
	US $ B	Rs. (Crores)	Rs. (Lakhs)	(in Lakhs)
Category-A Software Products	20	90,000	45.00	2.00
Category-B IT Services E-Business	38 5	1,71,000 22,500	33.75 33.75	5.07 0.70
Sub-total				5.77
Category-C IT-Enabled Services E-Business	19 5	85,500 22,500	6.75 6.75	12.60 3.30
Sub-total				15.90
TOTAL				23.67

[1 US $ = Rs.45]

Note: For the purpose of analysis in this Table, the segment of Software Products has been considered to require manpower with highest skill level. The segment of IT Services and half of the E-Business will need skill level of category B manpower as defined in Table-II. The remaining segments of IT -enabled Services and half of E-business can be catered to by Category C professionals sourced largely from Non-formal IT Training Institutes and other engineering/ diploma level students.

As per analysis presented above; a total of23.671akh IT professionals are required for IT industry to enable it to achieve the targeted growth by 2~08. As the manpower for achieving the turnover in the terminal year should be available at the beginning of the year, the total manpower of 23.67 lakh professionals should be available to the industry by the year 2007. Based on this analysis, annual manpower requirement in next seven years works out to be as given below in Table IV:

TABLE-IV

Category	Total Requirements by 2007 (7 years) [X]	Average Annual Requirement [X/7]	Cumulative Average Annual Requirement
A	2.00 lakhs	28,500	(A) 28,500
B	5.77 lakhs	82,500	(A+B) 111,000
C	15.90 lakhs	227,150	(A+B+C) 338,150

As per above analysis, 28,500 IT professionals of skill level of Category A are required on an annual basis for the next seven years. A total of 1,11,000 IT professionals will be required with the skill level of Category A and B. Category C professionals for segment of IT-enabled Services and half of the requirements of E-Business segment will be 2,27,150. This brings the total <u>annual</u> requirement of 3,38,150 professionals for all segments of software industry.

The study commissioned by NASSCOM (Mckinsey report) in December 1999, has estimated manpower working in software industry as 2.8 lakhs. As per above analysis, the number should reach the level of 23.67 lakh by 2007 with 2 lakh of Category A, 5.77 lakh of Category B and 15.9 lakh of Category C professionals. Retaining the same category-wise proportion of manpower and annual requirement as above, the following Table-V presents yearly profile of manpower requirement in the three categories:

TABLE-V

Year	Category of Manpower (in lakhs)			
	A	B	C	Total
2000	0.236	0.683	1.880	2.80
2001	0.285	0.825	2.272	3.38
2002	0.570	1.650	4.543	6.77
2003	0.855	2.475	6.815	10.15
2004	1.140	3.300	9.085	13.03
2005	1.425	4.125	11.356	16.91
2006	1.710	4.950	13.627	20.29
2007	2.000	5.770	15.900	23.67

Present level of annual manpower generation:

The present level of annual manpower generation for various Courses in the Institutes in the country is given below in Table- VI:

TABLE-VI

Discipline	No. of Institutes	Capacity intake (All Streams)	Capacity intake (CS&E Streams)	Capacity intake in Streams other than CS&E Streams
M.Tech (CS/E)	242	20,000	3,200	16,800
B.Tech (CS/E)	>700	1,78,000	60,000	1,18,000
MCA	310	10,000	10,000	--
Total (Degree Holders)		2,08,000	73,200	1,34,800
Diploma (CS/E)	1300	2,50 000	90 000	1 60 000
ITI (CS/E)	>4,000	--	6,40,000	--

It may be seen from above that out of 2,08,000 technical professionals (degree holders), 73,200 belong to Computer Science/ Electronics Streams, conventionally considered to be IT disciplines. This leaves 1,34,800 technical professionals (degree holders) from non-IT disciplines. The total requirement of Categories A and B IT professionals estimated to be 1,11,000 could, therefore, be met by 73,200 people generated and remaining 37,800 out of professionals through non-IT disciplines who may go undergo 'Bridge Programmes' for cross-migration to IT disciplines. Out of 73,200 graduates who come from IT related disciplines, 28,500 should belong to skill level of Category A. Assuming 50 students in each of the IT related disciplines, viz. Computer Science (CS), Electronics (E) and Electronics & (Tele) Communications (EC) stream in an institute, we would get 150 students per institute per year. Accordingly, for 28,500 students, we would need to upgrade 190 institutions to Grade A level to meet this requirement.

The annual requirement of 2,27,150 of Category C professionals can be sourced out as given in Table VII:

TABLE-VII

Category	No. of Students
Non-formal Stream from IT Training Institutes	200,000
Graduates from Grade C Institutions	97,000
Diploma from Polytechniques (CS/E)	90,000
Diploma from it is	50,000
Total	437,000

Chapter 9: R&D for Information Technology

1. Introduction

India has reached a turning point in this era of Information technology. During the last ten years, the Indian software industry has consistently maintained an impressive growth. Indian engineers and scientists have been globally acclaimed for their contributions in this area and also for their entrepreneurial skills in this field. Indian Software companies have achieved remarkable success in the export of IT software and services in the enterprise segment. Most of the leading international players, especially in the area of VLSI design, have set up their design centres in India. Some Indian companies have also made successful entry into global R&D services, which could be a stepping stone to develop world class products in the future. Encouraged by these developments, we have fixed for ourselves an export target of US$50 billion by the year 2008 for this sector. Even when the Software sector has done so well, there are some concerns that need our attention. These are:

- As our Software export industry has been mainly concentrating on services sector, the overall per-capita productivity is much lower as compared to the developed countries.
- Even though the Indian professionals and the Indian software industry might have contributed to the development of Intellectual Property, very limited IPR is owned by the Indian industry.
- The IT services sector has been able to provide sustained growth over the last decade. This growth, however, cannot be sustained due to competition from other countries as well as limited availability of skilled manpower. Indian industry needs to take immediate steps to move up the value chain.
- The performance of the hardware industry has been below expectations. There has been miniscule investment in the hardware sector in the last decade and many hardware export units have failed to meet their targets. This may result in large imports in this sector.

History suggests that high quality of university education has enabled nations to achieve worldwide leadership in scholarship and research. Germany founded its first modern university in Berlin in 1809 to acquire intellectual and scientific leadership. United States of America, during the last quarter of 1Ninth century set up many new and distinctly American Universities. These gained, after World War I, for USA the global leadership in scholarship & research. In this context, it is noteworthy that Britain fell behind Germany and USA after being leader for about two hundred years because, around last quarter of 1Ninth century, it failed to modernize its education and research. India both during freedom struggle and after gaining independence in 1947, despite lack of resources, established institutions of higher learning and research that have benefited India immensely. Recognition of India in software is mainly due to the high quality of the institutions of higher learning & research. Unfortunately, the number of research scholars in our premier institutions has started declining to alarmingly low levels. This is a matter of great concern and corrective measures need to be taken immediately if we want to remain competitive in this field which is knowledge intensive. New technologies coupled with current ones are expected to tilt global power equations in favour of those nations who adequately invest in human resource development as well as in Research & Development.

Amongst others, two new technologies i.e. nano-technology and genetic engineering (also called biotechnology) are expected to shape scientific and industrial revolution of 21st century. Each of them would help in understanding and development of the other. Information Technology (high end computing & communications) would also benefit from these technologies, which, alongwith mathematics, would play a crucial role in this revolution. Nano-technology promises to increase speed of computers as well as to increase memory storage per unit surface a thousand fold. Genetic Engineering, besides IT applications like DNA computing, promises to revolutionise agriculture by increasing crop yields to end world hunger & malnutrition. These will also have serious repercussions for national security. The revolution due to these

technologies may become a reality in next 20 years, may be earlier. It is essential to keep a watch on such areas and initiate long-term research programs, with large government funding.

The future is built on the foundations of present based on dreams and vision of tomorrow. The growth and new applications of current technologies and techniques such as microelectronics, Micro Electro Mechanical Systems (MEMS), photonics etc. are already increasing the performance of VLSI devices, computers and communications at an unbelievable pace. Even in current technologies, India is far behind the developed world. Wireless technologies and next generation Internet are areas of large growth potential. It is time to rejuvenate our existing R&D institutions and enable them to focus on selected technologies in their thrust areas. We need to initiate large projects around existing institutions, together with the industry, in order to develop this sector and become a player in defining global standards in these areas.

For India to retain the competitive advantage in the IT sector, it is necessary that in addition to continued support to the service sector, India prepares a strategy of generating its own IPR for moving up in the value chain. This would help us, not only to substantially surpass the export target, but also to build foundations for achieving sustained high growth in the future. For India to become an IT power, as it wants to be, it is necessary that an integrated approach that boosts the hardware and software sector, strengthens manufacturing and lays emphasis on education, research and development and generation of IPR is evolved and implemented. Further, for India to emerge as one of the leading nations, the industrial revolution likely to be ushered by the nano-scale technologies, and others, should not be allowed to bypass India.

In this report, only the issues of R&D have been addressed, which is essential for generating Intellectual Property required for achieving high growth and global leadership. The success in these areas depends heavily on the quality of human resource available for development and research. As Research and Development is not an end by itself, the benefits would depend on our policies and programmes for manufacturing, deployment and export. Industry has been requesting Government to streamline policy and procedures, so that the industry is able to focus their energies in the areas of their core-competence. This needs to be looked into in order to accelerate the growth of the Indian industry.

2.   Achievements during Ninth Plan

During the Ninth Five Year Plan, the country achieved significant success in many areas of IT and electronics, notably in software development and also in some of the strategic areas. In the area of IT services, Indian industry has been able to create a niche of its own in global market. However, the Hardware sector did not perform as well. The number of people employed in the IT sector increased significantly. Easing of visa restrictions by many countries also provided a large opportunity of employment in other countries.

The Indian Electronics industry has achieved a CAGR of 25% in production and 46% in exports during 1996-2001.

The production figures for the first four years of the Ninth Five Year Plan are shown in the table below:-

(Rupees in crores)

Sector \ Year	1997-98	1998-99	1999-2000	2000-01
Hardware	22030	25250	28100	30940
Software	10040	15890	24350	37760
Total	32070	41140	52450	68700

The Indian software industry has achieved a remarkable growth not only in exports but also in the number of industries engaged in software exports. The penetration of computers as well as the communication infrastructure has improved significantly.

At present, out of the total of 1180 R&D units registered with Department of Scientific and Industrial Research there are about 300 units in electronics & IT.

The present investment in the R&D within the country is not on par with rest of the world. About 30% of the total production of electronics and IT industry is from the major public sector industries which invest about 5 to 6 percent of their turnover on R&D. Remaining 70% production is from the private sector industries which invest only a small fraction of their turnover on R&D.

Besides the public and private industry investment in the R&D there are a number of Central/State Government agencies like Ministry of Information Technology, Department of Atomic Energy, Department of Bio-Technology, Department of Ocean Development, Department of Science and Technology, Council of Scientific and Industrial Research, Defence Research and Development Organization, Indian Council of Agricultural Research, Indian Council of Medical Research, Indian Space Research Organization, University Grants Commission, and others which provide financial support for research and development at academic institutions, R&D laboratories, and industry both in public and private sector. These agencies play a catalytic role in the scientific innovations, which accelerates the pace of development and creating infrastructure to enhance production capabilities in the country. It is estimated that besides Department of Space, Atomic Energy and DRDO which have their own major programmes, other agencies invested about Rs.200 crores per year for the purpose of initiating programmes in the area of electronics and information technology. These programmes have been able to establish a technological base in the country besides generating specific products and equipment. It has produced strong pockets of specialised expertise for major national projects and has also provided trained manpower to the industry.

The plan allocation for R&D for the last five years by MIT has been as follows:-

(Rs.in crores)	97-98	98-99	99-2000	2000-01
R&D allocation	55	70	75	85

Research and Development in emerging technological areas has always remained a key activity of MIT and promotional efforts in electronics and IT have helped enormously in the laying of solid foundation in the IT industry. A major result of sponsored research has been the enhancement of technological base and capabilities in the country besides generating specific products and equipments. It has also produced strong pockets of specialized expertise which have been used as a spring board for launching major national projects, besides providing the much needed trained manpower, to man such national programmes. Major areas where significant success has been achieved, through sponsored R&D projects is highlighted below:

R&D Promotion Through Sponsored Projects

DOE since inception, has been supporting new initiatives in research, design, development and engineering related to various sectors of electronics & information technology i.e. computers, control and communications, broadcasting and entertainment electronics, photonics and micro-electronics, strategic electronics and materials & components for electronics. Such pro-active promotional efforts through DOE have led to the development of many technical programmes of national importance alongwith the development of a number of state of the art products. Some such initiatives during ninth plan are: Future Air Navigation System (FANS) programme in airport navigation led to the development of GPS and other airport modernization equipment for use by Civil Aviation Department.

Design & Development of 'PARAM' series of Super Computers based on distributed memory architecture was a major initiative of DOE. DOE contributed towards development of many metrological instruments including Cyclone Warning radar, radiosonde etc. and MST

Radar (Mesosphere, Stratosphere, Troposphere) which is a multi-agency project. This MST was third of its kind in the world. Various diagonostic and therapeutic instrument for cancer therapy were also developed.

Under Fibre Optics Systems Application Promotion Programme (FOSAPP) development on projects such as Fibre Optics Railway Signaling System, fibre optic mux/demux system, fibre optic node controller, high speed bus links, fibre optic data and radio links, fibre optic remote terminal unit, fibre optics based monitoring and control instrumentation system and optical smart pressure transmitter was completed.

During the ninth plan, over 200 projects were initiated at al large number of institutes including industries, academic institutes and research labs spread all over India. Some of the successful projects are given below:

Technologies for E-Governance

Various E-governance and E-commerce projects have been initiated by MIT. VOICE, a versatile online information system to address the needs of citizens, civic administration and municipal corporation etc., has been successfully implemented in AP. Based on the success of this project, many State governments have initiated projects in the area of e-governance.

Communication and Broadcasting

Digital mobile radio to provide secure and reliable mobile communications with full duplex voice or data with an option for encryption has been prototyped. A spread spectrum radio modem has been developed indigenously for various networking applications. UHF wireless data modems for high speed data communications have also been designed and developed.

Technology Development in Indian Languages (TDIL)

TDIL Programme is a vehicle to carry the benefits of Information Technology to the masses of the country and minimize the digital divide. This programme promotes the development of information processing tools to facilitate human machine interaction in Indian languages and to create and access multi-lingual knowledge resources. It also promotes the use of information processing tools for language studies and research. Indigenous R&D efforts in the following technology areas of Indian languages are being supported:

Knowledge Resources, Knowledge Tools , Translation Support Systems, Human Machine Interface Systems, Voice Recognition Systems, Text to Speech Systems, Localization – Adapting IT tools and solutions in Indian languages, Development of Computer Courseware in Hindi

The Ministry has also established thirteen Resource Centres for Indian Language Technology Solutions covering all the constitutional languages.

Transportation & Safety

Vehicle tracking system project based on GPS has been taken up. Other projects in the transport sector include Port Management System and Automatic Vehicle Counting system which have applications in warehouses and in fleet management etc. Development of switched reluctance motor, for use in pollution free electric automobiles has been completed.

Automation & Process Control

Robotics welding system for hazardous applications have been developed along-with a seam tracking system for weld automation. This is for high quality welding especially for pressure vessels, power plants and heat exchangers etc. An integrated monitoring system for Area

Manager has been designed. Simulators to assist proactive shop floor control also have been developed. Retrofit automation for pulp, paper, sugar, jute and tea, steel and textile industry has been completed. Dyeing systems with computerised controls have been developed for textile industry. A computerised energy management system for steel plant has been developed.

Health and biotechnology

Significant progress has been made in the development of Telemedicine networks for helping the rural area patients have quick access to the experts as well as the diagnostic medical database. Also hospital dis-infection system for safe disposal and treatment of hospital waste has been developed.

Agro and Pural Applications

Various agro-instruments like fertilizer testing kit, soil and grain moisture indication instruments, soil nutrient measuring instrument, rice polish measurement system and multichannel choke indicator to optimise the seed spacing using a tractor have been developed. These instruments are simple to operate and can be productionised at nominal costs. Also IT tools for watershed development have been developed alongwith irrigation canal control automation. Solar pumps for rural use also have been fabricated.

Microelectronics & Photonics

In this area various semiconductor devices have been developed alongwith manufacturing technologies to improve the yield of semiconductor devices. Other important results of R&D efforts in this area are development of Optical fibre, need specific detectors for high speed optical communications and optical receiver module etc.

Power Electronics

MIT jointly with BHEL, AP Transco and CPRI supported Phase-II of HVDC project. State-of-the-art digital control and protection system was designed indigenously. The supervisory control and data acquisition system is used at 1500MW HVDC project. Many sub-systems and devices like high power thyristor have been developed as a part of this project.

Materials & Components

Barium carbonate for use in the manufacture of permanent magnets have been developed . Also optical grade silicon tetrachloride and other MOS grade chemicals have been developed. High purity materials and alloys which are the basic building blocks of semiconductor technology have been developed.

R&D Promotion through Societies

MIT has also set up several autonomous organizations like C-DAC, STQC, NCST, SAMEER, ERNET, ER&DCI, CEDTI etc., to address the requirements of different sectors of Information Technology in a focused manner. These organisations help the electronics industry by providing infrastructure, design, consultancy, training, and are actively involved in R&D activities in their specific areas. The role and achievements of these organisations is briefly described below:

Education and Research Network (ERNET)

ERNET was the first major network in India to cater to the requirements of Education and Research community. ERNET has been providing internet services to this community since 1990. Presently ERNET provides connectivity to over 750 organizations representing a mix of

universities, R&D labs, NGOs and has over 80,000 users. ERNET is one of the most competitive network and Internet Service Provider in the country. ERNET collaborates with premier institutes in the country to undertake advanced research projects.

Centre for Development of Advanced Computing (C-DAC)

The Centre for Development of Advanced Computing (C-DAC), has, over the last over a decade of its existence, diversified its activities, transferring the expertise it acquired and technologies it developed for the development and deployment of information technology (IT) based solutions in Government, Corporate, Education and other key sectors of economy. It continued to provide focus on its R&D activities in the ara of high performance computing and communication (supercomputers) and multilingual multimedia information technologies. C-DAC also developed technologies and offered information technology (IT) based solutions in sectors of Telecommunication, Power, Healthcare, Finance, E-Governance, Networking and special projects for Government and Corporates.

The activities of C-DAC in the ninth plan include:

High Performance Computing and Communications (HPCC)

Using state-of-the-art commodity nodes with PARAM Net switch and suit of system software developed by C-DAC, a parallel system PARAM ANANT was built to provide cost effective computing power for educational sector. C-DAC has recently executed a project for installation of the parallel system PARAM 10000 with peak performance of 6.4 Gflops at selected 12 premier academic institutions in India.

Multilingual and Multimedia Information Technology

C-DAC has developed a number of products in multilingual and multimedia technologies. These tools address web applications like Internet messaging, chat, web content creation using dynamic fonts and interface to third party softwares in Indian languages. Software package for self-learning Hindi LILA received the CSI award for best shrink wrapped product. Newsroom Automation system and DVD authoring based on MPEG II were also developed.

In the area of multimedia, Quick Multimedia album and Multimedia Portal were developed and launched.

Sponsored projects

C-DAC took up projects in diverse areas of information technology sponsored by different Government Departments. Some of these are:

Digital library, elemedicine, E-Governance solutions, Sanskrit Rendering System, Machine Aided Translation System, GIS tools, Compact PCI based industrial PC system, Core Network Security Technology, Fault Tolerant System etc.

Education and Training

C-DAC has also been offering advanced courses in the areas of (i) advanced computing (ii) VLSI design (iii) Multimedia etc. Over 15,000 students take-up these courses every year.

National Centre for Software Technology (NCST)

NCST, a premier R&D institution in software technology, operates as a centre for excellence in software technology and related computer science. NCST has developed its reputation as the National Laboratory for Software Technology. It has retained its R&D character and has expanded into education and training. As a part of the centre for excellence in virtual

computing, a multimedia virtual environments laboratory has been created. A world class Virtual Reality (VR) application, created as a walkthrough of the Fatehpur Sikhri Monument has been demonstrated widely and has been well received around the world. Intel, which also donated some equipment for its laboratory, has included this application in its demo CD for showing 3D graphics power of its high end processors. This lab would be useful in the rapid implementation of multimedia and VR applications on low cost platforms, which have a wide installed base in the country.

NCST's significant achievement is development of Hindi Version of Windows 2000, which has been released by Microsoft Corporation, USA recently.

NCST is a consultant to several institutions, both government and private, in areas of e-commerce, wide area networking, financial services, education, and other sectors. NCST has been selected as one of the two operational centres of the Commonwealth Network for Information Technology for training and development. Several major corporate networks for India were designed by NCST.

NCST has developed software in the following areas:

Intelligent Computing, Visual Computing, Internet Technology, Data and Knowledge Engineering, On-line Education & Testing, Localisation for use in Indian languages

Society for Applied Microwave Electronics Engineering and Research (SAMEER)

SAMEER, with three Centres at Mumbai, Chennai and Calcutta, is engaged in R&D in areas of microwave engineering and applied electromagnetics. Its thrust areas are microwave and RF applications in industry, instrumentation and health, linear accelerator technology, millimeterwave, electromagnetic compatibility, antennas, etc. Important developmental projects has been undertaken in these areas including Hospital waste disinfection system.

In the radar-based instrumentation programme, SAMEER has taken up design and development of the Wind profiler and several other systems. SAMEER has contributed in development of national facilities like Mesosphere, Stratosphere and Troposphere (MST) Radar at Gadanki, Andhra Pradesh which is being used for atmospheric study.

Electromagnetic Compatibility (EMC) metrology and consultancy is the major activity of SAMEER Chennai Centre. Apart from doing the testing and reliability services, this centre is also engaged in the research and development activities related to power electronics, information technology, process control, communication and medical electronics industry. Many technologies, especially in area of antennas, have been transferred to local industries.

In communication engineering area SAMEER has designed, developed and commissioned dedicated Microwave Data Link System (MDLS) for strategic Applications; Hardware for CDMA-based digital data link; powerline frequency magnetic field meter; broadband sleeve monopole antenna; whip antenna and printed antenna for Wireless Local Loop system. Sameer centres have been of help in providing domestic strategic solutions in areas where it is difficult to import the technology.

Electronics Research & Development Centre of India (ER&DCI)

Electronics Research & Development Centre of India (ER&DCI) has mandate to promote and establish modern, state-of-art, scientific research and development in electronics and to design and develop electronics equipment and systems. ER&DCI is operational at three centres at Thiruvananthapuram, Kolkatta and Noida. ER&DC is also contributing in Human Resource Development in high-tech Software and Hardware Technology areas. Some of the technological developments include embedded JAVA controllers, System-on-chip products and networking hardware. ER&DC, Thiruvananthapuram has completed projects on the following areas:

Interactive set-top box, Digital mobile radio and TETRA, in the area of digital communications, Energy management systems, Process control, Traffic control, Hospital management, Health information systems and ASICs for monitoring and control

The Centre has also trained a large number of students through various courses and training programmes conducted by them.

The Kolkatta centre has developed Integrated System Development for Indian Coal mines leading to enhance production safety and management, Remote Data Access Technology and Industrial controllers.

The Noida centre has developed software for computerisation of the registration, accreditation and examination records of over 200,000 students registered with DOEACC Society. The centre has also taken several projects in the area of Natural Language Processing, Transaction accounting for railways, cable modem, News room automation and others.

New Initiatives

Media Lab Asia: MIT in collaboration with Massachussets Institute of Technology, USA, has set up Media Lab Asia with an initial investment of RS.65 cores during the first year. The Media Lab Asia would address the issue of digital divide, IT for masses and would also fund development of futuristic technologies.

E-Commerce & Internet Security: In order to bring greater synergy amongst the activities/initiatives in the overlapping areas of e-commerce, IT Act and information security, an independent division was created in January, 2001. Besides being a proactive facilitator this division provide single point interface to all the concerned agencies.

Telemedicine Programme: Telemedicine technology for Radiology, Cardiology and Pathology is being developed for tele-diagnosis, tele-consultation (second opinion and consultations among experts) and tele-education to interconnect three referral hospitals namely, SGPGI, PGIMER and AIIMS. Telemedicine for diagnosis and monitoring of tropical diseases over low speed WAN for diseases such as leprosy, skin related diseases, etc. are being developed by IIT, Kharagpur and Webel Electronic Communication System, Kolkota. The system has been installed for carrying out system testing.

IT Application for visually handicapped: Under Jai Vigyan National S&T mission, a programme has been initiated for Braille Literacy in Indian languages. The objective of the project is to develop infrastructure to facilitate rapid development and dissemination of educational material and information for the visually impaired with the help of IT.

E-Internet based distance education: To promote internet based distance education, various projects have been initiated by MIT, i.e. virtual campus at IGNOU, on-line interactive courseware – IIT Delhi, multimedia based courseware - BITS, Pilani, National Resource Centre for online learning – NCST, Mumbai.

IT for watershed development: Design and development of software for planning and management of different types of watersheds in rural areas. The software package has been successfully developed, the user guidelines have been finalized. Arrangements is being made to provide initial training to all concerned users in field data collection, monitoring, and network utility of software and application for watershed. The package is proposed to be distributed to watershed planners and designers at a reasonable price by PROGRESS.

IT for masses: MIT is working towards promotion of IT application for masses. The efforts are focused towards local language issues, digital divide and to bring IT benefits to rural masses.

Course in Cyber-law: In order to increase awareness among attorney's, judges, police etc., a PG Diploma Course on cyber law and Intellectual Property Rights. This nine month PG Diploma course has been sponsored at Indian Law Institute, New Delhi. The course is also proposed to be developed in a form of multi-media for larger dissemination.

3.   Objectives / Aims of Tenth Plan

India is a member country of World Trade Organization and we are required to implement its industrial and trade liberalization policies. In the liberalized scenario, it has become imperative for us to develop technologies, products and services of international quality to remain competitive. We also need to strategize to become a global leader at least in some selected fields. Research and Development is the only way for us to meet this challenge. However, we have to be careful not to fritter away our scarce financial and human resources by trying to tackle all areas. The study team deliberated on various approaches. The broad consensus was that for India to become a leading global player, it is necessary that we, in the long term, focus on key emerging technologies such as nano-technologies which are expected to be all pervasive and would impact everything. In the medium-term we should focus on current technologies such as Wireless technologies, Next Generation Internet etc., which have mass deployment potential and would create necessary infrastructure for achieving accelerated growth. This would also enable us to apply these technologies for development of new applications and to upgrade them at a much lower cost as compared to imported technologies. This would also enable India to become a global supplier of these equipment and services. The study team was also of the view that the Government R&D should enhance its focus on large and complex projects. Keeping this broad picture in view, objectives/aims have been arrived at.

Statement of Objectives/Aims

*   To establish leadership in research in the area of nano-scale technologies and harness its benefits in some selected areas.
*   To become a major supplier of products and services in the area of Wireless and internet technologies and others.
*   To strengthen R&D infrastructure in academic institutions to enable them to carry out research in frontier areas of technology & applications and for training research manpower for helping the Indian industry in moving up the value chain.

Achievements

The expected achievements upto 2010 in respect of objectives as given above are:

*   Nano-technology being a nascent area of research is not sufficiently understood. It is expected to take longer than Tenth plan period before major commercial applications are developed and deployed. It is not expected to be deployed commercially in a major way during the next five years. The anticipated achievements during the Tenth Plan are as follows:
    *   Required institutional framework would be set up.
    *   Research projects and associated institutions would be identified, required infrastructure would be set up and research would start and progress
    *   Collaborative research needs with foreign institutions & laboratories would be identified and implementation would start
    *   Products / applications, at par with the developed world, would start coming out of our own laboratories.
*   Current technologies are reasonably well understood but the availability of trained manpower is inadequate. The anticipated achievements during the tenth plan are as under:

- ▪ Manpower development programs would be initiated to train adequate manpower for taking up design work in the areas of selected mission mode/major projects.
- ▪ Research and Development work would start and some projects would be completed.
- ▪ By 2010, the product development and field trials would be completed. Manufacturing and deployment would also start. The impact in terms of improvement of services through locally developed products would also be visible.
- ● The initiative would enable business ventures through Technology Start-ups which would help in increasing the Share of Value added products in the area of IT.

Indian R&D is expected to be at par with the developed world in select fields provided required investments are made in time.

4.   R&D Model for Growth of Technology

Governments support research and development for strategic reasons as well as to enhance the competitiveness of their industry. As different technologies are at different levels of development and the level of commercial exploitation of these technologies varies significantly, the governments also support futuristic technologies requiring large investments and involving high risk.

Industry takes up development mainly in such technology areas that are clearly understood and a significant effort is towards making the product more reliable, user friendly, easy to produce at low cost.

The educational and research institutions are interested to take up challenging research issues and technologies that are not very clearly understood. The fund requirements as well as the time to develop are different for these classes.

Additionally for technologies that are not clearly understood, a long term R&D strategy with the clear focus is essential. Such work can be best done by centres working in specific areas and supporting them with long term funding to ensure continuity of work during the entire life cycle of research.

Based on the above requirements there is a need for categorization of R&D for funding appropriate solutions. R&D models can be designed based on the (i) strategic value (ii) gestation period (iii) Technology risk (iv) investments required (v) immediate commercial potential etc.

Categorization of R&D Programs

Different technologies are at different stages of development and commercialization. Some of these are futuristic and their theoretical and practical investigations are at nascent stage. In such cases, benefits are uncertain; gestation periods could be long in the range of 10-20 years or more and, therefore, investments risky. Due to these reasons, research in these technologies, even in the developed countries is conducted by universities and R&D laboratories with major funding support provided by the governments. Some programs of strategic nature could also be included in this category. Research and development on these technologies have been categorised as 'Long term R&D Programmes'.

After years of research, some of these technologies are understood to a large degree and are being utilised for design and development of new applications and also for improving the performance of existing applications at reduced cost. The gestation period for development in these technologies is relatively small and development is less risky. Research and development in such technologies, as well as development of new applications, is generally funded both by governments and by private enterprises in their field(s) of business. In many such areas, where commercial exploitation is possible on a large scale, availability of trained manpower in adequate numbers is also an issue that may need to be addressed. The programmes in such areas could be large and complex and may also involve substantial effort in human resource development,

research as well as in design of both hardware and software. Duration of projects and programmes could vary between two to five years, depending upon the complexity. This category has been termed as 'Medium-Term R&D Programme'.

For technologies that are well understood, the R&D projects would generally be for development of new products, and for improvement and innovation in existing products with duration of 1-3 years. Narrowly focused research in technologies and their applications having business opportunity could also be included in this category. In this sector, the role of private sector needs to be encouraged and increased. Such programmes have been categoriesd as 'Short-term R&D Programme'.

The above programs would generally have a focus, and substantial funding should be given in these areas. This would also enhance the chances of success.

The last category of R&D projects can be categorised as 'Free Wheeling R&D Programmes' These programmes would involve research or investigations of new ideas / approaches, algorithms and would generally be done at academic institutions or R&D laboratories. These programs would be based on professional competence and interest of the groups involved, and would spread across a broad spectrum.

In addition to supporting the above programs, there is a need to provide funding to enhance the competitiveness of the Indian industry as well as to help the industry in moving up the value chain. These are described in the subsequent section.

Funding Mechanism

The R&D model as well as funding mechanism should also address the following issues:

- India is an emerging global power from the third world and it has to protect itself against technology denial in strategic areas.
- India has excellent academic / research institutions for industrial research but the commercialization of technologies by these institutions is weak.
- Even in the software export sector, where the Indian industry has demonstrated success, the Indian industry is working at the low end of spectrum. Steps are required to help the industry in moving up the value chain.
- India is rich in intellectual resource but short of capital and infrastructure.
- Innovation and development is essential for the survival of the Indian industry, especially for SMEs. It needs to be supported.
- The ownership of commercially potent technologies will decide the global economic order.

The following R&D funding methodology is suggested for different categories of projects described above. In each of the models of funding, some technology areas have been used as an example to illustrate the point. A detailed list of areas is given under Major Thrust Areas & Mission Oriented Project. The list would require to be reviewed on a yearly basis to include additional areas as they emerge. Additionally, major programmes will need to be identified, at least one in each application area by concerned expert groups.

Funding for Long-term R&D projects

Nano-technology and genetic engineering are examples of areas that fall in this category. These technologies may take between 10-25 years before we reach a level of substantial understanding to develop applications. However, success could be much nearer, especially for IT applications. In August, 2001, IBM researchers announced that they have created the world's first logic circuit , an inverter, within a single molecule. The same team had earlier developed a new technique to produce arrays of carbon nano-tube transistors, bypassing the need to separate metallic and semi-conducting nano-tubes. These successes demonstrate the commercial potential

of the technology. In a way, this seems similar to the invention of transistor and then the development of integrated circuit which enabled the IT revolution of today.

When India, after attaining freedom, started its nuclear technology and space technology development programmes, these may have appeared as in- comprehensible and remote as nano-technology and genetic engineering may appear today. Programmes of this nature require continuity and focus over a prolonged period, which can be best done by setting up independent organisations on the lines of Indian Space Research Organisation with full powers and responsibility to conduct in-house research and to develop applications and also to fund research at other centres working in this area. The research in these technologies would involve all branches of engineering and science including biological science and mathematics. The government should also simultaneously create interdisciplinary centres, as required, in leading technical institutions such as IITs, IISc etc.

However, as the resource requirement as well as the impact of these technologies would be very large, government may set up a committee for working out the full details for launching a few such programmes during the Tenth plan.

Funding for medium-term R&D

As explained earlier, the areas covered under medium-term R&D funding are understood to a sufficient degree and are being utilised for design and development of new applications and also for improvement of performance of existing applications at reduced cost. These technologies are also being further developed through R&D. Some of the technologies in this category would include MEMs, wireless technologies, Photonics, high-end computing, microelectronics, robotics etc. The present trend is to develop process and techniques to utilise these technologies and their combinations to achieve higher performance. For example, photonics and microelectronics are being used together to improve performance of VLSI devices. The combination of microelectronics, photonics and MEMs are being used to improve wide-band communications. Wireless technologies are being used to make communications accessible all the time and everywhere.

The setting up of facilities for fabrication of devices based on these technologies require large investments, of the order of a few billion dollars. However, as design of these devices can be done without having fabrication facilities in the country, India can become a design house for the world in these areas. Application of these technologies would also generate large requirement for software development.

In some areas included under medium-term R&D, where the commercial potential is large, simultaneous attention will have to be paid to (i) Human Resource Development (ii) Research funding as well as funding for development of products. Provision will also have to be kept for pilot production and deployment.

Ministry of Information Technology had set up several autonomous organizations like C-DOT, NIC, C-DAC, STQC, NCST, SAMEER, ERNET, ER&DCI, CEDTI etc., to address the requirements of different sectors of Information Technology in a focussed manner. These institutions could act as lead agencies for taking up medium term projects in their focussed areas. The lead agency should take up research & development, field trials and should represent India in international forums for development of standards. This agency should also facilitate technology transfer as well as test deployment of applications and packages.

With the growing complexity of projects, it is not possible for a single agency to develop know-how on all aspects of the project. The concept of subcontracted research with system integration should be encouraged. This would help in developing system integration expertise and help in quick design of products.

The study team, after deliberations, felt that India should focus its R&D efforts in the medium term on:

- Major projects/programmes in application areas such as Next Generation Internet, 4G Wireless technologies, etc. These technologies are under development in the developed world and major programmes have been initiated by different countries in the area of wireless technologies, and others. These areas are expected to have a large demand in the near future. Even though the technology is reasonably well understood, the availability of trained manpower is highly inadequate. The programme should also include components for generating adequate human resource in these areas. Simultaneously, research grants as well as grants for product development will have to be provided to academic/research institutions as well as to the industry. Since such programmes would involve design and development of both hardware and software and would address major market segment, it has the potential to enable India to become a global player.

- Development of advanced computers at par with the best in the world. The high-end computing being enabling technology for conducting research & development in almost every field is both crucial and essential. With the improvement of telecom infrastructure, it would be possible to use the idle computing power in the network. "Grid computing" is an area that needs to be focussed.

Funding for short-term R&D

Short-term R&D is generally for improving products and/or reducing their cost. For such purposes, Government should provide partial funding for projects related to cost reduction / improvement in design and full funding for research projects.

Funding for free wheeling R&D projects

These projects are meant to facilitate fertilization of new ideas. The projects in this category would generally be based on strong institutional competencies. The project duration for this category should generally not be more than three years. The funding could be given in any area of Information Technology.

Other Modes of Funding

In addition to funding the projects in the above four categories, the R&D funding should also be given for the following:

- Developing "Indian solutions for Indian requirements".
- Funding to industry to enhance their competitiveness

Medium term as well as short-term projects need to be funded by the Government for such requirements. This would also help the Indian industry in deploying similar solutions, especially in the third world countries. In such cases, the extent of Government support could be limited to 50%. The IPR can be shared between the Government and the industry and industry would pay royalties on sale of goods / technology. In areas where the expected benefits are very large, full funding of projects could also be considered.

However, the technologies which are commercially attractive in short-term and do not require high investment, beyond reach of private sector, should not be funded by Government.

Setting up R&D Cooperatives

On a global scale, Indian companies are small in size. Individually, these companies, especially small and medium scale enterprises (SMEs), are not in a position to set up their own in-house R&D infrastructure. The SMEs are also at a disadvantage as they cannot attract and retain high quality manpower. Creation of a common infrastructure that can be used for R&D by a class of industries would make it affordable for these industries to carry out their R&D. The Government of India could support the initial infrastructure and the subsequent upgrades can be

managed by funding from the user industry. In such an infrastructure, it would also be possible to engage technical consultants for helping the industry.

Creating national incubation network

Even though the Indian industry has done well in the software and services export sector, the productivity per person per year in India is an order of magnitude less than Ireland, Israel and other advanced countries. With the anticipated competition in the Software services from China, Philippines, and others, it is necessary to deploy R&D as a means of Moving Up the Value Chain. Supporting technology incubation at leading technical institutions was suggested as a step in this direction.

It was suggested to create a national incubation network for encouraging technology start-ups and thereby facilitating the Indian industry to move up in the value chain.

Facilitating Technology Transfer and Patents

There is a large likelihood of commercialising the technologies funded under the medium-term R&D. A conducive policy framework needs to be created so that the faculty and researchers at academic / research institutions are able to set up their own industry, while in service. Technology transfer from R&D institutions to the industry needs to be encouraged. A reasonable portion of earnings from technology transfer should be shared with the inventors. In order to encourage the development and filing of Patents, the fees for filing international patents should be borne by the Government, on merit.

Implementation Approach For Mission Projects

The study team was of the view that the Government should encourage locally developed technologies by becoming the first buyer for such technologies. The condition of proven technology clause for domestic bidders, based on indigenous technologies, may be relaxed, particularly for major Government procurement.

Based on these discussions, approach for few enabling technologies / mission oriented projects having large scale deployment potential was discussed as under:

For Next Generation Internet

Government institutions such as NIC, ERNET have long experience in the field of data communications. They also manage national data communication networks and have the necessary manpower for R&D. These institutions can easily gear up for taking up R&D in the field of Next Generation Internet (NGI). As they have their own network, they would also have the advantage of trying out their technologies / products on their own network. Internet is likely to remain the application driver for many applications and NGI will have large commercial potential in the near future.

For high-end computing

A national committee of experts (NCE) on super computing can draw technical specifications and suggests time frame for completion. CDAC can be nominated as 'The Agency' to take up development as per the specifications. In order to have shorter time of development and reduce cost, CDAC should subcontract research and development of hardware, software and application development, wherever possible, to any agency in India and for critical parts anywhere in the world.

Government should purchase first few machines to be installed at leading academic and R&D centres. These could be linked using Next Generation Internet developed indigenously.

The project should be completed within the Tenth Plan period.

Similar methodology could be used for other medium term projects.

Modified R&D approach at academic institutions

Availability of highly educated human resource is a pre-requisite for taking up research and development. Government should follow a policy to ensure availability of best faculty at educational institutions and encourage best students to take up research and teaching. Due to lack of comparative remuneration vis-à-vis private industry and near absence of research in frontier areas, young people are not getting attracted towards higher studies and for taking up teaching / research jobs in academic Institutions and R&D laboratories. In the long term, this will hinder India's dream / vision to become a major shareholder in the global economy. This calls for a policy change and large resource allocation to address these issues. Some of the suggestions are as follows:

- Enhance junior research fellowship for full-time research scholars to a level of starting salary of Group 'A' officers.
- In order to motivate the faculty to take up industrial R&D as well as to set up technology start-ups, many leading institutions like IISc & IITs are formulating policy changes to allow faculty to start their own companies while in service. Such policies should be applied at all Government institutions.
- For the Government funded projects, the project investigators should be encouraged to commercialize the technologies developed by them by offering them incentives. Sharing of the royalties / know-how transfer charges with the project investigators in the form of cash or equity along with sharing intellectual property rights could be one such method. This will also enhance the effectiveness of government R&D funding.

Strategies for absorption & upgradation of technology

Countries, such as Japan, have become technology leaders in many areas because of their technology absorption and upgradation strategy. Even though India has acquired many technologies in the past, its success in technology absorption and upgradation has been low. The following suggestions are given in this regard:
- Every importer of technology is required to pay a 5% cess for TDB, which is managed by DST. Sector-wise database of imported technologies, along-with the names and addresses of technology importers should be maintained in a web-site for public knowledge. This would facilitate interaction between technology developers and importers.
- Based on this database, MIT and other agencies could fund projects for technology absorption / upgradation. For this purpose, the funds collected as cess from import of technologies in the IT sector should be transferred to MIT
- MIT should institute an award for technology absorption / upgradation in the area of IT.

Major Thrust Areas & Mission Oriented Projects

Electronics and IT is an all pervasive technology and it impacts development in all areas. Ideally, a nation of our size should have activities in all areas, however due to limited availability of resources, the study team suggested the following thrust areas & mission oriented projects. However the conclusion was that each division of MIT should identify one major result oriented project for the Tenth Plan. The Study team suggested that this list should be reviewed periodically.

Thrust Areas

- Assitive technologies for disabled
- Bioelements for computing
- Bio-informatics

- Blue Tooth Technology
- Capital Goods
- Communications Systems/Networking
- Crime Identification System
- Digital Compression Technologies
- Digital Signal Processing
- Disaster Management System
- E-Commerce
- E-Governance
- E-learning
- Embedded System
- Evolutionary Systems
- Future Air Navigation Systems
- GIS
- High-end computing, Grid / Genetic / Neural / Quantum / Soft - computing
- Human Computer Interface
- Image Processing
- Information security
- Intelligent Manufacturing Systems (IMS)
- Intelligent Materials
- IT for masses e.g. literacy mission, telemedicine, agri-insystems, web based education & training
- Large Database
- Low cost Internet access devices
- Low cost PC
- Mathematical Modeling
- Microelectro mechanical Systems (MEMs)
- Microelectronics
- Multimedia
- Nanoscale technologies
- Next Generation Internet
- Photonics
- Power Electronics, Distribution and Management
- Smart Card
- Speech recognition synthesis in Indian Languages
- Strategic applications for defense
- Virtual Reality
- VLSI Design & related Software, Silicon on Chip, IP Cores
- Voice on Internet
- Wireless technologies
- X-Rays/Explosive/Narcotic detectors and other Sensors

Selected Areas for creating centres of Excellence

- Nanoscale technologies
- Communications Systems and Networking
- Multimedia
- Signal and Image Processing
- Speech recognition & synthesis for Indian languages

Mission Oriented Projects

- High-end computing
- Next Generation Internet
- Wireless technologies

Some of these areas were discussed in greater detail and based on that a brief sketch of these missions is given below:

High end computing

With the advent of new applications in areas such as Bio-Informatics, Genetic Engineering, Multimedia content generation etc. the need for high performance computing is being emphasized the world over. A vision where shared computing power could be used to generate terascale of computing power is being conceptualized. Grid computing harnesses the computing power of resources available in a global, location independent namespace. Grid computing enables flexibility to integrate the technological advances in various areas (processor, network etc.) protects the investment in resources such as data resources, computing resources as well as software packages, dynamic deployment of resources ensures flexibility and scalability. This model of high performance computing is highly relevant for India where the number of high end computers is small but the collective power of computers connected over the network is increasing. A reliable, high-speed communication infrastructure is also likely to be available soon. In the area of High end computing ,grid computing should be a thrust area to enable computing power in terascale for deployment in areas of high computing requirements.

Wireless Technologies

Wireless Technologies, due to their advantages of mobility, ease of inter-connection, expandability, scalability and cost effective access are gaining prominence all over the world. Some of the main areas of research in the wireless technologies are the mobile communication, wireless computing, data and voice integration, wireless lan etc. Wireless technology is also likely to play a catalytic role in faster penetration of Internet in the country and will facilitate convergence of services. As a byproduct, this initiative would provide a phillip to developments in 3G and 2.5G wireless technologies and services. India, with its poor communication infrastructure and requirements for connecting up remote areas where connection through wires are costly and inconvenient, stands to gain a lot from the deployment of wireless technology. The envisaged growth worldwide in various wireless technologies such as mobile wireless systems, broadband wireless market, short range wireless market are predicted to be enomorous.

A Roadmap study on "Wireless Networking and New Generation Access Devices/Terminals" has been done. The roadmap suggests at creating an enabling framework in which select Research and Development institutions and private industries can participate in the joint development and creation of Wireless Communication designs and products, new applications and services with which India Inc can capture $3 Billion world market.

It further aims at creating human resource in this area. The roadmap proposes an investment outlay of Rs.360 crores over a period of three years.

Smart card Initiative

Smart cards are gaining pre-eminence as the ultimate portable and network personal computers of today. With the growth of e-commerce , card based personal systems will remain the most common online payment method. Businesses and countries that do not use these technologies are unlikely to capture global markets. With the availability of better security technologies and lower costs, smart cards have the potential for use in many applications such as the banking,retail payments, internet payments, vehicle registration, citizen ID, e-governance, driving license , health records etc. Deployment of smart card in welfare schemes such as public

distribution systems would ensure timely and efficient delivery of benefits to the target groups. Smart cards are likely to be deployed in major way over the next 2-3 years. There is a large market for smart cards in India and an integrated approach for widespread deployment of smart cards and evolving interoperability standards is being conjectured with active participation from major user departments, financial institutions and industry. Government should support the smart card initiative by providing test beds, development of pilot applications and providing infrastructural support for initial take-off. Early deployment of Smart Cards in India would also provide the Indian industry, an opportunity to develop products and applications which can also be deployed in other countries.

Technologies for E-Commerce and Info-security

Technologies for E-Commerce, Info-security and Protecting IPR have taken the central stage for development and deployment for the entire growth of broadband services and customers' trust in terms of acceptability depend upon these directions. Cryptography (Encryption and Digital Signature), Public Key Infrastructure, Smart Cards, Biometrics and Digital Rights Management are the five core areas where Technology Developments, Applications & Standards need to be progressed in a holistic way. The government could earmark Rs.300 crores for these activities during the Tenth Five Year Plan which would include a Research Centre in Information Security and implementing a critical info-infrastructure protection plan.

Moving up the value chain: Framework for National Incubation Network

The success of Indian software industry in the last decade is mainly due to achievements in the area of IT software and services. In the face of current global slow down and potential threat of competition from countries like China, especially in the software service sector, it has become essential for India to devise strategies for moving-up the value chain. This will be essential in order to maintain the growth rate in the area of Software Exports. International experience has shown that many new and innovative products have been designed by technology start-ups, which provide major value enhancement to the IT sector. Many countries are providing incubation support to technology start-ups in order to create successful ventures in the area of IT. Technology incubators give fledgling entrepreneurs opportunities to develop their innovative ideas and set-up new businesses in order to commercialize them. Chances of success of start-ups have been generally higher when incubators have been spawned in the university and research environments, which are repositories of knowledge and innovative ideas.

Many leading institutions in India are contemplating liberalizing the policy framework to encourage industry - academic interaction in order to facilitate technology start-ups in their institutions. Substantial support is needed to accelerate the process, especially in the IT sector, where the infrastructure requirements are small and India has comparative strengths. This will, in the long run, also help India to sustain high growth rates through value added products and thereby counter the competition threat from countries like China, Philippines and others in the area of software services sector.

The technology incubators will have to provide (i) physical premises, (ii) professional guidance, (iii) administrative support and legal assistance as well as organize financial resources. In the first phase the network will cover 5 to 6 premier institutions like IITs, IISC etc. Based on the experience gained, more institutions will be added in phase.

International R&D Cooperation

International R&D cooperation needs to be utilized more effectively, especially in the areas where long-term and medium-term research programs are supported. India should seek international cooperation in these areas, based on the strength of cooperating countries, institutions, research labs or Industries. A committee headed by leading S&T person should

identify possible collaborators and evolve terms of collaboration and suitable mechanism for streamlined implementation.

Mechanism for synergisation / cooperation

Successful research is an outcome of human endeavor. Looking at history of research, it is obvious that different researchers/research groups have found different solutions to the same problems. Further, one specific group has never found all solutions of a particular area. Therefore, duplication of research should be promoted on selective basis. However, large scale duplication need to be avoided due to limited resources. This could be done by having representatives of concerned departments / Ministries as Members in the committees which consider funding of new projects. Additionally, each funding agency should post information on projects funded by them on their web-site. Linkages to other web-sites providing this information should also be provided.

The IT Task force had also deliberated on this issue and had suggested creation of a High Level Institutional Framework to coordinate and focus IT R&D efforts in the country alongwith related action plan.

Model for patenting IPR

The competitiveness in the electronics and IT industry is determined by the ability to innovate and put new products with improved features at a lower cost in the shortest possible time. Since it is difficult for any small and medium enterprise to have in-house expertise in all areas, it has to depend on using the intellectual property of others in order to reduce the time to market. In the WTO regime, each country is required to adhere to some minimum standards for protection of intellectual property by the member countries. India is a signatory to the Agreement on Trade Related aspects of Intellectual Property rights (TRIPS). In this context, the intellectual property is recognised as a wealth which can be licensed / assigned again and again to reach the customers globally.

India, having core competency in the area of R&D, can try and position itself as the global design destination in the area of IT. As of now, India does not own much Intellectual Property and Indian researchers and industry, specially SMEs, are not fully aware of the implications of IPR. It is seen that the number of US patents granted to India in all fields in the last 23 years is less than .05% of total patents. For India to take advantage of this opportunity our researchers need to be aware about IPR issues.

Following activities need special focus:

IPR Awareness: The knowledge of national and international IPR is very important for developers and researchers as well as for development and retention of market share by the companies. Lack of knowledge in this area can lead to expensive duplication of work which would not result into intellectual property and the products developed through these technologies cannot be commercially exploited in international markets. It is necessary to enhance the awareness of IPR amongst researchers and the industry. The awareness building can begin by introduction of courses in leading technical and scientific institutions and frequent public events.

IPR Training: Specialized training is essential at various levels to tackle IPR related issues. Some of the select target groups include: software developers, multimedia creators, technology creators and assessors, legal professionals, industry and educational managers etc.

Strengthening Patent Search: Facilities have to be created / strengthened to facilitate easy, upto-date patent search and utilization in the area of IT and electronics. In this context, the prior art database which has information not only about software patents granted globally but also about all documented and undocumented prior art literature needs to be created. All creativity needs facilitation for IPR protection in the country and abroad.

Promotion of indigenous patents: R&D funding may be provided to promote indigenous patents.

Licensing and use of foreign patents: In order to enhance the competitiveness of technologies developed locally, provision may be kept to support licensing of national / international patents and other IPR.

Policy issues: Protecting IPR internationally is an expensive proposition in the Indian context. In order to motivate the industries for filing patents, it may be necessary to look at policy issues and treat the expenditure towards procuring and filing patents at par with expenditure on R&D. The taxation on licensing fee / sale, both nationally and internationally should be exempted from Income Tax upto the year 2010 as has been done for software exports.

Government also needs to improve the patenting infrastructure and the availability of legal and technical experts for providing patenting services. The Indian legal system at present is inadequately equipped to handle highly techno- legal cases in the area of patents. Even in the US, which has a well established infrastructure and a large number of patent examiners, many patents are challenged.

It is necessary to strengthen the IPR cell of MIT to facilitate the above activities. It is estimated that a sum of Rs.21 crores will be required for this purpose.

Measures to raise R&D funds

In case of development of hardware, the problems of R&D are linked with the cost of manufacturing in India vis-à-vis cost of imported items. Manufacturing companies would spend on R&D only when manufacturing in India is profitable as compared to imported products. It is, therefore, necessary to correct the anomalies to promote the manufacturing sector.

In case of software where government has given tax incentive, infrastructure investments are not high and R&D in India is cost & quality competitive, some software companies have started doing R&D for their foreign clients. A similar support is required for encouraging Hardware development and for creation of IP through R&D.

Strategies for Indian R&D in Electronics & Information Technology to emerge on global platform

This report has been prepared keeping this goal as one of the key parameter. As R&D is a step by step process, a long term vision for R&D and a sustained support on all aspects is essential for Indian R&D to emerge on global platform. As Research and Development is not an end by itself, a sound manufacturing and deployment policy is essential for sustained R&D support.

Additional facilities for calibration & Testing

Additional facilities under new schemes required to be created for testing, certification and calibration in the areas of Cable TV, software testing, IT security, Blue Tooth technology products, Smart Cards etc. under STQC at a total cost of Rs.50 crores have been proposed.

5.   Fund Requirements

In order to remain competitive in IT sector, the industry needs to spend a minimum of 5% of its turnover in R&D. Based on this, the total R&D investment would work out to Rs. 3400 crores per year in the area of IT. Assuming that the industry contribution would be about 80% of the total investment, as in advanced countries, the total financial support required from the Government for supporting R&D in the IT sector would come to Rs. 680 crores for the current year. Taking this as a base figure, the total requirement for the tenth plan period would be Rs 3,400 crores.

Working Group on Information Technology for Tenth Five Year Plan (2002-07)

Terms of Reference

1. To evolve the Approach for Information Technology sector for the Tenth Plan keeping in view the comparative advantage, strengths and weaknesses of the IT industry, international scenario including WTO regime and the national goal of making India an IT super power.

2. To assess year-wise capacity and production for the different sub-sectors of the IT industry for the Tenth Five Year Plan period (2002-07) in line with the perspective up to 2010 AD taking into account domestic requirements and export potential.

3. To make an assessment of the likely exports and imports taking into account the option available with respect to 'make v/s busy' and also to assess year-wise projections for the Tenth Five Year Plan.

4. To estimate the investments required to be made in the public and private sector during the Tenth Five Year Plan.

5. To critically review the impact of the various policy measures already initiated, identifying the constraints and to suggest further policy framework to be adopted to achieve the set goals.

6. To examine the adequacy to the existing infrastructure facilities like Standardization, Testing and Quality Assurance Centres, National and Regional Computer Centres, Components and Materials Development Centres and Manpower Development and training centres etc. in Computer Networks and Networking Centres

7. To examine the problems/constraints facing the growth of hardware sector in the country and make recommendations regarding policy changes/new initiatives that need to be undertaken to ensure optimum growth.

8. To assess the role and impact of telecommunications and IT on other sector of the economy especially in the context of the objectives of socio-economic development.

9. To examine the constraints on development and application of IT including identifying the "killer" or lead application in each sector and to suggest the role of Government in achieving progressive IT application.

10. To certify evaluate the impact of IT and IT enabled services on the employment scenario and determine the employment potential of IT and IT enabled services in various segments of the economy and to recommend measures and strategies for ensuring optimum growth of job opportunities in consonance with attainment of other objectives.

11. Any other item that the Working Group deems necessary to be included for making recommendations Useful.

Composition

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Study Team on Computer Software and Services

Terms of Reference

1. To review the present status of the Indian Computer Software and Services Industry in terms of domestic and export and to compare what is likely to be achieved by 2001-02 with that projected in the IX Plan and analyse the causes of major deviations, if any, and suggest remedial actions in the appropriate areas.

2. To assess the Indian Computer Software and Services Industry both domestic and export year-wise upto 2006-07 with an indication of the perspective upto the year' 2010 and identify key areas for special thrust.

3. To examine the structural weakness of the Indian Computer Software Industry (both domestic & export) and suggest ways and means to improve them so that India becomes leading software exporter viable and attractive. Covering the customrised software development, packaged software development, technology levels, etc.

4. To make an assessment of the likely imports and exports.

5. To review the status of and estimate the investments required to be made in the public sectors in the context of *I.* the projections for the Tenth Plan.

6. To critically review the impact of the various policy measures already initiated and suggest an appropriate policy frame work for the development of the Indian Computer Software and Services industry and the optimal way of achieving the desired objectives with due regard to technology, production cost and employment considerations.

7. To identify emerging technology areas in software for taking up R&D and such suggest, methods, actions for building expertise.

8. To strengthen the industry-academic linkages for taking up research for developing expertise in cutting edge/ emerging technologies.

9. To certify evaluate the impact of IT and IT enabled services on the employment scenario and determine the employment potential of IT and IT enabled services in various segments of the economy and to recommend measures and strategies for ensuring optimum growth of job opportunities in consonance with attainment of other objectives.

10. The Study Team may co-opt any person whose knowledge or expertise is considered to be useful for the study team and may invite such persons to attend\meetings. The non-official members of the Group will be\paid TA/DA by the Ministry of Information Technology as per Rules.

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10. Shri Manas Pattnaik, Director
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11. Shri Shiv Kumar, Joint Director

12. Software Technology Parks of India

Study Team on Infrastructure

Terms of Reference

1. To review the present status of Information Technology infrastructure in terms of computer networks, production and availability of computer hardware, software, services, telecommunications, computer usage, human resources and compare with the other developed and developing countries in the world.

2. To examine the structural weakness of the IT infrastructure in the country in terms of technological levels, R&D procedures and indigenous know-how etc.

3. To critically review the growth of the corporate industrial sector and the core sector in the country that form the basic infrastructure for national development and suggest measures for greater use of IT in different sectors and closer coordination with the user sectors and their technology development.

4. To suggest an appropriate IT policy framework identifying issues, linkages, legal foundation for the development of National IT infrastructure and to suggest measures for setting up of the infrastructure giving thrust to strengthening technology, implementing mechanism, production, R&D, human resources and modifications/ changes in the govt. procedures and policies.

5. To identify emerging technology area of IT infrastructure for taking up R&D and such suggest, methods, actions for building expertise.

6. To suggest role of Government, in establishment of IT infrastructure in the country.

7. To review the status of investment and recommend investment and other inputs required to be made in the public and private sectors in the context of setting and strengthening of IT infrastructure.

8. The Study Team may co-opt any person whose knowledge or expertise is considered to be useful for the study team and may invite such persons to attend meetings. The non-official members of the Group will be paid TA/DA by the Ministry of Information Technology as per Rules.

Composition

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   Bharti Telecom

2. Shri Nahata
   HFCL

3. Shri Rajiv Malhotra
   Shyam Telecom

4. Dr. A.K. Seth
   Reliance Telecom

5. Representative, VSNL

6. Representative, BSNL

7. Representative, MTNL

8. Representative, Satyam Infoway

9. Representative, Dishnet DSL Ltd.

10. Representative, DOT

11. Shri Ashok Panjwani
    Sterlite Optical Tech. Ltd., Aurangabad

12. Shri Punj
    CEO, Spectranet

13. Prof. Selvarajan
    IISC, Bangalore

14. Shri S. Lakshminarayanan
    Joint Secretary

15. Director
    STPI, Bangalore

16. Shri S. Basu
    Sr. Director, MIT

17. Shri P.S. Narotra - Member-Convenor
    Director, MIT

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Study Team on Application Development

Terms of Reference	Composition

Terms of Reference

1. To assess the infrastructural requirements for faster growth and penetration of Internet in the country and creation of convergence of services.

2. To suggest measure for promotion of e-governance at various levels in the Government starting from Gram Panchayat level and to suggest strategy to be adopted in this regard.

3. To suggest measures to address the issue of digital divide and taking the benefits of IT to the masses.

4. To examine the constraints on development and application of IT in various sectors, suggest measures to promote faster use of IT including identifying the "killer" or lead application in each sector and to suggest the role of Government in achieving progressive IT application.

5. The Study Team may co-opt any person whose knowledge or expertise is considered to be useful for the study team and may invite such persons to attend meetings. The non-official members of the Group will be paid TA/DA by the Ministry of Information Technology as per Rules.

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1. Shri Ashok Jhunjhunwaia
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2. Dr. V.K. Agnihotri
   Addl. Secretary, Deptt. of Admn.
   Reforms & Public Grievances

3. Representative, TCS

4. Mr. R.K.Arora
   Executive Director, C-DAC

5. Secretary (IT) Rajasthan

6. Secretary (IT) Karnataka

7. Shri S.S. Ghosh
   CMD, CMC

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9. Representative, DOT

10. Prof. V.K. Nagai
    University of Roorkee,
    Deptt. of Management Studies

11. Joint Secretary (Tech)
    Ministry of I&B

12. Dr. V.K. Dharmadhikari
    Sr. Director, MIT

13. Shri S.S. Graver
    Sr. Director, MIT

14. ShriS.R. Das
    Sr. Director, MIT

15. Dr. Krishna Kant,
    Sr. Director, MIT

16. Shri Subir Hari Singh - Member-Convenor
    Joint Secretary, MIT

Study Team on Manufacturing Sector

Terms of Reference

1. To review the present status of the Electronics Industry in terms of capacity, production, consumption, imports, exports and S&T programmes and to compare what is likely to be achieved by 2001-02 with that projected in Ninth Plan and analyse the causes of major deviations, if any, and suggest remedial actions in the appropriate areas.

2. To assess the capacity and production of the electronics industry year-wise upto 2006-07 with an indication of the perspective upto the year 2010, taking into account domestic requirements and export potentials.

3. To make an assessment of the likely exports and imports taking into account, the options available with respect to 'make v/s busy' and also to assess year-wise projections for exports for the Tenth Five Year Plan.

4. To identify the thrust areas where the country has potential to become internationally competitive for achieving significant exports and to suggest measures/ policies to achieve these with reference to international price, quality and technology, etc.

5. To review the status of an estimate investment required to be made in the public and private sectors in the context of the projections for the Tenth Five Year Plan.

6. To critically review the impact of the various policy measures already initiated, identifying the constraints and to suggest further policy framework to be adopted to achieve the set goals with special emphasis on economic size of units, technology, production cost and labour laws, WTO regime, and free market economy with the option available to 'make v/s busy'.

7. To examine the adequacy to the existing general infrastructure facilities like Standardization, Testing and Quality Assurance Centres, R&D base, Manpower Development & training centres, etc.

8. Review of adequacy of S&T programmes in relation to the needs over a 10 year's period and from the point of view of technological self-reliance and recommendations to fill critical S&T gaps, intensify R&D efforts in most emerging areas.

9. To study the implications of convergence of Computer, Communication and Consumer Electronics technologies and its impact on Indian consumer electronics industry in terms of new products, applications, etc.

10. To review the availability of critical raw-material and components for the industry and to recommend their indigenous manufacturing keeping in view the option of Make Vs Buy.

11. To suggest software requirements from AIR/DD in content of promotion of consumer electronic industry.

12. To examine the problems/constraints facing the growth of hardware sector in the country and make recommendations regarding policy changes/ new initiatives that need to be undertaken to ensure optimum growth.

13. To assess the role and impact of telecommunications and IT on other sector of the economy especially in the context of the objectives of socio-economic development.

14. To examine the feasibility of establishing at least one mege-fab in the country during the X Plan period and to work out its implementation strategy.

15. To suggest any other measures that may be appropriate for meeting the recommended targets/objectives.

16. The Study Team may co-opt any person whose knowledge or expertise is considered to be useful for the study team and may invite such persons to attend meetings. The non-official members of the Group will be paid TA/DA by the Ministry of Information Technology as per Rules.

Composition

1. Shri P.K. Sandell
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2. Shri P.M. Dhoot
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3. Shri Rajeev Karwal
   President, CETMA

4. Shri B.S. Sethia
   ELIN Industries

5. Shri R. Ranganathan
   GM, Components, BEL, Bangalore

6. Shri Raj Kapur
   Vice President, JCT Colour Tubes

7. Shri Somnath Chatterji
   Secretary General, ELCINA

8. Shri U.M. Shafi
   NeST, CEPZ, Cochin

9. Shri Parmeshawarn
   DDG(LTP), Department of Telecom

10. Shri H.R.Bhargava
    Addl. Director, Directorate of EP&IPR, DRDO

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11. Representative
    MAIT

12. Representative
    TEMA

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14. Dr. A.K. Chakravarti
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    Adviser, MIT

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    Sr. Director, MIT

17. Dr. K.S.K. Sai
    Sr. Director, MIT

18. Shri N. Dassharma /Shri T. K. Sarkar
    Sr. Director, MIT Director

19. Dr. R.C. Chopra
    Sr. Director, MIT

20. Dr. Om Vikas
    Sr. Director, MIT

21. Dr. K. S. Chart
    Sr. Director, MIT

22. Dr. U.P. Phadke - Member-Convenor
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Co-opted Members

1. Mr.S.C.Khanna
   Secretary General
   Association of Basic Telecom Operator

2. Mr.T.V.Ramachandran
   Director General
   Cellular Operator Association of India
   New Delhi

3. Mr. Rajesh Jain
   President, IEEMA

4. Shri Ajit G.Nambiar Chairman and Managing
   Director BPL Ltd. Bangalore

5. Mr. Gulu Mirchandani
   MIRC Electronics Ltd.

6. Shri D. Dutta
   Director, MIT

7. Shri R.C. Sachdeva
   Director, MIT

8. Dr. Krishna Kumar
   Director, MIT

9. Shri Rajiv Rastogi
   Director, MIT

Study Team on Electronics and IT Policy & Procedures

Terms of Reference

1. To critically review the impact of the various policy measures already initiated, identifying the constraints and to suggest further policy framework to be adopted to achieve the set goals with special emphasis on economic size of units, technology, production cost and labour laws, WTO regime, and free market economy with the option available to 'make v/s busy'.

2. To review the present duty structure for electronics and IT Industry and suggest changes/modifications, if required.

3. To examine and recommend improvement in the monitoring system in Electronics & IT sector (e.g., Value addition, Imports, Exports, Investments, Flow of Financial Resources etc.) so as to provide a quick feed back to assess the impact of policy changes and enable timely remedial measures.

4. To identify major bottlenecks in implementation of policy/ procedures considering the growth level envisaged in the tenth plan and perspective upto the year 2010.

5. To examine the present role of various Government agencies involved at regulatory and promotional level and suggest improvements.

6. To recommend an appropriate role of small scale sector including women cooperative and identify steps which are required to assist the small industry keeping in view the new policy measures announced by the Government.

7. To suggest any other measures that may be appropriate for meeting the recommended targets/objectives.

8. The Study Team may co-opt any person whose knowledge or expertise is considered to be useful for the study team and may invite such persons to attend meetings. The non-official members of the Group will be paid TA/DA by the Ministry of Information Technology as per Rules.

Composition

1. Representative, ELCINA
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4. Representative, CETMA
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7. Shri S.S. Midha
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8. Shri R.C. Sachdeva
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Co-opted Members

1. Representative, TEMA
2. Representative, ESC
3. Shri P.P. Malhotra, Advisor, DCSSI
4. Shri B.S. Sethia
   Director, ELIN Electronics
5. Shri S.K. Malik
   Chairman, Calcom Vision Ltd.

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Study Team on Human Resource Development

Terms of Reference

1. To examine the adequacy of Manpower Development and training centres, etc. in the areas of information technology, electronics, computer networks and ' networking centres, etc.

2. To assess yearwise manpower requirement in IT sector both at low end and high end as well as for IT enabled services and IT led education to achieve an software export target of US$ 50 billion and a turn over of US$ 87 billion by the year 2008. Also to assess manpower requirement for electronics hardware sector during the Tenth Plan.

3. To suggest measures for Software Manpower Development in order to meet Software Export Challenges. The Study Team should especially focus on IT Manpower development both at low end and high end as well as for IT enabled services and IT led education.

4. To recommend a strategy to develop manpower which is relevant to industry/user requirements and to suggest I ways and means of ensuring active participation and support of the industry.

5. To examine the existing infrastructure and constraints for developing high quality manpower and to recommend (measures to meet the needs of the industry in the global perspective including strategies for continuing education for professionals.

6. To review the academic curricula at different levels of engineering education and recommend specific changes/ modifications required in the curricula, teaching methodologies, administrative mechanism for imparting industry relevant education at the institutions.

7. To study the role of new educational technologies, e.g., Distance Education, Multimedia etc. and to recommend modalities for their integration in the present educational/ training system. To suggest measures necessary to improve teaching of non-IT subjects by using computers and the Internet for all students.

8. To make recommendations regarding the modalities for achieving mutually beneficial cooperation between educational institutions in IT in the formal sector and those in the private sector.

9. The Study Team may co-opt any person whose knowledge or expertise is considered to be useful for the study team and may invite such persons to attend meetings. The non-official members of the Group will be paid TA/DA by the Ministry of Information Technology as per Rules.

Composition

1. Representative, Ministry of HRD

2. Shri Pawan Aggarwal
   Director, Deptt. of Secondary & Higher Education, MHRD

3. Professor B. Sangameshwara
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4. Representative - UGC

5. Representative, MAIT

6. Representative, APTECH

7. Representative, C-DAC

8. Representative, CEDTI

9. Shri S. Maitra -
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10. Vice President
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11. Secretary (IT)
    Govt. of West Bengal

12. Secretary (IT)
    Govt. of Maharashtra

13. Secretary (IT)
    Govt. of Karnataka

14. Secretary (IT)
    Govt. of Punjab

15. Rep., C-DAC

16. Prof. Subrat Kar
    IIT, Electrical Engg., Delhi

17. Dr. Y. K. Sharma
    DDG, NIC

18. Shri S. Ramakrishna
    Sr. Director, MIT

19. Dr. P.N. Gupta
    Ex. Director, DOEACC

20. Shri W.R. Deshpandey - Member-Convenor
    Sr. Director, MIT

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Study Team on Research & Development

Terms of Reference

1. Review of IX plan and S&T status in electronics w.r.t.
   a. Review of MIT S&T Programmes,
   b. Other S&T Departments,
   c. R&D in Electronics and IT Industry,
   d. Review of Technology imported by industry from absorption and upgradation point of view.
2. To consolidate objective/aims and expected achievement of the Tenth plan, for the perspective growth upto 2010.
3. In the changed scenario of industrial/trade liberalization, to suggest an optimum strategy including organization structure implementation methodology and monitoring mechanism for strengthening the present S&T efforts of the Ministry of Information & technology.
4. To suggest appropriate R&D strategic model for growth of technology in context of ongoing globalization needs.
5. To suggest measures to effectively absorb and upgrade the market proven technologies competing internationally, compatible with Indian environment keeping in view the perspective growth till 2010.
6. To identify the major thrust areas of work keeping in view the R&D model and suggest mission-oriented projects to achieve the same.
7. To suggest selected areas creating centres of excellence.
8. To identify the areas of international R&D co-operation/joint research and implementation mechanism thereof.
9. To suggest mechanism of synergisation/cooperation amongst various supporting R&D in electronics to avoid duplication and creation of critical mass nationwide.
10. In order to keep pace with state-of the art R&D scenario & suggest appropriate model for implementation of patenting/IPR.
11. To suggest measures to raise R&D funds besides the Government support through R&D support and strengthening the mechanism for funding even private sector.
12. To suggest special incentives for innovative in-house R&D in public and private Sector.
13. To consolidate aforesaid issues to suggest strategies to make Indian R&D in Electronics & Information Technology to emerge on global platform in some selected areas at the end of X plan.
14. Review the status of testing and calibration facilities available in the country and suggest additional facilities to be created/ improvements to be made after taking into account current level of utilisation and to achieve national goals of Export of IT and electronic products in the light of changing global scenario in Europe and other developed nations.

15. The Study Team may co-opt any person whose knowledge or expertise is considered to be useful for the study team and may invite such persons to attend meetings. The non-official members of the Group will be paid TA/DA by the Ministry of Information Technology as per Rules.

Composition

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3. Prof. Surendra Prasad, Elect. Engg., IIT, Delhi
4. Representative, DST '
5. Representative, DSIR
6. Representative, ELCINA
7. Representative, CETMA
8. Representative, ITI, Bangalore
9. Representative, BEL, Bangalore
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13. Director, SAMEER
14. Dr. M.J. Zarabi Chairman & Managing Director, SCL
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18. Shri M.S. Vasudeva Sr. Director, MIT
19. Dr. V.K. Dharmadhikari Sr. Director, MIT
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