



## CHAPTER XXXVI

# ELECTRONICS AND INFORMATION TECHNOLOGY

The Government of India visualized the importance of electronics and information technology (IT) and its critical role in the economic growth of the country, and as a result, established the Department of Electronics (DOE) in June, 1970 and the Electronics Commission in February, 1991. The objectives of the Department were to review the field of electronics with regards to research, development and industrial operations, to formulate policy in the field of electronics and IT and to direct implementation of all measures, both promotional and regulatory, to attain self-reliance. In 1975, the Government of India strategically decided to take effective steps for the development of information systems and utilization of information resources, and also for introducing computer-based decision support system in government ministries and departments to facilitate planning and programme implementation to further the growth of economic and social development (Informatics-led development). In view of its relevance for all round socio-economic growth, and also to get benefit of the emerging digital economy, the Central Government has created a new Ministry of Information Technology (MIT) in 1999 by merging the DOE, National Informatics Centre (NIC) and Electronics and Software Export Promotion Council.

The 1970s saw the Policies of “self-reliance” and “promotion” of an indigenous IT industry in

India. The idea that “import of technology could accelerate national development in the field of electronics and computer”, had gained support in the Policies/Statements of the Central Government announced between 1978-1984. Many State/Central Electronics Corporations (i.e. KELTRON, MELTRON, UPTRON, WEBEL, HARTRON, ESPL, KEONICS, ELCOT, BEL, ECIL) were established in 1970s and 1980s to develop electronics industry in the states. Various policy announcements like the Import Policy (1983), Computer Policy (1984), Electronic Policy (1985), and Software Policy (1986) laid the foundations for the liberalized growth of IT industry in the country. It was recognized that IT would become strategically as important to the Indian economy as oil.

### EMERGING DIGITAL ECONOMY

The global market for IT enabling services is estimated at US \$ 585 billion by 2004, of which 5%, or about US \$30 billion, could go to Indian companies, (Goldman Sachs Global Equity Research Report). Indian IT sector has recorded a compound annual growth rate of 55% from USD 270 million in 1992 to 5.7 billion in the Fiscal Year 1999-2000. The NASSCOM-McKinsey report projects about USD 87 billion in 2008 for Indian IT Companies. More than 40 per cent of the Fortune 500 companies use the services of Indian enablers. NASSCOM reports that spurred by IT spending by the various State

Governments, Indian software and hardware market (including Devanagari) is slated to touch USD 2.2 billion by 2001.

In the era of globalization and knowledge economy propelled by the phenomenal growth in IT, a paradigm shift in productivity and economic development and in management thought is clearly discernible. Significant growth has been witnessed in the Electronics and IT sector during 1980s and 1990s. The electronics production, in value terms, has increased from Rs. 9,100 millions in 1989-90 to Rs. 6,87,000 millions in 2000-01. The software exports grew from Rs. 1,650 million to Rs. 2,85,000 in 1990s. The outsourced or trans-border IT Enabled Services (ITES) have a great potential for growth and contribution towards employment opportunities in India. Unlike most developing countries, India is expected to gain from the 'emerging Digital Economy', as it has:

- Affordable access to core information resources, cutting edge technology and sophisticated telecommunication systems and infrastructure;
- The capacity to build, operate, manage, and service the technologies involved;
- Policies that promote equitable public participation in the information society as both producers and consumers of information and knowledge; and
- A workforce trained to develop, maintain and provide the value-added products and services required by the information economy.

Information Technology Act (2000) and Communication Convergence Bill (2001) of the Government clearly show the direction in which the country is moving to facilitate a single communication network catering to all types of technologies (i.e. Internet, Datacom, Telecom, Wireless, Wireline, Fixed, Mobile, Cellular, Satellite Communication, etc.), and e-commerce. Public Investment for creation of basic informatics infrastructure with universal access and the consequent creation of employment, has been recommended to be realized by allowing every

Central, Centrally sponsored and State Plan projects to utilize up to 3% of their total budget for IT. A National Information Infrastructure (NII) is evolving as a "network of networks" including such nationwide networks as NICNET, ERNET, HVNet & I-Net, in addition to an extensive Fibre Optic Telecommunication Backbone being set up by Department of Telecommunication (DOT), Railways, and the Private Sector.

IT investment in Government Sector has been negligible up to 1990s. The Vittal Committee (1997) constituted by the Department of Administrative Reforms recommended 2-3% of the budget outlay for IT applications in Government Departments. The National Conference on Informatics for Sustainable Agricultural Development (ISDA) 1995 recommended 3-6% of IT applications in the agricultural sector. In the present "crucial decade" of this millennium, a high rate of investment in IT capital and a supportive environment are expected to achieve "digital economy".

National Task Force on Information Technology and Software Development (1998) of the Central Government has suggested a plan of action to make India an IT super power in the World. Emergence of IT on the National Agenda and announcement of IT Policies by about 19 State Governments have strengthened India's position in the software-driven IT sector in the world. These IT policies, more or less, envision: Re-engineering administrative processes, IT Budget, IT initiative fund, Statewide Area Network, Smart Cards, Department-wise specific MIS, IT literacy, and Promotion of IT industry. Many State Governments have introduced "computer education" as a compulsory subject in schools and established Indian Institutes of Information Technology (IIITs), IT Parks, Hardware Parks, and Software Technology Parks to promote the growth of IT education, services, and industry in India. Impact of IT would be predominant in the social sectors like health, education, judiciary and rural development.

## INITIATIVES OF THE MINISTRY OF INFORMATION TECHNOLOGY

The MIT has taken steps to implement a comprehensive action plan to make India an IT Super Power and achieve a target of USD50 billion in software exports by 2008, and to accelerate the internet revolution emphasizing the creation of useful contents in Indian languages. Development of IT enabled services, IT education, electronics and computer hardware manufacturing and exports, silicon facility, e-commerce and Internet based enterprises has become the thrust area of the Ministry. R&D in emerging technological area has remained a key activity of the Ministry and the promotional efforts in electronics and IT have helped enormously in the laying of solid foundation in the IT industry. The Ministry has set up several autonomous organizations, as given below, to address the requirements of different sectors of IT in a focussed manner: Centre for Development of Telematics (C-DOT); National Informatics Centre (NIC); Centre for Development of Advanced Computing (C-DAC); Computer Maintenance Corporation Ltd.; Standardization, Testing & Quality Certifications (STQC) Directorate; Controller of Certification Authority(CCA); National Centre for Software Technology (NCST); Society for Applied Microwave Electronics Engineering and Research (SAMEER); ERNET Society; DOEACC Society; Centre for e-Governance; Centre for Electronics Design and Technology of India (CEDTI); Semiconductor Complex of India (SCI); Electronics Research & Development Centre of India; ET&T; Electronics and Software Export Promotion Council; Technology Development Council; National Radar Council; National Photonics Council; Electronics Materials Development Council.

These organizations are playing a major role in training and development of manpower for electronics and computer industry. In addition they help and guide the electronics industry by providing infrastructure, policy support, design, consultancy, training, testing, accreditation, market

support, and are also actively involved in R&D activities in their specific areas. The Ministry supports and funds technology development through councils set up in various fields. A major result in sponsored research has been the enhancement of technological base and capabilities in the country, besides generating specific products and equipment. Major areas where significant success has been achieved, at par with the developments internationally, through sponsored R&D projects, are as follows:

- Appropriate Automation Programme – Retrofit Automation, Energy Management, Process Controls, Robotics Welding System, & Simulators for Proactive Shop Floor controls;
- Automatic Data Handling Systems for Plan ADGES;
- Axle Counter and Chopper Control Equipment and Interlocking System for Indian Railways;
- Communication, Broadcast & Telemetry – Digital Mobile Radio, Subtitling in regional languages, Spread Spectrum Radio Modem, and UHF Wireless Data Modem;
- ‘PARAM’ series of Super Computers based on distributive memory architecture;
- Meteorological instruments (i.e. Cyclone Warning Radar, Radiosonde, MST Radar);
- Pollution free vehicles;
- Telemedicine Networks;
- Electronics Industry Development Project (Manpower Component) – Project IMPACT;
- Fibre Optics Application Programme (FOSAPP);
- Future Air Navigation Systems (FANS) programme in Airport navigation;
- HVDC project jointly with BHEL, AP Transco and CPRI;
- Instrumentation for Paper & Pulp, Textiles, Tea, Sugar, Jute Industry;
- Microprocessor Application Programme;
- Microwave Tubes for providing strategic solutions;
- Software for Indian Languages;
- Technologies for Internet, e-Commerce, and

e-Governance; and

- Vehicle Tracking System based on GPS technology.

The Ministry has initiated about 300 R&D projects at more than 100 institutes including industries, academic institutes and research laboratories. Recently emphasis has shifted toward Information & Communication Technologies (ICT) Area for sponsored projects development. Some of the major areas of activities are:

**Technologies for Internet, e-Commerce and e-Governance:** Netmaster, a software system for traffic monitoring and bandwidth management of the Internet access link has been developed. *Anglabharti*, a rule based machine translation system for translating documents from English to Hindi has been developed. A number of e-governance and e-commerce projects have been undertaken. VOICE, a versatile online information system to address the needs of citizens, civic administration and municipal corporation has been successfully implemented. Another project, knowledge management system KMAP has been developed to help people in an organization to have access to context specific information to help them in decision making process. Tourism Information system is under development in collaboration with Government of Andhra Pradesh. Products for e-commerce applications i.e Internet based credit card and e- cheque alongwith digital certification.

**Communication, Broadcast & Telemetry:** 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 stereo console for broadcasting and hardware and software for news room automation has been developed. A system for use in subtitling of feature film telecast in regional languages has been designed and developed. A spread spectrum radio modem has been developed indigenously for various networking applications. UHF wireless data modems for high speed data communications have

been designed and developed.

**Software for Indian Languages:** *Rupanthar*, software developed by NCST was used for transliterating documents in large numbers from English to Hindi and have been used by many organizations like universities for translating names from English to Hindi. E-mail in *Devanagari* and other languages has also been made available in public domain. Development efforts on machine aided translation from English to Indian languages have led to the development of *Anglabharati*, *Matra* and *Mantra*, the machine translation systems; *Anusarak*, the language accessor; *Varthalap*, a multilingual internet relay chat application, e-mail in regional languages with cross translation possibilities etc. Collaboration with microsoft has resulted in incorporating Indian languages at the kernel level in Windows 2000 and further similar localization efforts for Linux have also been initiated. Software for directory building, spell checker and similar software tools for various Indian languages have been developed.

**Automation & Process Control:** Process control system which is a display and monitor system and can be customized for any environment has been developed. Robotics welding system for hazardous applications has been developed alongwith a seam tracking system. This is for high quality welding especially for pressure vessels, power plants and heat exchangers. An instrument for monitoring paper cross-directional strength and uniformity has been successfully developed. Retrofit automation for pulp, paper, sugar, jute and tea, steel and textile industry has been completed. Dyeing systems with computerised controls for textile industry and computerized energy management system for steel plant have been developed.

**Agro - and Rural 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 optimize seed spacing, using a tractor have been developed. These instruments are simple to operate and can be produced at nominal costs. Also IT tools for watershed development have been developed alongwith irrigation canal control automation. Solar pumps for rural use have been fabricated. Under Microprocessor Application programme, various infrastructural sectors like water treatment, irrigation and road were addressed.

**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 fiber, nano technology, need-specific detectors for high-speed optical communications and optical receiver module etc.

**Power Electronics:** Major initiative of DOE in this area is HVDC project funded jointly with BHEL with AP Transco and CPRI as the main executing agencies. Hardware and software for state-of-the-art Digital Control and Protection System have been indigenously developed. Many subsystems and devices like 200MW thyristor have been developed as a part of this project. Supervisory control and the data acquisition system developed is under use at 1500MW Chandpur Padghe Commercial HVDC project. In addition, lightning protection unit, ATE for UPS also have been designed and developed.

### AUTONOMOUS ORGANIZATIONS

**Centre for Development of Telematics (C-DOT):** Development of Telecommunications equipment and technologies have been areas of priority for the DOE. C-DOT was established in 1984 with a mission to develop switching system/exchanges in India to work in harsh tropical environment of the country. C-DOT has developed a wide range of Digital and Rural Switching Systems between 200 lines to 40,000 lines. C-DOT technology based design has now

about 17 million lines manufactured by over 20 different cooperatives and has revolutionized rural telecom in India. A number of items of equipment including ISDN and Intelligent Networks have been added. C-DOT was subsequently transferred to the Department of Telecommunications, which is the nodal Ministry for Telecom in India.

**National Informatics Centre (NIC):** National Informatics Centre (NIC) is a premier S&T organization of the Government of India in the field of Informatics Services and IT applications. NIC was set up in 1977 as a constituent unit under the aegis of DOE to provide computer-based informatics services to Government and other agencies having majority funding by the Government. The nationwide Computer-Communication Network, NICNET, set up by the NIC, is the Government Network. NIC is offering network services over C-band and Ku-band (TDMA, FTDMA & SCPC) VSATs, Wireless Metropolitan Area Networks (MANs) and Local Area Networks (LANs) with NICNET gateway for Internet resources, to promote economic, social, scientific and technological activities, and also for macro-economic adjustment programme of the Government.

During the last 25 years, NIC has played an important role as an 'active, catalyst and facilitator' in informatics development programmes in Governments at the national, state and district level, which made them take policy decisions to create 'knowledge societies' – societies that can exploit knowledge to derive competitive advantage using the opportunities provided by 'digital technology'. NIC has been instrumental in adopting IT and Communication Technology 'to reach out into India' (i.e. by implementing IT applications in social and public administrations), which are discernible from the following developments:

- Central Government Informatics Development Programme- A strategic decision to overcome 'Digital Divide' in Central Government Departments and Ministries during the Fifth

Plan Period (i.e. 1972-77);

- NICNET gateway for Internet/Intranet Access and Resources Sharing in Central Government agencies in 1980s and 1990s;
- IT in Social Applications and Public Administrations;
- State Government Informatics Development Programme – A strategic decision to overcome ‘Digital Divide’ in Central and State Governments during the Seventh Plan Period (i.e. 1985-1990);
- NICNET – A first of its kind among the developing countries, using the state-of-the-art Ku-band VSAT technology-facilitates (i) decentralized planning, (ii) improvement in government services, and (iii) wider transparency of national and local governments and improving their accountability to the people;
- DISNIC – A District Government Informatics Programme based on NICNET : A strategic decision in 1985 to overcome ‘Digital Divide’ in 540 District Administrations;
- Reaching out into India during 1985-90, even before the arrival of ‘Internet’ Technology, to 540 districts of the country, which is a land of diversity with different types of terrain, various agro-climatic conditions, different levels of socio-economic conditions, and varied levels of regional development, etc.

Some of the important IT projects, undertaken by NIC in the Central and Centrally Sponsored Sector Programmes, are: Budget Computerization; Central Excise Computerization; Commercial Tax Computerization; Community Information centre Project; Corporate Companies Computerization; Courts Computerization Project – Supreme Court, High Courts, and District Courts; Customs computerization, and EDI implementation; District Information system; District Rural Development Agency Computerization project; District Treasury Computerization; e-Governance and e-Commerce Project; Parliamentary Elections data transmission and analysis; Employment Exchange

Computerization; National Drinking Water Technology Mission Project Computerization; Passport Computerization; Registration Department Computerization (CARD Project); Road Transport Vehicles Registration Computerization; Utility Mapping Project.

‘Indian Image’ is a popular Web Site of NIC which presents a true perspective of India and its Government before the Internet Community.

NIC has assisted many government bodies including Parliament to prepare and implement their IT plans. It has signed Memorandum of Understanding (MoU) with State/UT Governments to strengthen decision support in Government departments in 28 State capitals, one NCT and 6 Union Territories and 520 district centres. NICNET facilities are utilized for the development of computer based Government informatics at the state/district level. State Government departments utilize NICNET facilities for on-line monitoring of various sectors of economy and social development on a regular basis and also for database development for administration and planning. Starting as a small programme under an external stimulus by an UNDP project, it has grown incrementally and later exponentially as one of India’s major S&T organizations promoting ‘Informatics-led Development’, which has helped to usher in the required transformation to cope with the trends in the new millennium.

#### **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 laboratories, NGOs and has over 80,000 users. ERNET collaborates with premier institutes in the country to undertake advanced research projects.

**CMC Limited:** CMC Limited commenced operations as ‘Computer Maintenance Corporation’

in the year 1976. CMC took up the challenge to service all computer installations of IBM, when IBM decided to wind up its operations in India in 1978. Later CMC also maintained computers supplied by scores of other foreign manufacturers.

Today, CMC is one of the leading IT companies in the country with multi-faceted expertise. CMC has five strategic business units in the areas of customer services, systems integration, international operation, education and training and Indonet. CMC still enjoys leadership in Third Party Maintenance. CMC continues to consolidate its position in the area of Networking Services alongwith its data centre activities. Keeping in line with the thrust on increasing international component of business in all areas, CMC is working in areas like VLSI design, tool support, network management, system administration etc. CMC has over 3000 employees with 18 offices in India and more than 150 service locations. Some of the important projects undertaken by CMC are:

Railway Reservation and Freight Operation Information System; Finger Print Identification System for India and Mauritius; On-line integrated customer based retail banking system; GENISYS (General Insurance System); India's first Integrated Operating Office Software for New India Assurance Co.Ltd.; Bombay Stock Exchange's On-Line Trading (BOLT), a comprehensive screen based trading software was indigenously developed by CMC; Application Specific Development Centre for SCADA (ASDC-SCADA) at Hyderabad has developed and supported many SCADA applications in electric power transmission and distribution; e-commerce solutions; e-governance solution for Municipal Corporation of Vijayawada and others; Vehicle Tracking System; BRI Inc. is CMC's wholly owned subsidiary in USA. CMC has executed many international projects in areas of networking, data warehousing, web and internet based solution, embedded systems, software testing, computerisation of ports, stock exchanges etc.

## CENTRE FOR DEVELOPMENT OF ADVANCED COMPUTING

The Centre for Development of Advanced Computing (C-DAC) is an autonomous scientific society established by the MIT. It was set up over a decade ago, as India's national initiative for indigenously design, development and delivery of high performance computing (supercomputer systems) and solutions based on parallel processing technology. C-DAC has, over the years, diversified its activities, transferring the expertise it acquired and technologies it developed in the high-end computing, to develop and deploy IT based solutions in various sectors of the economy. Through this approach, it has maintained a balance between developing strategic technologies on the one hand, needed by the country in the high performance computing area for achieving self-reliance and addressing mission-oriented critical problems in the science and engineering fields, and, on the other, using expertise developed to commercialize its technologies and products to meet the requirements in various sectors.

C-DAC has been operating in a mission mode in order to develop the technologies in the specific time-targeted manner. It has accordingly brought out in its earlier missions, the PARAM series of Supercomputers. C-DAC's current mission is for the development of the next generation High Performance Computing & Communications (HPCC) technologies and applications, taking advantage of the developments carried out in its previous missions in this area. As part of this, C-DAC has set up a National PARAM Supercomputing Facility (NPSF) to allow access to researchers to solve their computer intensive problems in various areas of science and engineering.

**Language Technology Mission:** C-DAC's other activity, the language technology mission, is to create a framework for support to the various living languages with diverse scripts on standard computers. C-DAC has innovated its trail-blazing Graphics and Intelligence-based Script Technology

(GIST) to achieve this goal. This technology is now extended to include multimedia and multilingual computing solutions covering a wide range of applications such as publishing and printing, word processing, office application suites with language interfaces for popular third party softwares on various operating platforms, electronic mail, machine translation, language learning, video and television, and multimedia content in Indian languages. These have been successfully commercialized.

C-DAC has established its Advanced Computing Training School (ACTS). This school currently offers a variety of course options in software technologies, Enterprise System Management (ESM), Geomatics, VLSI designs, digital multimedia etc. at its own four centres and about 100 franchise centres around the country.

Building on its foundation in almost all major areas of IT, C-DAC offers advanced computing products, solutions and services to several sectors including education, research, power, telecom, health care, finance, transport, networking and internet applications. Specific areas of focus currently are e-governance, e-commerce, digital libraries and advanced solutions based on data warehousing, genetic algorithms, network security, GIS, artificial intelligence, real time systems, and so on. Under the Data Warehousing Project for Andhra Pradesh Government, C-DAC developed citizen's database (Voters List, Food and Distribution, Industry, Professionals, Household data, Health, Economic Status and Demographic data).

**Software Technology Parks of India (STPI):** The export of computer software has received special thrust and has become the largest item being exported in the IT sector. STPI acts as a single window solution provider for organizations engaged in export of IT Software and Services. It provides infrastructural facilities, including High Speed Data Communication Services (HSDC), required by the IT industry and it solicits all the Government approvals as required by this industry.

Eighteen earth stations have been established which act as International Gateways. STPI also provides incubating infrastructure mainly for start-up operations of Small and Medium Entrepreneurs (SMEs) enabling them to commence their operations without any gestation period. STPI has also set up a 'Business Support Centre' in the Silicon Valley (USA) area in order to support the Small and Medium Enterprises (SMEs).

As a result of focused attention to the software exports sector, STP schemes have attracted many entrepreneurs in the area of software development. A total of 6329 units are registered with STPI. The export revenue of the STP units is showing consistent growth of more than 100% every year.

**National Centre for Software Technology (NCST):**

NCST, a premier R&D institution in software technology, 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. It has won national and international recognition and is performing valuable role in educating and training high level technologists for Indian business and industry. 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 Sikri monument has been demonstrated widely and has been well received around the world. INTEL, which also donated some equipment to its laboratory, has included this application in its demo CD for showing 3D graphics power of its high end processors.

NCST's activities as Domain Registrar for India have increased several-fold, as the Internet revolution has rolled along. Software developed by NCST has been used by many reputed organizations including TCS and INFOSYS within the country. NCST's significant achievement is development of Hindi Version of Windows 2000, which has been released by Microsoft Corporation, USA recently.

**Society for Applied Microwave Electronics Engineering and Research (SAMEER):** SAMEER, with three Centres at Mumbai, Chennai and Kolkata, 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 and antennas. 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 studies.

Electromagnetic Compatibility (EMC), meteorology and consultancy are the major activities of SAMEER at the Chennai centre. 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.

**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-the-art, scientific research and development in electronics and to design and develop electronics equipment and systems for the growth of electronics industry. ER&DCI is operational at three centres at Thiruvananthapuram, Kolkata and Noida. Recognizing the importance of internet, ER&DCI has accorded special emphasis to the development of low-cost Net-PCs, Set-Top box and Internet appliances. Other technological developments include embedded JAVA controllers, System-on-chip products and networking hardware.

**Standardization, Testing & Quality Certification (STQC):** STQC Directorate is a premier institution in

the country dedicated to provide total quality solutions to the Indian Electronics and IT industry by way of establishing a nation-wide quality assurance infrastructure. The STQC Directorate is providing a wide range of the quality related services to the Indian industry through a network of test laboratories located all over the country. Some of its important functions are: Standardization support at the National/ International level; Implementation of National and International level Certification schemes covering aspects of performance, safety, Electromagnetic Compatibility (Radio Interference), Quality and Environment Management Systems as well as Information Security; Testing of electronic products against national/international standards; Calibration of measuring instruments to ensure measurement traceability; Product/Quality system development support, Counselling and Training; and Reliability Assessment and Failure Analysis.

## HUMAN RESOURCE DEVELOPMENT

Ever since the setting up of DOE, development of human resources in electronics have always been a prime goal. In early 1980's projects generate talented young persons with M.Tech degree in Microwaves and Underwater Electronics were initiated by DOE at the University of Delhi and IIT, Delhi respectively. Later, in March 1985, while announcing the Integrated Policy measures on electronics, a great deal of emphasis was laid on manpower development in the electronics sector. As a result, the following programmes were initiated to train a wide spectrum of professionals at all levels in the area of electronics and computers.

(i) *Master of Computer Applications (MCA) Programme*: This programme was started at various institutions and universities. The entire course structure and the curriculum for this programme was developed and adopted by over 500 institutions.

(ii) *DOE/UGC Programme in Electronics*: M.Sc in Electronics was started in 11 centres. This Course

was later incorporated in almost all the universities.

(iii) *Post-B.Sc. Diploma in Computer Application (PGDCA)* : This diploma course was initiated in 28 centres and is now being offered by many institutions.

(iv) *Teachers' Training Programme* : Five major institutions viz, the four IITs (Mumbai, Delhi, Kanpur and Chennai) and Jadavpur University have established training programmes for teachers in Computer Science. A separate training programme for training faculty for Diploma level courses in computer applications was initiated at six institutions across the country.

(v) DOE, in consultation with Department of Education and UGC, has set up a chain of four Indian Institutes Information Technology (IIITs) in four regions of the country.

(vi) *Class Programme*: DOE, alongwith CMC, started this programme of computer education in schools.

**Electronics Industry Development Project (Manpower Component) Project IMPACT:** The project IMPACT (Industry oriented Manpower with Appropriate Competence and Training) was initiated in 1991 jointly by the Swiss Agency for Development and Cooperation (SDC), World Bank and the Government of India with the objective of improving the quality and relevance of education and training in the field of electronics and computers. The project involves 14 engineering colleges and 12 polytechnics. Project IMPACT has made a substantial impact in changing the culture of electronics engineering and computer sciences education at these colleges and has helped the industry through increased availability of better trained personnel in IT. A Sustainability Support Scheme was initiated in January, 1998 to ensure that the benefits of the project IMPACT are sustained at the participating institutions.

**Centre for Electronics Design & Technology of India (CEDTI):** CEDTI has seven Centres located at Aurangabad, Calicut, Gorakhpur, Imphal,

Srinagar/Jammu, Mohali and Tezpur. Some of the long-term courses offered by these centres are Diploma in Electronics Production and Maintenance, M.Tech in Electronic Design Technology and DOEACC "A & B" (see below) level computer courses. Thousands of students including professionals from industry are participating in these courses.

### DOEACC SCHEME

The DOEACC (Department of Electronics Accreditation of Computer Courses) started in August 1990 with the following objectives:

- to utilize the facilities and infrastructure available in the private institutions to generate quality manpower in the area of computers.
- enhance the quality of computer manpower training imparted by private sector institutions.

Under this scheme, the institutes meeting the defined quality and service standards are given accreditation for conducting specified level of courses 'O' (foundation level), 'A' (advanced diploma), 'B' (graduate level), 'C' (post-graduate level). The curricula for these courses are defined by the DOEACC Society, which also conducts examinations in these courses. So far about 600 institutes have been accredited for conducting various levels of DOEACC courses.

**Technology Development in Indian Languages (TDIL):** TDIL Programme is a vehicle to carry the IT benefits 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.

The Ministry has also established thirteen Resource Centres for Indian Language Technology Solutions, covering all the languages included under the Indian Constitution.

## SOME INITIATIVES OF MIT

- *Controller of Certifying Authority(CCA)* : As part of IT Act 2000, Office of the CCA has been created to set up and regulate a country-wide infrastructure of certifying authorities to issue digital signatures, which are passport to the cyber world.
- *e-Commerce & Internet Security*: To foster greater synergy among the activities/initiatives in the overlapping areas of e-commerce, an independent division with the title 'IT Act and information security' was created in January, 2001. Besides being a proactive facilitator, this division provides a single point interface to all the concerned agencies.
- *Community Information Centre*: The MIT has taken up an ambitious project for setting up of Community Information Centres (CICs) in 446 blocks in the seven North-Eastern States and 40 blocks in Sikkim as a part of the Prime Minister's agenda for the socio-economic development of the region. The CICs in each block will be provided with a VSAT link, a server and computers with other facilities to ensure comprehensive communication ability at a place. All the blocks will be connected to a close user group network as also internet and in the process connected to District Information Centres and State Information Centres of North East and Sikkim states through Virtual Private Networks or otherwise. The project will be implemented in two years.
- *Centre for e-Governance*: MIT is examining the practical implications of IT-related issues in the Government to provide better services to citizens and improve internal working in the Government. A centre has been set up for this purpose to provide general information on e-governance and also to take care of major policy issues related to e-governance.
- *Course in Cyber-law*: To increase awareness among the judiciary, attorneys, prosecutors and the police a PG Diploma Course on cyber law and Intellectual Property Rights has been initiated. This nine- month PG Diploma course has been sponsored at the Indian Law Institute, New Delhi.

